Final Environmental Impact Statement

for the

Revised Land and Resource Management Plan

for the

Croatan National Forest

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Croatan National Forest

December 2002

Carteret, Craven, and Jones Counties of North Carolina

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Abstract:

Six alternatives for revision of the Land and Resource Management Plan for the Croatan National Forest are described and compared in this Final Environmental Impact Statement. The alternatives are labeled A, B, C, C-modified, D and E. **Alternative E is the alternative preferred by the Forest Service.**

The *Revised Land and Resource Management Plan for the Croatan National Forest* is a companion document that provides the detailed direction of the preferred alternative. The *Record of Decision for the Revised Land and Resource Management Plan for the Croatan National Forest* is also a companion document that gives the rationale for the preferred alternative.

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SUMMARY

This Final Environmental Impact Statement (FEIS), prepared by the USDA Forest Service, describes six alternatives for managing the land and resources of the Croatan National Forest. It describes the affected environment, and discloses environmental effects of the alternatives considered.

Proposed Action
The USDA Forest Service proposes to revise the Land and Resource Management Plan (1986) for the Croatan National Forest. The proposal updates the management goals, objectives, standards, and monitoring requirements for the planning period 1998-2012. In addition, the proposal includes new management areas and management prescriptions. New management direction is developed for recovering red-cockaded woodpecker populations, developing recreation sites, restoring longleaf pine, increasing the use of fire, and managing the road system.

ISSUES ADDRESSED

1. Biological Diversity.

Recovering red-cockaded woodpecker (RCW) populations. The RCW was listed as endangered in 1970. A recovery plan identifies the CNF, Camp Lejeune and Holly Shelter as restoring one viable population. Recovery of the RCW depends on restoring the longleaf pine ecosystem and the role of prescribed fire in its maintenance. The CNF is capable of supporting about 30,000 acres of longleaf pine savannas. There are currently 6,000 acres of mature longleaf pine. Various levels of restoration are examined in the alternatives which result in different population objectives for RCW.

Natural Communities. Fifty-one rare species currently exist on the CNF. Their likelihood of survival is enhanced when natural systems are functioning properly. There are several ways of restoring and managing natural communities. One way is to designate natural areas and limit human disturbance. Several ways of providing natural community structure and function are explored, including old growth communities.

Wildlife and Fish Habitats. In the southeastern wetlands, black bear habitats have been fragmented by rapid development. Providing black bear habitat on the CNF is crucial to sustaining the population of bears in this area. Any designation for bear habitat may conflict with resource objectives that require development, especially open roads. Advocates for widespread, open access to the CNF are concerned about how and where bear habitat would be provided in this plan.

Hardwood Cypress Wetlands. Decline of neotropical migratory bird (NMB) habitat has occurred over the last 30 years. Of 45 million acres in the southeast about 30 million acres remained in 1985. This trend continues today. Much of the habitat for neotropical migratory birds on the CNF is found in hardwood cypress wetlands. One strategy is to establish a special zone for hardwood wetlands and guide activities to maintain these habitats. Some people may object to restricted activities in these areas, especially for access to streams.

2. Recreation Opportunities.

There are several types of recreation on the Croatan where demand is not being met by existing opportunities – water-based day use, water-based dispersed camping, and non-motorized trails. There is also high demand for additional motorized recreation, but opportunities to provide this activity on the Croatan are very limited by physical factors. Several types and amounts of water-based day use and dispersed camping opportunities are explored in the alternatives.

There is a low density of trails on the Croatan, owing to the high percentage of the area that is unsuitable for trail development. A range of additional trails will be discussed in this analysis, with varying opportunities for horseback riding, mountain biking, as well as for hiking. Several options for motorized routes are also explored. Limiting factors for various types of additional trails will continue to be soil composition as well as potential user conflicts with other forest activities.

3. Special Land Allocation.

Wilderness and Wild and Scenic Rivers are allocations of land to specific uses that require Congressional designation. Special allocations of land may limit timber and wildlife management, and recreational access. While many want to see more of these designations, many others oppose additional restrictions on land management. Some even desire reductions in the amount of land devoted to these specific uses. The alternatives explore a range of Wilderness to recommend for Congressional designation. The alternatives also explore how to address river corridors that are potentially eligible for designation as Wild and Scenic Rivers. Due to limited CNF ownership of these river corridors, the state of North Carolina may be more appropriate to conduct further analysis of suitability and to recommend designation.

4. Silviculture, Forest Products and Forest Health.

The current plan emphasizes loblolly pine regeneration using the combination of clear-cut, bedding and planting. To provide RCW habitat, mature loblolly stands would be converted to longleaf pine. The methods used to convert varies according to site characteristics. In stands where loblolly and longleaf coexist, then two-aged regeneration or shelterwood can successfully regenerate longleaf. Where only loblolly exists, then no longleaf seed source is available and this requires a clear-cut and planting of longleaf. The amount, type and location of regeneration can adversely affect scenery and recreational experiences, along with wildlife species dependent on older age classes. However, the lack of conversion to longleaf pine could slow the recovery of RCW populations. A range of silvicultural methods are explored in the alternatives.

5. Fire Management.

Fire is the primary disturbance factor on the Croatan; it has a vital role in the management of this coastal ecosystem. Fire also poses great risks to adjacent human communities, homes, and industrial timberlands in the form of wildfire. One management action, prescribed fire, has been devised to limit hazardous fuel buildup while maintaining natural communities that depend on fire, especially longleaf pine savannas. But prescribed fire creates smoke and leaves a blackened landscape that can be aesthetically displeasing. Different amounts of prescribed fire are evaluated in the alternatives.

6. Access.

Public access to enter or pass through the forest has become increasingly controversial as local populations have grown and uses of private land adjacent to the forest have changed. Serious concerns have arisen about the impact on forest resources. For example, illegal trash dumping, unregulated shooting from roads, and degrading of wildlife habitat that require freedom from motorized disturbance are widespread occurrences on the forest. Of special concern is the use from off-highway vehicles (OHV). This activity is demanded on the CNF, where sandy soils provide challenging riding conditions. However, this area has the highest occurrence of rare plants, which are damaged from OHV use. The alternatives explore different strategies for access and accommodating OHV users while protecting rare plant communities.

7. Local Communities.

As local communities grow, the pressure increases to accommodate a variety of uses of the CNF. While these uses should blend with the multiplexes of the national forest, there is often conflict among the various uses. The alternatives explore how human use of the CNF can be managed to be compatible with the physical and biological environment. Some examples of special uses suggested by the public include pine straw raking, firewood collecting, setting aside areas for research and nature study, building an educational center, and providing opportunities for guide services. To conserve the natural attributes that make this area a special place, collaboration with local communities and agencies is important.

RESPONDING TO ISSUES

Six alternatives were considered. Each alternative explored a different theme for addressing groups of similar issues. The alternatives are described below in terms of the key issues that were identified. In all alternatives except A, the RCW Management Standards and Guidelines (1995 RCW FEIS), as well as the RCW Recovery Plan, direct RCW management.

Alternative A---Current Management Direction

This alternative represents a continuation of the 1986 Land and Resource Management Plan and its amendments. Few acres are restored to longleaf pine, and loblolly plantations would continue to be planted. RCW expansion would be slow. Widespread, open access to the forest would continue.

Alternative B

This alternative was developed to address a number of public comments asking for low-impact timber management to restore natural communities, increased emphasis on nature-based, recreation activities in remote settings, generally a lighter human hand on the land. Alternative B emphasizes low-impact activities and restoration of natural communities at a slow rate. Natural communities would be restored through uneven-aged management, using the potential natural vegetation predicted by the ecological classification as a basis for desired condition. RCW augmentation efforts would stimulate very slow expansion of the population. Prescribed fire would be used primarily to reduce hazardous fuel loads. Recreation activities would have low impacts.

Alternative C

This alternative addresses public comments desiring active longleaf pine restoration, expansion of the existing RCW population, more habitat for black bears, neotropical birds, and wild turkey, and more fuels management in wildland-urban interfaces. Alternative C provides for restoration of natural communities, using a combination of even- and two-aged silvicultural systems. Emphasis is on restoring longleaf pine to sites currently occupied by loblolly pine, with a longleaf pine ecological type. Expansion of RCW populations would be actively pursued. Fuel loadings would be reduced in wildland-urban interfaces and pocosins. Recreation would be primarily nature-based and further development would emphasize the Croatan as a unique natural setting for a variety of recreation opportunities.

Alternative C-Modified

In this modification, Pond Pine Addition B is proposed for wilderness designation. All other actions and effects are as described above for Alternative C. This new wilderness enlarges the Pond Pine Wilderness to the east and provides linkage around Great Lake to the Sheep Ridge Wilderness to the north and the Pocosin Wilderness to the south. A quarter mile non-wilderness buffer is provided on the north side of the Camp Lejeune Railroad.

Alternative D

This alternative addresses public desires for more human accessibility to and use of national forest lands. In Alternative D, current timber management types would be the basis for regeneration, and longleaf pine and hardwoods would not be actively restored. The level of RCW population expansion would be slow. Fuels management would be aggressive, and emphasis on habitat improvement would be less than in other alternatives. Recreation management would emphasize a full range of opportunities. A wide variety of special uses would be accommodated throughout the forest, and local community development would be highlighted where possible.

Alternative E (Preferred)

This alternative addresses public comments about the preferred Alternative C in the Draft Environmental Impact Statement and the Proposed CNF Revised Plan. The theme of this alternative is similar to Alternative C: strive to restore longleaf pine, expansion of the existing RCW population, enhance habitat for black bears, neotropical birds, and wild turkey, and more fuels management in wildland-urban interfaces. However, the way of restoring longleaf pine and increasing RCW clusters would change between the alternatives. Alternative E emphasizes two-aged regeneration systems over clearcutting in order to retain mature longleaf pine trees for RCW. One OHV area provides opportunities to meet demands for all terrain vehicles.

COMPARISON OF ALTERNATIVES CONSIDERED IN DETAIL

1. Biological Diversity

RCW Management

In all alternatives, activities needed to protect and promote the RCW and its habitat is balanced with other biological and social needs unique to the CNF. Alternatives B, C, D, and E follow management

direction found in the final EIS for the Management of the RCW and Its Habitat on National Forests in the Southern Region (June 1995). This management direction emphasizes establishing suitable habitat for the recruitment of new RCW clusters. Table S.1 displays RCW Management objectives by alternative.

Table S.1: RCW management objectives by alternative.

	Alternative A	Alternative B	Alternative C/ C-Modified	Alternative D	Alternative E
Growing season burning in HMA	200 ac. / year	1,000 ac. / year	2,000 ac. / year	1,000 ac. / year	2000 ac/year
Average annual burning in CNF	15,000 acres	12,000 acres	25,000 acres	24,000 acres	25,000 ac./ year
Longleaf pine restoration (acres)	600	0	4,000	230	2,650-3,600
Size of the RCW HMA (acres)	37,845	46,656	46,656	43,424	69,000
New recruitment stands in 10 yrs	15-20	15-20	25-30	15-20	20-26
Cavity augmentation (box, cavity)	cavity	none	cavity and box	box	cavity and box
# of RCW clusters in 10 years	68-75	68-75	85-93	70-78	83-89
Long-term population objective	126-139	151-169	151-169	136-151	137-169

Risks of not achieving population goals are higher in Alternatives A and B compared to the other alternatives, due to the lack of foraging habitat caused by a low level fire program. Additional risk in Alternative B is the likelihood of not restoring longleaf pine due to the exclusive use of uneven aged management. Alternative D would likely reach population goals due to the high level fire program that maintains foraging habitat, but has the likelihood of lower nesting potentials due to the lack of longleaf restoration. Alternatives C/C-modified and E were designed to restore the long term nesting potentials through longleaf restoration and maintain foraging habitat through the high level fire program. Alternative E places greater emphasis on short-term conditions of potential nesting sites and understory conditions. In Alternative E, large trees would be retained as potential nesting sites during longleaf restoration where two-aged methods are used, and, wiregrasses would be favored in the understory by using alternatives to bedding as site preparation methods.

Rare Communities and Rare Species Management

All alternatives would protect and enhance rare species and rare communities by providing the natural community structure and function to support their survival. The alternatives differ in the rate at which these goals are met and the need for future mitigation measures in sensitive habitats. Alternatives B, C, and E establish a network of natural areas, wilderness areas, and the RCW habitat management area as

core areas for rare species protection and enhancement. Impacts on sites outside of these core areas would be less critical because core populations of rare species would always be maintained. Alternatives A and D rely more heavily on future site-specific evaluation to determine the probable effects of proposed activities on populations of rare species. A comparison of management objectives in each alternative reflects these different philosophies (Table S.2).

Table S.2: Rare communities and rare species management objectives by alternative.

	Alternative A	Alternative B	Alternative C/ C-Modified	Alternative D	Alternative E
# of designated Special Interest Areas (Natural Areas)	11	28	18	11	18
Total acres in SIAs (Natural Areas)	42,452	63,924	47,730	42,452	47,730
% CNF rare spp. protected [1]	37%	72%	70%	37%	70%
Rare community restoration (ac.)	600	50	4,570	230	3,220 to 4,170
Average annual burning in CNF	15,000 acres	12,000 acres	25,000 acres	24,000 acres	25,000 acres
# of new rare species populations	0	2	11	0	11
# of old growth longleaf sites	0	0	21-54	21-54	21-54
Old growth suitable for timber	yes	yes	no	yes	no

[1] *species are considered protected in Natural Areas, old growth management areas, RCW nest areas, and Wilderness areas*

2. Recreation Opportunities

Recreation and Scenery

Recreation use on the CNF occurs year round, with seasonal variations for different uses. One feature--water, including the ocean, rivers, and streams offers unique public recreation opportunities. Recreation use is discussed in terms of capacity or numbers of people a site can accommodate, and the experience visitors might have. These range from a remote, rustic campground experience to a highly developed campground with many amenities and where visitors may see lots of other people recreating in the area. The alternatives provide for an increase in recreation opportunities to meet growing demand for more rustic experiences and facilities, and trail systems for a variety of users. Potential degradation of natural resources and archeological sites, and conflicts between user groups are resolved to varying degrees in the alternatives. Developed recreation capacities and projected amount of trail opportunities by alternative are shown in Table S.3.

Table S.3. Recreation management objectives by alternative.

Alternative	A	B	C/ C-Modified	D	E
Developed Rec. PAOT[1] Capacity by ROS Class					
-Rural	1,050	1,050	1,208	1,312	1,208
-Roaded Natural	450	500	638	638	638
-Semi-primitive Motorized	175	217	394	394	394
Trail Miles					
-OHV	36	8 - 10	20 - 30	20 - 30	8-10
-Mountain bike	0	10 - 15	20 - 40	20 - 40	20-40
-Horseback	0	10 - 15	10 - 20	10 - 20	10-20
-Hiking	31	31	31	31	31
-Canoe	0	8	16	16	16
Other Recreation Site Opportunities					
-Fishing Ponds	0	3	5	5	5
-Wildlife Viewing Opportunities	0	0	4	4	4

[1] *People at One Time*

Rustic camping areas would increase by more than 40 percent in Alternatives C/C-mod, D and E, and, highly developed sites would increase by about 15 to 20 percent to accommodate demands by visitors. These programs have less emphasis in Alternatives A and B.

Higher amounts and kinds of trails would be offered in Alternatives C/C-mod, D, and E, with exception to OHV trails. More open access for OHV would exist in Alternative A and D, due to higher designated trails and a low emphasis on closing out unauthorized trails. Alternative C/C-modified would limit OHVs to 2 areas, whereas Alternatives B and E would designate one OHV area and close out unauthorized trails. OHV areas would require substantial investments to assure user preferences are met and natural resources are protected.

3. Special Land Allocations

Wilderness and Roadless Areas

There are 31,221 acres of Wilderness on the CNF. An additional 20,801 acres of Roadless Areas are suitable for Wilderness designation. The alternatives vary by the number of acres (Table S.4) that would be proposed to Congress for recommendation to the wilderness system.

Table S.4. Wilderness management objectives by alternative.

Alternative	A	B	C	C-Modified	D	E
Acres	31,221	51,992	31,912	34,892	31,912	31,912

Alternatives C, D and E propose only boundary adjustments to the existing wilderness areas. The adjustments are due to acquisitions of land that are within wilderness boundaries. The low level of wilderness recommendations in these alternatives respond to concerns about the difficulty of managing a landscape with many urban interfaces and which requires an active prescribed fire program to maintain plant communities. Alternative B would recommend most of the roadless inventory for wilderness designation. Alternative C modified would recommend an expansion of the Pond Pine Wilderness area.

River Corridors Eligible for Wild and Scenic River Status

The White Oak River and Brice Creek including West and East Prong Creeks are eligible for Wild and Scenic River designation. Table S.5 shows the amount of CNF land in interim management as Wild and Scenic Rivers until further studies are completed.

Table S-.5. CNF land managed as Wild and Scenic Rivers until studies are completed.

Alternative	A	B	C/ C-Modified	D	E
CNF managed as Wild and Scenic Rivers until studies are completed		3,351	3,351	0	3,351

Alternatives B, C/C-Modified, and E would recommend further study of these rivers for their suitability as Wild and Scenic Rivers. Due to the limited CNF ownership within the river corridors, the State of North Carolina is the appropriate agency to carry forward a recommendation for designation to Congress. Alternative A would only recommend the White Oak River for further study. Alternative D would recommend that both rivers not be studied further.

Alternatives B, C/C-Modified, and E: Brice Creek and White Oak River corridor on CNF would be managed to protect the outstandingly remarkable values of these rivers on CNF land. Historic and archeological sites, riparian zones, and wildlife and aquatic habitats would also be protected. Clean up after catastrophic events would be more difficult because of restrictions within the corridors.

4. Forest Products and Forest Health

Management for timber production goals would simultaneously support longleaf restoration goals for RCW habitat objectives. As shown in Table S-6, timber production activities would focus on lands suitable and scheduled for harvest and regeneration over the 160 year planning horizon. The allowable sale quantity is upper limit of harvest from lands suitable and scheduled for timber production. The capacity to produce timber over the long term varies due to the silvicultural methods proposed and the projected harvest amounts over the planning horizon. The expected regeneration methods by alternative are shown in Table S-7. All alternatives have positive financial returns.

Table S-6. The allowable sale quantity, land suitable for timber production, sustained yield, and present net values by alternative.

Alternative	**A**	**B**	**C/ C-Modified**	**D**	**E**
Acres suitable and scheduled for timber production	24,985	10,890	26,774	21,546	25,723
Allowable Sale Quantity MCF/Year (1st period)	497	260	2,093	1,484	876
Long Term Sustained Yield Capacity MCF/Year	1,625	442	1,247	1,573	1303
Maximum PresentNet Value (MM $)	$23.2	$4.4	$29.3	$26.2	$20.9

Table S-7. Acres probable longleaf restoration and regeneration methods by alternative over the next ten years.

Alternative	**A**	**B**	**C/ C-modified**	**D**	**E**
Total Longleaf Restoration	600	0	4000	230	2500
Clearcut	530	0	2730	4400	1000
Seed-tree/ Shelterwood	620	0	2000	0	
Two Aged Shelterwood	0	0	1500	0	1500
Group Selection	50	1040	0	0	0
Total Regeneration Acres/Year (1st period)	1200	1040	6230	4630	2500

In the current suitable timber base (Alternative A), more than two-thirds are occupied by loblolly pine forest types. Alternatives A, B, and D would nearly sustain that mix of forest composition over the long term. Alternatives C/C-modified and E would shift the composition to favor longleaf forest types, with more than two thirds of the overstory in longleaf over the long term. High risks are assumed for longleaf restoration in Alternative B due to the exclusive reliance on group selection.

Alternative C/C-modified has higher amounts of suitable lands than A, D, and E, but lower sustained yield capacities. This is due, in part, to the harvest in Alternative C/C-modified in the first 10-year planning period that is higher than sustainable levels in subsequent planning periods. Alternatives A, B, D, and E would follow a non-declining, sustainable yield schedule of timber outputs for each 10-year planning period.

5. Fire Management

Fuels on the CNF have been mapped and analyzed based on landtype, forest type, soils, and disturbance history. Fuel models (Anderson, 1982) are used to describe fuel conditions and identify wildfire risk based on predicted fire behavior. In all alternatives, wildfire risk is expected to increase with the

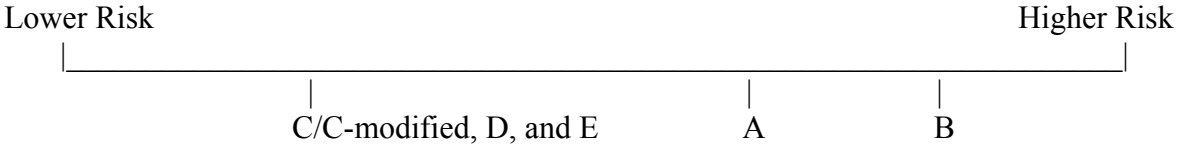
increase in future development outside the CNF. Wildfire and prescribed fire management are expected to become more difficult and expensive as populations increase. Problems associated with smoke management may also become more difficult to address. The alternatives vary by the amount of land that would be treated to reduce fuels. The degree of wildfire risk reduction is reflected in the distribution of fuel models by alternative (Table S.8). Wildland urban interfaces have been identified in alternatives C, D, and E.

Table S.8. Acres by fuel type and alternative.

Fuel Model	Alternative A	Alternative B	Alternative C/ C-Modified	Alternative D	Alternative E
2	8200 (5%)	8200 (5%)	9400 (6%)	9400 (6%)	9400
4	42400 (26%)	5400 (34%)	0 (0%)	0 (0%)	0
6	26100 (16%)	14500 (9%)	62700 (39%)	62700 (39%)	62700
7	36500 (23%)	59600 (37%)	31700 (20%)	31700 (20%)	31700
9	39300 (23%)	16100 (10%)	48700 (30%)	48700 (30%)	48700
Not Modeled	8600 (5%)	8600 (5%)	8600 (5%)	8600 (5%)	8600
Total	161,100	161,100	161,100	161,100	161000

A relative risk analysis resulting from the desired future condition and probable management activities within each alternative is displayed below. This analysis is based on the differences in fuel treatment programs, including identification and treatment of wildland urban interfaces.

Wildfire Risk by alternative



Frequent return intervals (3 to 5 years, see also Table S-1) for prescribed fire are needed to manage risk of wildfire. Longer return intervals produce high volumes of fuels that create high risk situations. Risks are substantially reduced when high pocosin vegetation (Fuel Model 4) are treated and maintained as low pocosin with frequent fire (Fuel Model 6). Alternative C/C modified, D, and E establish a frequent return interval due to the high level of prescribed fire. A portion of the prescribed fire program would be applied to pocosin landtypes. Without the frequent return intervals, Alternatives A and B assume higher risks of catastrophic wildfires.

Alternative C/C-modified, D, and E further reduce risks by creating urban-interface zones of defensible space between CNF land and the private lands, which generally have residential or commercial buildings. Alternatives A and B would not initiate programs to reduce risks in those zones.

6. Access

Public access to the CNF has become increasingly controversial as local populations have grown and land uses adjacent to the forest have changed. Forest access opportunities are public benefits, but also, impact may occur on forest resources including wildlife habitat, fragile plant communities, and the opportunity for non-motorized recreation. Secondary impacts include illegal trash dumping and unregulated shooting from roads. The CNF has enough existing roads to meet future needs and no new road construction is proposed. The alternatives address access through changes (Table S.9) of open FS roads, closure of unauthorized trails, and the number of miles and location of OHV trails.

Table S.9. Access management objectives by alternative.

Alternative	**A**	**B**	**C** **C-Modified**	**D**	**E**
Forest Service Roads - miles	222	222	222	222	222
Roads Closed - miles	14	50	30	12	15-20
Seasonal Access - road miles	9	29	17	5	15-20
OHV Trails - miles	36	8 - 10	20 - 30	20 - 30	8-10

High levels of access on classified roads are provided in Alternatives A and D, but the level of illegal shooting, trash dumping and effects to wildlife species would continue. In Alternatives B, C, and E, open classified roads would be closed where the highest probability of illegal events would occur. Open roads in these alternatives would likely be maintained in better conditions since road maintenance funds would be used on fewer open roads.

Unauthorized access occurs throughout the forest. Due to level topography, the CNF can be traversed by OHVs in many areas. Plant communities, especially rare plants, are adversely affected, as well as wildlife species, such as bear and turkey, that require less motorized disturbance for survival. Alternatives A and D would not emphasize the closure of unauthorized access. Alternatives B, C/C-modified, and E would close out unauthorized access. OHV use would be restricted to 2 areas in Alternative C/C-modified, and one area in Alternatives B and E.

7. Local Communities

The main impacts from management practices on the CNF are changes in employment and income levels of the regional population. The two activities that have the most impact are timber harvesting and providing recreation opportunities.

When national forest timber is sold, jobs are created for the harvesters and haulers of the timber, who then use their income to buy goods and services in the region. Visitors to the CNF require goods and services based on the type of recreation activity pursued and the duration of their visit. These expenditures by visitors have a multiplier effect by creating jobs (Table S.10) in the local community.

Table S.10. Economic Impacts by Alternative.

Alternative	**A**	**B**	**C/ C-Modified**	**D**	**E**
Timber Employment Number	35	20	126	92	51
Harvesting Income $	694,405	349,179	2,799,528	2,004,104	1,834,845
Recreation Employment Number	582	614	733	738	730
Recreation Income $	12,754,359	13,566,742	16,637,482	16,777,863	16,249,782

More uses of forest products and recreation places create more jobs and income. Therefore, Alternatives C/C-modified, D and E, which have more emphases on products and opportunities for use would create more employment and income than Alternatives A and B.

Local communities are also affected by how they use the CNF directly. More emphasis is placed on all alternatives to increase opportunities for nature based recreation income. This could be accomplished by generating opportunities for outfitters and guides on the forest. Providing opportunities for local community awareness of the unique environments on the CNF is a common theme among all alternatives.

CHAPTER 1: PURPOSE AND NEED

This Final Environmental Impact Statement (EIS), prepared by the USDA Forest Service, describes six alternatives for managing the land and resources of the Croatan National Forest. It describes the affected environment, and discloses environmental effects of the alternatives considered.

1.1: Proposed Action

The USDA Forest Service proposes to revise the Land and Resource Management Plan (1986) for the Croatan National Forest. The proposal updates the management goals, objectives, standards, and monitoring requirements for the planning period 1998- 2012. In addition, the proposal includes new management prescriptions. Specific management direction is needed for the following:

- To designate habitat management areas, set population objectives, establish management direction and location for red-cockaded woodpeckers (RCW) clusters and habitat linkages.
- To identify rare natural communities, plants and animals and explore strategies for restoring them.
- To determine the need for management direction to enhance neotropical migratory bird habitat.
- To determine what mix of multiple uses, recreation settings, activities, and facilities should be offered on the Croatan National Forest, including interpretation of heritage resources.
- To determine whether or not to recommend river corridors eligible for Wild and Scenic Rivers to Congress for designation and whether or not to recommend additional Wildernesses.
- To assess the extent of longleaf pine restoration, the appropriate rate of restoration efforts, and the appropriate regeneration methods.
- To assess areas where wildland-urban interfaces are a concern and to specify the role prescribed fire could play in reducing wildfire risks to these areas.
- To determine if natural or lightning-caused wildland fire should be used for resource benefit, particularly in wilderness, and, if so, under what conditions.
- To assess what areas should be available for motorized access, especially off-highway vehicles.
- To determine what kinds and extents of special uses to allow for supporting community growth within the context of multiple uses of the national forest.
- To estimate the quantity and distribution of habitat needed to maintain a stable population of black bears.

1.2: Purpose and Need for the Forest Plan Revision

Natural resource management decisions are made in two stages. First, land and resources are allocated to various uses or conditions, appropriate management prescriptions are devised, and the places where the prescriptions would be applied are specified for the plan area. These first-stage decisions become the Forest Plan, which sets a framework for the second-stage of decisions. Second-stage decisions involve approval of the site-specific projects that implement the Forest Plan.

Forest plans establish goals and objectives to achieve the desired resource conditions for the national forests. Forest plans also establish limits on actions (standards) that can be taken to create desired

conditions. Planners often use management areas to delineate where management prescriptions and their associated goals, objectives, and standards apply in the plan area.

Integrating multiple-resource conditions and uses are important outcomes of Forest Plans. The decisions made in Forest Plans and the related planning regulations are summarized below.

1. Establishing multiple-use goals, objectives, and desired future conditions for the forest, including estimates of goods and services expected -- 36 CFR 219.11(b).
2. Establishing forestwide management requirements -- 36 CFR 219.13 to 219.27.
3. Applying multiple-use prescriptions and associated guidance, including selected and probable management practices, to each management area on the Forest --36 CFR 219.11(c).
4. Identifying land that is and is not suited for timber production -- 36 CFR 219.14.
5. Determining the allowable sale quantity for timber and the associated sale schedule -- 36 CFR 219.16.
6. Recommending roadless areas for potential wilderness designation -- 36 CFR 219.17.
7. Determining monitoring and evaluation requirements -- 36 CFR 219.11 (d).

1.3: Public Participation

Public involvement is an important component of the land management planning process. The purpose of identifying issues and concerns is to determine the public desires for goods, services and environmental conditions on the Forest.

The identification of issues for consideration began in July 1996, during the analysis of the management situation. This analysis provided the interdisciplinary team with a basis for formulating a preliminary list of issues in planning. A notice of intent to prepare an environmental impact statement was filed in the Federal Register on October 17, 1996. A planning newsletter published in November of 1996 notified the local public of identified issues and provided the opportunity to comment. We also conducted open houses at three locations during December 1996. Approximately 70 people attended these meetings. The forest planning interdisciplinary team received 77 letters containing approximately 375 individual comments during this scoping period.

The Draft Environmental Impact Statement was released on December 20, 1999. Its availability was published in the Federal Register on December 30, 1999. Approximately 27 letters were received. Responses to comments are included in Appendix A.

Issues addressed in this analysis follow:

1.3.1: Biological Diversity

Recovering red-cockaded woodpecker (RCW) populations. The RCW was listed as endangered in 1970. A recovery plan identifies the CNF, Camp Lejeune and Holly Shelter as restoring one viable population. Recovery of the RCW depends on restoring and maintaining the longleaf pine ecosystem, including the use of fire. The CNF is capable of supporting about 30,000 acres of longleaf pine savannas. There are currently 6,000 acres of mature longleaf. Rapid restoration of RCW habitat would greatly increase the probability of recovering the population over the long term. Since restoration includes timber harvesting and planting, people are concerned how widespread the activity would be, as

it affects scenery, recreation experiences and other plant and animal species. Various levels of restoration are examined in the alternatives, which result in different population objectives for RCW.

Natural Communities. Fifty-one rare species currently exist on the CNF. Likelihood of survival is enhanced when the natural community structure and function prevails. There are several ways of restoring and managing natural communities. One way is to designate natural areas and limit human disturbance. There are concerns about where natural areas would be designated and how restrictive activities would be. Several ways of providing natural community structure and function are explored, including old growth communities.

Wildlife and Fish Habitats. In the southeastern wetlands, black bear habitats have been fragmented by rapid development. Maintaining and improving black bear habitat on the CNF is crucial to sustaining the population of bears in this area. Because bear range widely over the landscape, protective zones require large areas. Any designation for bear habitat may conflict with resource objectives that require development, especially open roads. Advocates for widespread, open access to the CNF are concerned about how and where bear habitat would be provided in this plan.

Decline of neotropical migratory bird (NMB) habitat had occurred over last 30 years. Of 45 million acres in the southeast about 30 million acres remained in 1985. This declining trend continues today. Most of the NMB habitat on the CNF is hardwood wetlands. One strategy is to establish a special zone for hardwood wetlands and guide activities to maintain these habitats. Some people may object to restricted activities in these areas, especially for access to streams here.

1.3.2: Recreation Opportunities.

There are several types of recreation on the Croatan where demand is not being met by existing opportunities – water-based day use, water-based dispersed camping, and non-motorized trails. There is also high demand for additional motorized recreation, but opportunities to provide this activity on the Croatan are very limited by physical factors. Several types and amounts of water-based day use and dispersed camping opportunities are explored in the alternatives.

There is a low density of trails on the Croatan, owing to the high percentage of the area that is unsuitable for trail development. A range of additional trails will be discussed in this analysis, with varying opportunities for horseback riding, mountain biking, as well as for hiking. Several options for motorized routes are also explored. Limiting factors for various types of additional trails will continue to be soil composition as well as potential user conflicts with other forest activities.

1.3.3: Special Land Allocation.

Wilderness and Wild and Scenic Rivers are allocations of land to specific uses that require Congressional designation. Special allocations of land may limit timber and wildlife management, and recreational access. While many people want to see more of these areas, many others oppose additional restrictions on land management. Some even desire reductions in the amount of land devoted to these specific uses. The alternatives explore a range of Wilderness to recommend for Congressional designation. The alternatives also explore how to address river corridors that are potentially eligible for designation as Wild and Scenic Rivers. Due to limited CNF ownership of these river corridors, the state of North Carolina may be more appropriate to conduct further analysis of suitability and to recommend designation.

1.3.4: Silviculture, Forest Products and Forest Health.

The current plan emphasizes loblolly pine regeneration using the combination of clear-cut, bedding and planting. To provide RCW habitat, mature loblolly stands would be converted to longleaf pine. The methods used to convert vary according to site characteristics. In stands where loblolly and longleaf coexist, two-aged regeneration or shelterwood may successfully regenerate longleaf. Where only loblolly exists, no longleaf seed source is available and this usually requires a clear-cut of loblolly and planting of longleaf. The amount, type and location of regeneration can adversely affect scenery and recreational experiences, along with wildlife species dependent on older age classes. However, the lack of conversion to longleaf pine could slow the recovery of RCW populations. A range of silvicultural methods is explored in the alternatives.

1.3.5: Fire Management.

Fire is the primary disturbance factor on the Croatan; it has a vital role in the management of this coastal ecosystem. Fire, specifically wildfires, also poses great risks to adjacent human communities, homes, and industrial timberlands. One management action, prescribed fire, has been devised to limit hazardous fuel buildup while maintaining natural communities that depend on fire, especially longleaf pine savannas. But, prescribed fire creates smoke and leaves a blackened landscape that some people dislike. Different amounts of prescribed fire are evaluated in the alternatives.

1.3.6: Access.

Balancing reasonable public access with protecting the natural resources is a critical challenge for national forest management. Too much access has caused problems with trash dumping, unregulated shooting, user conflicts, negative impacts to wildlife, unauthorized use of closed roads, resource damage, and unauthorized, user-created new trails and roads. High levels of access also increase the cost to maintain roads to an adequate and safe standard. However, limiting access too much restricts the public from thoroughfares, and from using the national forest in ways that they enjoy such as biking, hunting, bird watching, off highway vehicle (OHV) riding, and camping.

1.3.7: Local Communities.

As local communities grow, the pressure increases to accommodate a variety of uses of the CNF. While these uses should blend with the multiplexes of the national forest, there is often conflict among the various uses. The alternatives explore how human use of the CNF can be managed to be compatible with the physical and biological environment. Some examples of special uses suggested by the public include pine straw raking, firewood collecting, setting aside areas for research and nature study, building an educational center, and providing opportunities for guide services. To conserve the natural attributes that make this area a special place, collaboration with local communities and agencies is important.

CHAPTER 2: ALTERNATIVES FOR MANAGING THE CROATAN NATIONAL FOREST

This Chapter summarizes the alternatives developed to compare potential management strategies for the Croatan National Forest. It describes the process used to develop and refine alternatives, outlines the alternatives considered, and compares the alternatives.

Alternative Development Process
Needs for revision of the forest plan arose from changes in policy, new scientific information, and changes in the demographics and social setting of the Croatan National Forest. Information gathered during scoping for site-specific projects, needs identified through monitoring and evaluation, and the formal analysis of the management situation highlighted many of these changes and influenced the themes of the alternatives.

Initially, seven major issues were described and released to the public for comment. Four themes for management were developed to address the issues, realizing the themes would change as public comment and further review occurred. After initial themes were created, the planning team refined the alternatives by determining for each management prescription and area the probable management practices that are consistent with the underlying theme. The direction and content of the alternatives were further tested and refined after numerous meetings with Ranger District personnel and outside cooperators.

2.1: AN ALTERNATIVE CONSIDERED BUT NOT STUDIED IN DETAIL

One alternative was formulated that responds to public comments received during the scoping phase of the NEPA process. Some respondents wanted to eliminate many human uses and human induced impacts of the CNF. In this alternative, there would be no vegetation projects, no prescribed fire, no management of the Catfish Lake Impoundment nor any wildlife openings, limited recreation uses, and no access for off-highway vehicles. This alternative was considered but not studied in detail because this level of management is already described in the Minimum Level Benchmark (see Appendix B). This alternative does not address all the issues identified by the public, and it would eliminate most of the multiple uses and benefits for which national forests were created. With demonstrated demands for public access, wildlife recreation experiences, forest products, and suitable RCW habitat (which result from prescribed fire), elimination of these activities would conflict with current agency policy. Taking prescribed fire as one example, "Continued use of fire, through an intensive prescribed burning program, is critical to the survival and recovery of the RCW "(RCW, FEIS, p 53). Alternative B, which substantially reduces the amount of human uses and activity, was formed to address the comments above.

2.2: ALTERNATIVES CONSIDERED AND STUDIED IN DETAIL

Six Alternatives were considered. Each alternative explored a different theme for addressing groups of similar issues. The alternatives are described below in terms of the key issues. In all alternatives except A, RCW management is directed by the 1995 EIS.

2.2.1: Alternative A---Current Management Direction

This alternative represents a continuation of the 1986 Land and Resource Management Plan and its amendments.

2.2.1.1: Biological Diversity

Red-Cockaded Woodpecker Management: The Croatan's RCW management would be directed by interim guidelines and the population objective would be 139 territories.

Rare Species Management: All federally listed species would be protected and sensitive species would not decline and make federal listing necessary.

Wildlife: Existing openings would be maintained and new openings would be created where needed. Existing hardwoods would be maintained. Existing management for the Catfish Lake Waterfowl Impoundment would be continued. Black bear habitat would be provided in existing wilderness and in semi-primitive non-motorized areas. In areas where bear management is featured, open-road densities would be less than 1.0 mile per 2500 acres. The standard for turkey will be less than 1.0 mile per 1280 acres.

Hardwoods: Hardwoods and upland hardwood types would continue to be classed as unsuitable for timber production.

Surface Water Management: No surface water management would be required for timber production.

2.2.1.2: Recreation Opportunities

Recreation: A variety of recreation settings and experiences, both motorized and non-motorized would be provided. Developed recreation facilities would support dispersed recreation by providing access to water-based recreation, trailheads, cultural resource interpretation, and horse staging areas. In addition to open roads available for use, 10 miles of specific OHV routes would be provided.

Heritage Resources: Existing sites that have a low maintenance cost would be interpreted.

2.2.1.3: Special Land Allocations

Special Interest Areas: Existing registered natural areas would be maintained.

***Wilderness/Wild and Scenic Rivers*:** The 31,221 acres of existing wilderness would be protected. The suitability status of the White Oak River as wild and scenic would be studied, with the State of North Carolina as the lead agency. During evaluation, a corridor 1/4 mile from the river would be maintained to avoid or mitigate any action that might adversely affect the river's potential for such designation.

2.2.1.4: Silviculture, Forest Products, Forest Health

Vegetation and Timber Management: Longleaf pine would be managed on a 100-year rotation, and loblolly and shortleaf pines on 80-year rotations. Forest lands managed for pond pine and hardwoods are unsuitable for timber production. Management type (vegetation type desired for timber management) would guide decisions for regeneration with primarily even-aged management.

2.2.1.5: Fire Management

Fire Management: Prescribed fire would be used for wildlife habitat improvement, fuel reduction, timber stand improvement, and site preparation. Management-ignited prescribed fire would be allowed in wildernesses. Wildland fire would not be used for resource benefit, and there would be no provision for risk reduction in the urban interface other than prescribed fire for fuel reduction. Use of mechanized fire suppression equipment would be allowed on the entire forest. Prescribed fire activities would be conducted within the constraints of current air quality guidelines. Air quality would be monitored during wildfires.

2.2.1.6: Access

Access. Most existing forest roads would be open, but new roads would be closed after intended use is completed.

2.2.1.7: Local Communities

Special Uses: Special uses, including transportation and utility corridors, would be authorized when there are public needs or interests, and when the use cannot reasonably be provided on private land.

Land Adjustment: Acquisition and exchange of National Forest System lands would continue in accordance with an approved land adjustment plan. Priority would be placed on adjustments meeting identified resource management needs, on consolidations to reduce administrative problems and costs, and on enhancement of public use, and on conveyance of land better suited for nonfederal ownership.

2.2.2: Alternative B

This alternative was developed to address a number of public comments asking for low-impact timber management to restore natural communities, increased emphasis on nature-based, solitary recreation activities, and in general a lighter human hand on the land. Alternative B emphasizes low-impact activities and restoration of natural communities at a slow rate. Natural communities would be restored through even- and uneven-aged management, using the potential natural vegetation predicted by the ecological classification as a basis for desired condition. RCW augmentation efforts would stimulate very slow expansion of the population. Prescribed fire would be used primarily to reduce hazardous fuel loads. Recreation activities would have low impacts.

2.2.2.1: Biological Diversity

Red-Cockaded Woodpecker Management: The long-term RCW population objective would be 151 to 169 territories and the goal about 2 percent annual population growth. Three clusters per year would be provided in areas with a high probability of success. Birds could occupy new habitat; therefore no active translocation would be done.

Rare Species Management: Habitat management for all threatened, endangered, and sensitive species would be maintained across the planning area. Rare species would be sustained within existing and 17 newly registered North Carolina Natural Heritage Program natural areas. The 10- year population objectives for sensitive and forest concern species would be set, and monitoring protocols would be developed.

Wildlife: No new wildlife openings would be constructed, and existing openings would receive low levels of maintenance. Management of the Catfish Lake waterfowl impoundment would continue.

Existing hardwood stands would be maintained for hard mast and habitat. Any hardwood restoration would occur at a slow rate.

Hardwoods: The potential natural vegetation predicted by ecological classification would be used to delineate the hardwood wetland zone on the ground, and managed as "not suited" for timber production.

Bear Habitat: Black bear habitat would be provided in proposed wilderness, in existing wilderness, and in proposed special interest areas. Pocosin habitat might be somewhat less productive without burning.

***Surface Water Management*:** No surface water management and active restoration of previously altered hydrology would be attempted.

2.2.2.2: Recreation Opportunities

Recreation: Low impact recreation development would be explored as opportunities arise. Emphasis would be on non-motorized recreation opportunities, such as mountain biking and horseback riding on closed roads. Existing roads and trails would be available for recreation use, but new trails would not be constructed. Trail miles would be close to existing numbers. Semi-primitive Non-Motorized experiences would be provided by closing some connector and spur roads. OHV's would be permitted on designated routes.

***Heritage Resources*:** Awareness would be promoted through signing and brochures.

2.2.2.3: Special Land Allocations

Special Interest Areas: All new proposed North Carolina Natural Heritage Program natural areas would be registered. These areas would be allocated to a Special Interest Area prescription.

Wilderness/River Corridors Eligible for Wild and Scenic River Status: All roadless areas suitable for wilderness would be recommended for designation. Corridors on CNF land along Brice Creek and White Oak River would be managed to retain the outstandingly remarkable values that make them eligible for Wild and Scenic Rivers. The road to Great Lake would remain open. To help preserve wilderness quality in and around Great Lake, boat engine size would be limited.

2.2.2.4: Silviculture, Forest Products, Forest Health

***Vegetation and Timber Management*:** Timber rotations would be lengthened, thereby delaying timber harvest until further into the future and providing more large trees. Longleaf pine would be managed on a 160-year rotation, and loblolly pine on a 100-year rotation. Hardwood stands and most pond pine stands would be classed as not suited for timber production. Potential natural communities predicted by the ecological classification would direct decisions about regeneration. No clearcutting would occur, and artificial regeneration would be limited to hand planting of bareroot or containerized seedlings without bedding or other intensive site preparation. Old growth would not be allocated to specific locations, but it would be provided by longer rotation lengths, by classification of hardwood and pond pine acres as not suited for timber management, and by other management prescriptions.

2.2.2.5: Fire Management

***Fire Management*:** Approximately 12,000 acres per year would be burned using prescribed fire. This average annual burning rate would result in about a 5-year or more rotation for burnable acres. The

purpose for prescribed fire would include wildlife habitat improvement, timber stand improvement, site preparation for natural regeneration, and an emphasis on fuel reduction. Ground disturbing activities would be minimized during prescribed fire and, where possible, during wildfires. Use of mechanized equipment for wildland fire suppression would be allowed on the entire forest for fire suppression. Mechanical ground disturbance would be minimized by permitting management-ignited fire in low pocosin, outside wilderness. There would be no provision for risk reduction in the wildland-urban interfaces. Wildland fire use for resource benefit would be considered. Wildfire suppression would be designed to minimize resource damage and provide for firefighter safety. Prescribed burning would be conducted within the constraints of current air quality guidelines. Air quality would be monitored during wildfires.

2.2.2.6: Access

Access: Open vehicle access would be reduced by closing connector and spur roads, and unauthorized use would be eliminated. Where possible, levels of maintenance would be reduced.

2.2.2.7: Local Communities

***Special Uses*:** New special uses would be subject to strict criteria for acceptance. A plan would be created to phase out some existing special uses as opportunities arise.

Land Adjustment: Adjustments would focus on the acquisition of land identified in the Land Adjustment Plan for resource management objectives and the consolidation of national forest ownership. Priorities would be placed on the acquisition of land that protects critical habitat, riparian ecosystems, historic or cultural resources, and Congressionally designated areas. Lands identified for acquisition to meet recreational objectives would be considered, but given less emphasis for acquisition.

2.2.3: Alternative C

This alternative addresses public comments desiring active longleaf pine restoration, expansion of the existing RCW population, more habitat for black bears, neotropical birds, and wild turkey, and more fuels management in wildland-urban interfaces. Alternative C provides for restoration of natural communities, using a combination of even- and uneven-aged silvicultural systems. Emphasis is on restoring longleaf pine to sites currently occupied by loblolly pine, with a longleaf ecological type. Expansion of RCW populations would be actively pursued. Fuel loadings would be reduced in wildland-urban interfaces and pocosins. Recreation would be primarily nature-based and further development would emphasize the Croatan as a unique natural setting for a variety of recreation opportunities.

2.2.3.1: Biological Diversity

***Red-cockaded Woodpecker Management**:* The RCW population objective would be 151 to 169 territories, and six percent population growth would be the goal. Six clusters per year would be provided in areas with a high probability of success. Birds would be translocated.

***Rare Species Management*:** Habitat management for all threatened, endangered, and sensitive species would be maintained across the planning area. To sustain known populations of rare species, appropriate habitat conditions would be provided through active management, where appropriate, in existing North Carolina Natural Heritage Program natural areas and eight newly registered areas. Ten-year population objectives for sensitive and forest concern species would be set, and monitoring protocols would be

developed. The network of natural areas, wilderness areas, and the RCW habitat management area would be used as core areas for rare species populations.

Wildlife: Existing wildlife openings would be maintained, and, where appropriate, permanent grass/legume openings would be established. New wildlife openings would be created in wild turkey management emphasis areas from existing roads and log landings. The Catfish Lake waterfowl impoundment would be managed according to the current management plan. Hardwoods would be maintained where they exist and restored on sites where the natural community potential is hardwood. Longleaf pine that occurs on hardwood types, however, would not be replaced in the RCW habitat management area.

Hardwood Wetlands: The potential natural vegetation predicted by the ecological classification would be the criterion for delineating the hardwood wetland zone, and managed as "not suited" for timber production.

***Bear Habitat*:** Bear habitat would be provided in a specific bear habitat management area, and pocosin burning would create rich bear habitat.

Surface Water Management: Natural hydrology would not be permanently altered. Natural hydrology and wetlands would be restored where possible.

2.2.3.2: Recreation Opportunities

Recreation: Existing sites such as Cedar Point might be expanded, and a group camp area would be provided. Recreation development would support nature- and culture-based tourism. Designated canoe, mountain bike, and horse trail systems would be provided. Hiking trail miles may increase. OHV use would be moved to new locations, and two sites would be designated for OHV use. A shooting range would be developed in Craven or Jones County, and as many as three fishing ponds might be created. An interpretive center close to the Highway 24 shoreline might be developed as land becomes available.

2.2.3.3: Special Land Allocations

***Special Interest Areas*:** Currently registered areas would be maintained, and eight of the proposed new areas would be registered and identified as a special inventory.

***Wilderness/River Corridors Eligible for Wild and Scenic River Status*:** An increase of 691 acres would be recommended for Wilderness due to boundary adjustments to reflect ownership changes and to simplify management. Corridors on CNF land along Brice Creek and White Oak River would be managed to protect the outstandingly remarkable values.

2.2.3.4: Silviculture, Forest Products, Forest Health

***Vegetation and Timber Management*:** Rotation lengths for timber management would differ inside and outside the habitat management area for RCW. Inside the RCW area, loblolly and pond pine would be managed on 80-year rotations, and longleaf on a 120-year rotation. Outside the RCW area, loblolly and pond pine would be managed on 60-year rotations. Existing hardwood stands would be classed as not suited for timber production, but restoration of hardwoods could occur on Stream and River Terraces and Drainage Slopes (Landtypes 3&4), hardwood forest, and hardwood slope sites. Potential natural communities predicted by the ecological classification would guide regeneration efforts. Sites would be

restored in a variety of ways using even- and uneven-aged management, natural and artificial regeneration. Site preparation would include intensive practices such as bedding and less intensive practices such as burning. Pine straw raking would be permitted on a sustained-yield basis. Longleaf Old growth sites would be allocated to specific areas, which would not be considered suitable for timber production. Old growth would receive only uneven-aged management in future planning horizons.

2.2.3.5: Fire Management

Fire Management: Prescribed fire would be used for longleaf restoration, wildlife habitat improvement, fuel reduction, timber stand improvement, and site preparation for natural and artificial regeneration. Emphasis would be placed on fuel reduction treatments and growing-season prescribed fire for longleaf restoration. Urban interface zones would be managed to reduce fuel loadings. Fuels might be treated mechanically in some cases. Wildland fire use for resource benefit would be considered. Prescribed fire would be applied to pocosins, including wildernesses, but only after research answers questions about organic soil ignition and emission factors. Use of mechanized equipment for fire suppression would be allowed on the entire forest for fire suppression. Ground disturbing activities would be permitted outside wilderness during pocosin burning. As burning parameters permit, prescribed fire would be applied to 25-50,000 acres per year in the future as pocosins can be burned safely. Wildfire suppression would be designed to minimize resource damage and provide for firefighter safety. Prescribed fire activities would meet current air quality guidelines. Air quality would be monitored during wildfires.

2.2.3.6: Access

Access: Some roads would be managed using seasonal closures for wildlife management. Unauthorized roads and trails would gradually be blocked and obliterated. A limited number of existing open roads would be closed except for administrative use.

2.2.3.7: Local Communities

***Special Uses*:** New special uses with high impacts would not be permitted. A plan would be created to phase out some existing special uses as opportunities arise.

Land Adjustment: Adjustments would focus on the acquisition of land identified in the land adjustment plan for resource and recreation management and on consolidation of national forest ownership. Priorities would be placed on the acquisition of land to protect critical habitat, riparian ecosystems, historic or cultural resources; Congressionally designated areas, and recreation and aesthetic values.

2.2.4: Alternative C- Modified

Alternative C is modified to include Pond Pine Addition B as recommended for wilderness designation. All other actions and effects are the same as Alternative C. This new wilderness enlarges the Pond Pine Wilderness to the east and provides a linkage around Great Lake to the Sheep Ridge Wilderness to the north and the Pocosin Wilderness to the south. A quarter mile non-wilderness buffer would be provided on the north side of the Marine Railroad (see map of Alternative C).

2.2.5: Alternative D

This alternative addresses public desires for more human accessibility to and use of national forest lands. In Alternative D, current timber management types would be the basis for regeneration, and longleaf pine and hardwoods would not be actively restored. The level of RCW population expansion would be minimal. Fuels management would be aggressive, and emphasis on habitat improvement would be less than in other alternatives. Recreation management would emphasize a full range of opportunities. A wide variety of special uses would be accommodated throughout the forest, and local community development would be highlighted where possible.

2.2.5.1: Biological Diversity

Red-cockaded Woodpecker Management: In the first 10 years, the objective of RCW management would be a population of 145 to 151 territories, and the goal would be 5 percent population expansion. Two to three clusters would be placed in areas most likely to be successful.

Rare Species Management: Habitat management for all threatened, endangered, and sensitive species would be maintained across the planning area. All rare species would be protected within existing North Carolina Natural Heritage Program natural areas. All proposed ground-disturbing projects would be evaluated for their probable effects on populations of rare species.

***Wildlife*:** New wildlife openings would be created with an emphasis on providing dove hunting fields. Existing hardwoods would be maintained for habitat and hard mast, but hardwoods would not be restored to areas where they historically occurred but are currently absent.

Hardwoods: The potential natural vegetation would be used to delineate hardwood wetland zones, and managed as "not suited" for timber production.

Black Bear: Black bears would rely on existing wilderness for protected habitat.

***Surface Water Management*:** Drainage might be improved on very poorly drained mineral soils to increase the sustained yield capacity by 10 percent.

2.2.5.2: Recreation Opportunities

Recreation: Recreation development would encourage a full range of recreation activities and provide easy access to the forest. The current OHV trail system would be relocated to a more desirable place, and additional OHV trails would be designated. Areas for horseback riding and mountain biking would be designated, and additional boat launches would be created. Two public shooting ranges would be developed in Jones and Craven Counties, and as many as three fishing ponds might be created. Existing campgrounds would be expanded and at least one group camp area would be provided. An interpretive center close to the Highway 24 shoreline might be developed as land becomes available.

Heritage Resources: Efforts to interpret and to increase public awareness would grow. The need for test excavation and mitigation also would have to expand because public use and associated damage would increase.

2.2.5.3. Special Land Allocations

***Special Interest Areas*:** Existing special interest areas would be maintained without a designated management prescription, but no new areas would be registered.

Wilderness/Wild and Scenic Rivers: New Wilderness would be recommended for designation only to adjust boundaries to simplify management and reflect ownership changes. No corridors would be managed to protect the values of wild and scenic rivers on CNF land. River integrity would be maintained through other management designations such as heritage resource areas, riparian, and hardwood-wetland zones.

2.2.5.4: Silviculture, Forest Products, and Forest Health

***Vegetation and Timber Management*:** Inside the RCW habitat management area, rotation lengths would be 80 years for loblolly and pond pines, and 120 years for longleaf pine. Outside the area, rotations would be 60 years for loblolly and pond pine, and 100 years for longleaf. Existing hardwood stands would be classed as not suited for timber production. The current Continuous Inventory of Stand Condition (CISC) management type would guide decisions for regeneration. Even-aged management, artificial regeneration, and intensive site preparation including bedding would be common. Pine straw raking would be permitted on a sustained-yield basis. Longleaf old growth would be allocated to specific areas, which would be considered suitable for timber production.

2.2.5.5: Fire Management

***Fire Management*:** Burning would be prescribed for longleaf pine maintenance, wildlife habitat improvement, fuel reduction, timber stand improvement, and site preparation for natural and artificial regeneration. Fuel reduction would be emphasized, particularly in wildland-urban interface zones. Fuels might be treated mechanically in some cases. Wildland fire for resource benefit would be considered. After research answers questions about organic soil ignition and emission factors, prescribed fire would be applied to pocosins, including wildernesses. The use of mechanized equipment for fire suppression would be allowed on the entire forest. Ground disturbing activities outside wilderness might be used during pocosin burning. As burning parameters permit, prescribed fire would be applied to 25,000 acres or more per year. Wildfire suppression would be designed to minimize resource damage and provide for firefighter safety. If possible, these programs would be funded at that level. Prescribed fire activities would be designed to meet current air quality guidelines. Air quality would be monitored during wildfires.

2.2.5.6: Access

Access: Most roads on the forest would be kept open to the public, and the quality of road maintenance across the forest would be high.

2.2.5.7: Local Communities

***Special Uses*:** Numbers and types of special uses would increase. Uses for community development would be encouraged.

Land Adjustment: Adjustments would focus on the acquisition of land identified in the land adjustment plan for recreation management and consolidation of national forest ownership. Priority would be placed on minimizing national forest ownership that creates wildland-urban interface through the exchange or transfer of land into private ownership to serve a greater public need. Transfer to private

ownership typically would occur in areas that are inside or adjacent to communities or other developed private land and that are valuable for non-national forest purposes.

2.2.6: Alternative E (preferred)

The goals of this alternative are similar to Alternative C. It addresses public comments desiring active longleaf pine restoration, expansion of the existing RCW population, more habitat for black bears, neotropical birds, and wild turkey, and more fuels management in wildland-urban interfaces. However, the way of restoring longleaf pine and increasing RCW clusters would change between the two alternatives. Alternative E emphasizes two-aged regeneration system (shelterwood with reserves method) over clearcutting in order to retain potential nesting trees for RCW. One OHV area provides opportunities to meet demands for off highway vehicles.

2.2.6.1: Biological Diversity

***Red-cockaded Woodpecker Management**:* Goals are changed from Alternative C. The RCW population objective would be 137 to 169 clusters in the long term, and 20-26 clusters over the next ten years. Six clusters per year would provide for linkage and six per year would be provided in areas with a high probability of success. Birds could be translocated.

***Rare Species Management*:** There are no changes from Alternative C. Habitat management for all threatened, endangered, and sensitive species would be maintained across the planning area. To sustain known populations of rare species, appropriate habitat conditions would be provided through active management in existing North Carolina Natural Heritage Program natural areas and eight newly designated Special Interest Areas (Natural Areas). Ten-year population objectives for sensitive and forest concern species would be set, and monitoring protocols would be developed. The network of natural areas, wilderness areas, and the RCW habitat management area would be used as core areas for rare species populations.

Wildlife: There are no changes from Alternative C. Existing wildlife openings would be maintained, and, where appropriate, permanent grass/forb openings would be established. New wildlife openings would be created in wild turkey management emphasis areas (upland hardwood management) from existing roads and log landings. The Catfish Lake waterfowl impoundment would be managed according to the current management plan. Hardwoods would be maintained where they exist and restored on sites where the natural community potential is hardwood. Longleaf pine that occurs on hardwood types, however, would not be restored to hardwoods in the RCW habitat management area.

Hardwood Wetlands: There are no changes from Alternative C. The potential natural vegetation predicted by the ecological classification would be the criterion for delineating the hardwood wetland zone, and managed as not suited for timber production.

***Bear Habitat*:** The bear habitat management area designation is dropped. However, the cumulative effect of desired conditions on bears is the same. Bear habitat would be provided through a combination of several management prescriptions protecting bear habitat. The prescriptions creating bear habitat management are wilderness, bear, and hardwood wetlands. Pocosin burning would create rich bear habitat.

Surface Water Management: No change from Alternative C.

2.2.6.2: Recreation Opportunities

Recreation: Existing sites such as Cedar Point would be expanded, and a group camp area would be provided. Recreation development would support nature- and culture-based tourism. Designated canoe, mountain bike, and horse trail systems would be provided. OHV use would be focused on one location. A shooting range could be developed in Craven or Jones County, and as many as three fishing ponds might be created. An interpretive center close to the Highway 24 shoreline might be developed as land becomes available.

2.2.6.3: Special Land Allocations

***Special Interest Areas*:** There are no changes from Alternative C. Currently registered areas would be maintained, and eight of the proposed new areas would be designated and identified as Special Interest Areas (Natural Areas).

***Wilderness/River Corridors Eligible for Wild and Scenic River Status*:** There are no changes from Alternative C. Wilderness boundaries would be adjusted to reflect ownership changes and to simplify management. Corridors on the CNF along Brice Creek and White Oak River would be managed to protect the outstandingly remarkable values for which these corridors are recognized.

2.2.6.4: Silviculture, Forest Products, Forest Health

***Vegetation and Timber Management*:** Longleaf restoration would be slower than in Alternative C. The method of restoration would primarily use shelterwood with reserves. Longleaf restoration within the RCW HMA would drive silvicultural activities. Existing hardwood stands would be classed as not suited for timber production, but restoration of hardwoods could occur on Stream and River Terraces and Drainage Slopes (Landtypes 3&4), hardwood forest, and hardwood slopes. Potential natural communities predicted by the ecological classification would guide regeneration efforts. Sites would be restored in a variety of ways. Conversion to longleaf could also be achieved by thinning loblolly and leaving longleaf. Site preparation may still favor flat and hand planting over more intensive practices such as bedding. However, since the number of acres that may be clearcut to restore longleaf is reduced, the number of acres needing intensive site preparation such as bedding is also reduced. Pine straw raking would be permitted on a sustained-yield basis. Longleaf old growth would be allocated to specific areas, which would not be considered suitable for timber production.

2.2.6.5: Fire Management

Fire Management: Prescribed fire would be used for longleaf restoration, wildlife habitat improvement, fuel reduction, timber stand improvement, and site preparation for natural and artificial regeneration. Emphasis would be placed on fuel reduction treatments and growing-season prescribed fire for longleaf restoration. Urban interface zones would be managed to reduce fuel loadings. Fuels might be treated mechanically in some cases. Wildland fire use for resource benefit would be considered. As research results provide more knowledge on ignition and emission in organic soils, an increase in the number of acres of pocosin on which prescribed fire is applied would occur. This would include wilderness also. Use of mechanized equipment for fire suppression would be allowed on the entire forest for fire suppression. Ground disturbing activities would be permitted outside wilderness during pocosin burning. As burning parameters permit, prescribed fire would be applied to about 25,000 acres per year. Wildfire suppression would be designed to minimize resource damage and provide for

firefighter safety. Prescribed fire activities would meet current air quality guidelines. Air quality would be monitored during wildfires.

2.2.6.6: Access

Access: Roads open for public motorized use are displayed on the map in the Plan. The remainder of the CNF would be closed to motorized use.

2.2.6.7: Local Communities

***Special Uses*:** New special uses with high impacts would not be permitted. A plan would be created to phase out some existing special uses as opportunities arise.

Land Adjustment: Adjustments would focus on the acquisition of land identified in the land adjustment plan for resource and recreation management and on consolidation of national forest ownership. Priorities would be placed on the acquisition of land to protect critical habitat, riparian ecosystems, historic or cultural resources; Congressionally designated areas, and recreation and aesthetic values.

2.3: COMPARISON OF ALTERNATIVES BY ISSUE

2.3.1: Biological Diversity

2.3.1.1: RCW Management

In the alternatives, activities needed to protect and promote the RCW and its habitat are balanced with other biological and social needs unique to the CNF. Alternatives B, C, D, and E follow management direction found in the final EIS for the Management of the RCW and its habitat on National Forests in the Southern Region (R8-RCW, June 1995). This management direction emphasizes establishing suitable habitat for the recruitment of new RCW clusters.

Recovery of the RCW depends on restoring the longleaf pine ecosystem and fire's role in its maintenance. The rate of restoration as well as the extent and season of prescribed burning would affect the rate and probability of successful RCW recovery. Management objectives in each alternative therefore reflect different levels of species recovery (Table 2.1).

Table 2.1: RCW management objectives by alternative.

	Alternative A	Alternative B	Alternative C/ C-Modified	Alternative D	Alternative E
Growing season burning in HMA	200 ac. / year	1,000 ac. / year	2,000 ac. / year	1,000 ac. / year	2000 ac/year
Average annual burning in CNF	15,000 acres	12,000 acres	25,000 acres	24,000 acres	25,000 ac./ year
Longleaf pine restoration (acres)	600	0	4,000	230	2,650-3,600
Size of the HMA (acres)	37,845	46,656	46,656	43,424	69,000
New recruitment stands in 10 yrs	15-20	15-20	25-30	15-20	20-26
Cavity augmentation (box, cavity)	cavity	none	cavity and box	box	cavity and box
# of RCW clusters in 10 years	68-75	68-75	85-93	70-78	83-89
Long-term population objective	126-139	151-169	151-169	136-151	137-169

Alternative A: Sets a 10-year population objective of 68-75 RCW clusters within a 37,845 acre RCW habitat management area (RCW-HMA). Only existing loblolly pine, longleaf pine, and pine-hardwood forest types identified from CISC data are considered suitable for RCW. Birds would move gradually to occupy new habitat because suitable plant composition, stand structure, and artificial cavities would be provided in only 15 to 20 new recruitment stands and no active translocation of birds would be done. Conditions in existing RCW clusters would be maintained but the quality of habitat would not rapidly improve because only 200 acres would be burned during the growing season. Forage quality would be maintained by burning 15,000 acres of pine dominated forest types every year. The restoration of longleaf pine would proceed slowly and the long-term RCW population objective of 126 to 139 clusters may take over 30 years to achieve.

Alternative B: Sets a long-term population objective of 151-169 RCW clusters within a 46,656 acre RCW-HMA. All sites except pocosins that currently support or could potentially support pine and pine hardwood forest types are considered suitable for RCW. Birds would move very gradually to occupy new habitat because suitable plant composition and stand structure would be provided in only 15-20 to 33 new recruitment stands and no active translocation of birds or installation of artificial cavities would be done. Conditions in existing RCW clusters would be maintained and the quality of habitat would improve within the 1,000 acres burned yearly during the growing season. Forage quality would be maintained by burning 12,000 acres of pine dominated forest types every year. The restoration of longleaf pine would proceed very slowly and the long-term RCW population objective of 151 to 169 clusters may take over 50 years to achieve.

Alternative C/C-Modified: Sets a long-term population objective of 151-169 RCW clusters within a 46,656 acre RCW-HMA. All sites except pocosins that currently support or could potentially support pine and pine hardwood forest types are considered suitable for RCW. Birds would move rapidly to occupy new habitat because suitable plant composition, stand structure, artificial cavities, and nest boxes would be provided in 25 to 30 new recruitment stands and active translocation of birds would be done. The quality of habitat in all RCW clusters would be improved greatly because 2,000 acres would be burned yearly during the growing season. Forage quality would be maintained by burning nearly 20,000 acres of upland pine types every year. The restoration of longleaf pine would also proceed rapidly and the long-term RCW population objective of 151 to 169 clusters may occur within 30 years. Rapid restoration of RCW habitat would greatly increase the probability of recovering the population shared by the CNF, Camp Lejeune, and the Holly Shelter Wildlife Refuge.

Alternative D: Sets a long-term population objective of 136-151 RCW clusters within a 43,324 acre RCW-HMA. All sites except pocosins that currently support or could potentially support pine and pine hardwood forest types are considered suitable for RCW. No recruitment territories are planned in the southeastern portion of the CNF along New Bern Road. This area is isolated from the major RCW population and considered the most difficult to reintroduce the species. Initially, birds would move rapidly to occupy new habitat because suitable plant composition, stand structure, and nest boxes would be provided in 35 to 45 new recruitment stands and active translocation of birds would be frequent the first 2 years. Conditions in existing RCW clusters would be maintained and the quality of habitat would improve within the 1,000 acres burned yearly during the growing season. Forage quality would be maintained by burning nearly 19,000 acres of upland pine types every year. The restoration of longleaf pine would proceed slowly and the long-term RCW population objective of 136 to 151 clusters may take over 30 years to achieve.

Alternative E: Sets a long-term population objective of 137-169 RCW clusters within a 69,000 acre RCW-HMA. Sites that currently support or could potentially support pine and pine hardwood forest types are considered suitable for RCW. Birds would move rapidly to occupy new habitat because suitable plant composition, stand structure, artificial cavities, and nest boxes would be provided in 20 to 26 new recruitment stands and active translocation of birds would be implemented. The quality of habitat in RCW clusters would be improved greatly because 2,000 acres would be burned yearly during the growing season. Forage quality would be maintained by burning nearly 20,000 acres of upland pine types every year. Restoration of RCW habitat would greatly increase the probability of recovering the population shared by the CNF, Camp Lejeune, and the Holly Shelter Wildlife Refuge.

2.3.1.2: Rare Communities and Rare Species Management

All alternatives would protect and enhance rare species and rare communities by providing the natural community structure and function to support their survival. The alternatives differ in the rate at which these goals are met and the need for future mitigation measures in sensitive habitats. Alternatives B, C, and E establish a network of natural areas, wilderness areas, and the RCW habitat management area as core areas for rare species protection and enhancement. Impacts on sites outside of these core areas would be less critical because core populations of rare species would always be maintained. Alternatives A and D rely more heavily on future site-specific evaluation to determine the probable effects of proposed activities on populations of rare species. A comparison of management objectives in each alternative reflects these different philosophies (Table 2.2).

Table 2.2: Rare communities and rare species management objectives by alternative.

	Alternative A	Alternative B	Alternative C/ C-Modified	Alternative D	Alternative E
# of designated Special Interest Areas (Natural Areas)	11	28	18	11	18
Total acres in SIAs (Natural Areas)	42,452	63,924	47,730	42,452	47,730
% CNF's rare spp. protected [1]	37%	72%	70%	37%	70%
Rare community restoration (ac.)	600	50	4,570	230	3,220 to 4,170
Average annual burning in CNF	15,000 acres	12,000 acres	25,000 acres	24,000 acres	25,000 acres
# of new rare species populations	0	2	11	0	11
# of old growth longleaf sites	0	0	20-30	20-30	20-30
Old growth suitable for timber	yes	yes	no	yes	no

[1] *species are considered protected in Natural Areas, old growth management areas , RCW nest areas, and Wilderness areas*

Alternative A: Establishes a 37,845-acre RCW-HMA and no new Natural Areas or Wilderness Areas. Only 37 percent of all documented rare species populations on the CNF would occur in these protected areas. Plant community restoration efforts would be concentrated in 600 acres of potential longleaf pine savannas and 15,000 acres of prescribed burning yearly would be used to maintain habitat conditions for species occurring in upland pine habitats. Current rare species populations would be maintained but no objectives would be set for establishing new populations except the RCW. Current longleaf old growth stands outside of Natural Areas may be suitable for timber production.

Alternative B: Establishes a 46,656 acre RCW-HMA, 17 new Natural Areas, and 1 new Wilderness Area. Over 70 percent of all documented rare species populations on the CNF would occur in these protected areas. Nearly 40 percent (64,000 acres) of the CNF would be in Registered Natural Areas. Plant community restoration efforts would be concentrated in marshes, maritime forests, and coastal prairie and would total 50 acres. Prescribed burning yearly would be used on 12,000 acres to maintain habitat conditions for species occurring in upland pine habitats. Current rare species populations would be maintained and, in addition to RCW population objectives, 2 new populations of spring flowering goldenrod would be established. Although no old growth longleaf sites would be established, much of the CNF would progress toward old growth conditions because only uneven-aged management systems would be allowed.

Alternative C/C-Modified: Establishes a 46,656 acre RCW-HMA, 9 new Natural Areas, and additions to existing Wilderness Areas. Approximately 70 percent of all documented rare species populations on the CNF would occur in these protected areas. About one third (47,730 acres) of the CNF would be in Natural Areas. Plant community restoration efforts would be extensive, occurring in marshes, maritime forests, treeless savannas, canebrakes, and longleaf pine savannas. Total restoration would exceed 4,500 acres. Prescribed burning would be used on 25,000 acres yearly to maintain habitat conditions for species occurring in nearly all Landtypes found on the CNF. Current rare species populations would be maintained and, in addition to RCW population objectives, 11 new populations would be designated for

five other species. Longleaf pine old growth sites would be established and one-third of all hardwood-cypress swamps, upland hardwood, and pond pine woodlands would be maintained in old growth conditions. Old growth areas would not be suitable for timber production.

Alternative D: Establishes a 42,452-acre RCW-HMA and no new Natural Areas or Wilderness Areas. Only 37 percent of all documented rare species populations would occur in these protected areas. Plant community restoration efforts would be concentrated in 230 acres of potential longleaf pine savannas and prescribed burning on 25,000 yearly would be used to maintain habitat conditions for species occurring in most all Landtypes occurring on the CNF. Current rare species populations would be maintained but no objectives would be set for establishing new populations except the RCW. Longleaf pine old growth sites would be designated and, outside of existing Natural Areas, may be suitable for timber production.

Alternative E: Establishes a 69,000 acre RCW-HMA, 9 new Natural Areas, and additions to existing Wilderness Areas. Approximately 70 percent of all documented rare species populations on the CNF would occur in these protected areas. About one third (47,730 acres) of the CNF would be in Natural Areas. Plant community restoration efforts would be extensive, occurring in marshes, maritime forests, coastal prairie, canebrakes, and longleaf pine savannas. Total restoration would exceed 2,500 acres. Prescribed burning would be used on about 25,000 acres yearly to maintain habitat conditions for species occurring in nearly all Landtypes found on the CNF. Current rare species populations would be maintained and, in addition to RCW population objectives, 11 new populations would be established for five other species. Longleaf pine old growth sites would be established and one-third of all hardwood-cypress swamps, upland hardwood, and pond pine woodlands would be maintained in old growth conditions. Old growth areas would not be suitable for timber production.

2.3.2: Recreation Opportunities

2.3.2.1: Recreation and Scenery

Recreation on the CNF occurs year round, with seasonal variations for different uses. The predominant feature that draws recreation use the variety of water present – the ocean, lakes and streams on the CNF offer a variety of recreation experiences. Recreation use will be discussed in terms of site capacity, and varying development levels. Development can range from very few facilities in a dispersed area with limited use to a highly developed campground with many amenities and high use levels. Due to increasing populations and recreation users, all alternatives provide for some increase in recreation opportunities. Emphasis will be on providing more facilities that provide opportunities for land-based and water-based dispersed recreation, such as developing additional trails for a variety of uses and developing access to waterways.

Viewing attractive scenery is one of the most important features for forest visitors. The quality of scenery can be affected by the intensity and impact of other management activities. Timber harvest, road building, and fire can have significant impacts of the quality of scenery. Highly visible areas along major roads and developed recreation sites may require management activities that impact scenery quality. The alternatives vary in their effect on scenery quality by the type and intensity of activities proposed.

Table 2.3. Recreation management objectives by alternative.

Alternative	A	B	C/ C-Modified	D	E
Developed Rec. PAOT[1] Capacity by ROS Class					
-Rural	1,050	1,050	1,208	1,312	1,208
-Roaded Natural	450	500	638	638	638
-Semi-primitive Motorized	175	217	394	394	394
Trail Miles					
-OHV	36	8 - 10	20 - 30	20 - 30	8-10
-Mountain bike	0	10 - 15	20 - 40	20 - 40	20-40
-Horseback	0	10 - 15	10 - 20	10 - 20	10-20
-Hiking	31	31	31	31	31
-Canoe	0	8	16	16	16
Other Recreation Opportunities					
-Fishing Areas	0	3	5	5	5
-Wildlife Viewing Opportunities	0	0	4	4	4

[1]*PAOT = People at one time.*

Alternative A: Current overuse and demand for more rustic and primitive facilities would not be accommodated, which could lead to resource damage and unmet visitor expectations. Demand for trail systems would be partially accommodated by using existing trails and closed roads. Use of unauthorized trails and the accompanying resource damage would likely continue.

This alternative proposes a low amount of regeneration acres, so impacts to the natural appearance of the scenery would be low.

Alternative B: Emphasis would be on non-motorized recreation opportunities and rustic recreation developments. These facilities would increase in capacity about 20%, which would partially accommodate the anticipated 30% increase in demand. As a result, visitor expectations might not be met. Since trail miles would be the lowest of all alternatives, existing trails would be overused, causing resource damage. Additionally, the use of undesignated trails may also increase, causing resource damage. However, less new recreation development and new access would reduce impacts to natural resources.

Approximately 2,600 acres would be harvested using small group selection. These activities would have low impact to the scenery compared to the other alternatives.

Alternative C: Highly developed facilities would increase by 15 percent and water based rustic facilities would increase by 40 percent. These increases would accommodate a growing interest in these

activities. Designed systems of trails for all users would be developed and unauthorized use would be prohibited, thus protecting other resources and sensitive plants from damage. Also included would be an interpretive program that complements and would often be associated with the recreation facilities. Recreationists would have opportunities to be well-informed and cooperating partners in managing the CNF.

Approximately 4,200 acres would be harvested in this alternative in an intensive program to convert areas to longleaf pine and RCW habitat. Active burning in the pocosins would be emphasized. Management including clearcutting and burning would be obvious from access roads and recreation facilities for the planning period. Visitation might decrease in some areas temporarily and complaints might increase. Long-term results would be an increase in attractive scenery due to emphasis on longleaf pine savannas and burning in the pocosins.

Alternative D: Highly developed facilities would increase by 30 percent and water based rustic facilities would increase by 40 percent. These increases would meet rustic demand and would more than meet demand for highly developed facilities. Designed systems of trails for all users would be developed and unauthorized use would be closed out, thus protecting other resources and sensitive plants from damage. Access to the forest would be emphasized in this alternative, so there might be increased conflicts between forest users' demands and the ability to provide high quality habitat for wildlife and some plant species. Users who desire more solitude might find it more difficult to find. Also included would be an interpretive program that complements and would often be associated with the recreation facilities. Recreationists would have opportunities to be well-informed and cooperating partners in managing the CNF.

Approximately 4,000 acres would be harvested in this alternative. Active burning in the pocosins would be emphasized. Management including timber harvest leaving seed trees and burning would be obvious from access roads and recreation facilities for the planning period. Visitation might decrease in some areas temporarily and complaints might increase. Long-term results would be an increase in attractive scenery due to emphasis on longleaf pine savannas and burning in the pocosins.

Alternative E: Highly developed facilities would increase by 15 percent and water based rustic facilities would increase by 40 percent. These increases would accommodate a growing interest in these activities. One OHV trail system would be developed and unauthorized use would be closed out. Also included would be an interpretive program that complements uses of the recreation facilities. Recreationists would have opportunities to be well-informed and cooperating partners in managing the CNF.

Approximately 2,500 acres would be harvested in this alternative in a program to convert areas to longleaf pine and RCW habitat. Active burning in the pocosins would be emphasized depending on safety. Management practices including 2-age regeneration and burning would be obvious from access roads and recreation facilities for the planning period. Visitation might decrease in some areas temporarily and complaints might increase. Long-term results would be an increase in attractive scenery due to emphasis on longleaf pine savannas and burning in the pocosins.

2.3 3: Special Land Allocations

2.3.3.1: Wilderness and Roadless Areas

There are 31,221 acres of Wilderness on the CNF. An additional 20,801 acres of Roadless Areas are suitable for Wilderness designation. The alternatives vary by the number of acres that would be proposed to Congress for recommendation to the wilderness system.

Table 2.4. Wilderness management objectives by alternative.

Alternative	A	B	C	C-Modified	D	E
Acres	31,221	51,992	31,912	34,892	31,912	31,912

Alternative A: Existing Wildernesses would remain managed as Wilderness, no new ones would be recommended. Under current direction, the roadless areas would be managed to provide semi-primitive non-motorized recreation and high scenic quality. Some vegetation management utilizing timber harvesting might occur along the edges of some of the roadless areas. Fuel build-up in both Wildernesses and roadless areas would probably occur since fire is seldom used in these areas under current direction.

Alternative B: All the Roadless Areas would be recommended as Wilderness. Approximately 50 miles of roads adjacent or within the areas would be closed, enhancing the semi-primitive non-motorized experience. Activities that require access and use of motorized equipment, like firefighting and search and rescue, would be difficult to achieve in this alternative. Wilderness values would have the greatest protection.

Alternative C: Boundary adjustments totaling 691 acres would be proposed for recommendation as Wilderness. These are all adjacent to existing Wildernesses. Approximately 30 miles of roads would be closed, half of these adjacent to Wilderness and roadless areas. Other roadless areas would be managed as black bear habitat, thus retaining the roadless characteristic of remoteness. Small portions of Catfish Lake Wilderness and Sheep Ridge Wilderness (approximately 350 and 100 acres respectively) are contained within the identified wildland-urban interface areas and may require vegetative treatment to reduce the fire hazard to adjacent private land. Prescribed burning and prescribed natural fire would be permitted in Wilderness. Fire in the Wildernesses would make access easier, possibly decreasing the feeling of solitude, but would increase the amount of attractive scenery.

Alternative C-Modified: The same boundary adjustments as described in Alternative C, and Pond Pine Addition B roadless area would be proposed for recommendation as Wilderness. These 3,671 acres would provide a linkage around Great Lake between Sheep Ridge Wilderness and Pocosin Wilderness. Approximately 30 miles of roads would be closed, half of these adjacent Wilderness and roadless areas. Other roadless areas would be managed as black bear habitat, thus favoring low motorized access. Small portions of Catfish Lake Wilderness and Sheep Ridge Wilderness (approximately 350 and 100 acres respectively) are contained within the identified wildland-urban interface areas and may require vegetative treatment to reduce the fire hazard to adjacent private land. Prescribed burning and prescribed natural fire would be permitted in Wilderness. Fire in the Wildernesses would make access easier, possibly decreasing the feeling of solitude, but would increase the amount of attractive scenery.

Alternative D: Boundary adjustments totaling 691 acres would be proposed for recommendation as Wilderness. These are all adjacent to existing Wildernesses. Approximately 12 miles of roads would be closed, half of these adjacent Wilderness and roadless areas. Other roadless areas would be managed as black bear habitat, thus retaining the roadless characteristic of remoteness. Small portions of Catfish Lake Wilderness and Sheep Ridge Wilderness (approximately 350 and 100 acres respectively) are contained within the identified wildland-urban interface areas and may require vegetative treatment to reduce the fire hazard to adjacent private land. Prescribed burning and prescribed natural fire would be permitted in Wilderness. Fire in the Wildernesses would make access easier, possibly decreasing the feeling of solitude, but would increase the amount of attractive scenery.

Alternative E: The same boundary adjustments of 691 acres as described in Alt. C would be proposed for recommendation as Wilderness. Most of the other roadless areas would be managed as black bear habitat, thus favoring low motorized access. Small portions of Catfish Lake Wilderness and Sheep Ridge Wilderness (approximately 350 and 100 acres respectively) are contained within the identified wildland-urban interface areas and may require vegetative treatment to reduce the fire hazard to adjacent private land. Prescribed burning and prescribed natural fire would be permitted in Wilderness. Fire in the Wildernesses could make access easier, possibly decreasing the feeling of solitude, but would increase the amount of attractive scenery.

2.3.3.2: Wild and Scenic Rivers

The White Oak River and Brice Creek including West and East Prong Creeks are eligible for Wild and Scenic River designation (Appendix D). Table 2.5 displays the amount of land that would be managed to retain the values of potential Wild and Scenic Rivers until studies are completed.

Table 2.5. CNF land managed as Wild and Scenic Rivers until studies are completed.

Alternative	A	B	C/ C-Modified	D	E
CNF managed as Wild and Scenic Rivers until studies are completed	1,362	3,351	3,351	0	3,351

Actions Common to Alternatives B, C/C Modified, and E: Further study of these rivers would be recommended for their suitability as Wild and Scenic Rivers. Due to the limited CNF ownership within the river corridors, the State of North Carolina would be the appropriate agency to lead studies of Wild and Scenic River suitability.

Alternative A: Only the White Oak River corridor would be managed in this way.

Alternatives B, C/C-Modified, and E: Brice Creek and White Oak River corridor on CNF would be managed to retain the values of the potential as Wild and Scenic Rivers. It would be managed to maintain its outstandingly remarkable values, which would result in a higher degree of scenery management, fewer developments, and less vegetation management. Historic and archeological sites, riparian zones, and wildlife and aquatic habitats would also be protected. Clean up after catastrophic events would be more difficult because of restrictions within the corridors.

Alternative D: Brice Creek and White Oak River would not be managed with the potential Wild and Scenic prescription, instead, both would be managed under prescription guidelines for hardwood cypress wetlands and water based recreation and heritage resources.

2.3.4: Forest Products and Forest Health

Table 2.6. The allowable sale quantity, land suitable for timber production, sustained yield, and present net values by alternative.

Alternative	**A**	**B**	**C/ C-Modified**	**D**	**E**
Acres suitable and scheduled for timber production	24,985	10,890	26,774	21,546	25,723
Allowable Sale Quantity MCF/Year (1st period)	497	260	2,093	1,484	876
Long Term Sustained Yield Capacity MCF/Year	1,625	442	1,247	1,573	1303
Maximum PresentNet Value (MM $)	$23.2	$4.4	$29.3	$26.2	$20.9

Table 2.7. Restoration and Regeneration goals by alternative over the next ten years.

Alternative	**A**	**B**	**C/ C-modified**	**D**	**E**
Total Longleaf Restoration	600	0	4000	230	2500
Clearcut	530	0	2730	4400	1000
Seed-tree/ Shelterwood	620	0	2000	0	0
Two Aged Shelterwood	0	0	1500	0	1500
Group Selection	50	1040	0	0	0
Total Regeneration Acres/Year (1st period)	1200	1040	6230	4400	2500

Alternative A: This alternative would involve even-aged management with rotations for loblolly pine at 80 years and longleaf pine at 100 years. Acres suitable for timber production are 24,985, second largest of all alternatives. The projected harvest level for the first period is 497 thousand cubic feet per year, ranking fourth among the alternatives.

Approximately 1200 acres during the first ten-year period would be regenerated using a combination of clearcutting and seedtree regeneration methods. Clearcutting is the regeneration method used in this alternative for longleaf pine restoration along with mechanical site preparation and planting. The seedtree method is proposed for regeneration of mixed pine (loblolly pine and pond pine) using

prescribed fire for site preparation and relying mostly on natural regeneration. Thinning is proposed for about 2680 acres for the first ten-year period. There would be no pine straw production.

Alternative B: This alternative would use uneven-aged management, the group selection regeneration method. Acres suitable for timber production are 10,890. The projected harvest level for the first period is 260 thousand cubic feet per year, the lowest among the alternatives. Approximately 1040 acres per year during the first period would be regenerated in small groups ranging from 1/2 acre to 3 acres in size. Thinning is proposed on about 4000 acres during the first period. No pine straw production is proposed for this alternative.

Alternative C/C-Modified: This alternative would use even-aged and two-aged management with a 120-year rotation for longleaf pine inside the RCW Habitat Management Area (HMA), and 80 years outside the HMA. For loblolly pine and pond pine, the rotation is 80 years inside the HMA, and 60 years outside the HMA. Acres suitable for timber production are 26,774. The projected harvest level is 2,093 thousand cubic feet per year during the first period.

Approximately 6,230 acres during the first period would be regenerated using a combination of clearcutting, two-aged, and seed tree regeneration methods. Clearcutting along with mechanical site preparation and planting would be used to restore longleaf where the seed source is not adequate and the two-aged method would be used in mixed stands where the longleaf component can provide an adequate seed source. The seedtree method is proposed for regeneration of mixed pine (loblolly pine and pond pine) using prescribed fire for site preparation and relying on natural regeneration. Thinning is proposed on about 3000 acres during the first period. Pine straw production is proposed on 200 acres per year with an expected yield of 200 tons per year.

Alternative D: This alternative would use even-aged management with varying rotations as in Alternative C. Acres suitable for timber productions are 21,546. The projected harvest level is 1,484 thousand cubic feet per year during the first period.

Approximately 4630 acres during the first period would be regenerated using clearcutting as the regeneration method along with mechanical site preparation and planting. Longleaf restoration would make up about 230 acres of the annual regeneration during the first period, while loblolly pine regeneration would make up the balance. Thinning is proposed for about 5000 acres for the first period. Pine straw production is proposed on about 400 acres per year with an expected yield of 453 tons per year. This is the highest of the three alternatives proposing pine straw production.

Alternative E: This alternative would use even-aged and two-aged management with a 120-year rotation for longleaf pine inside the RCW Habitat Management Area (HMA). Restoration efforts would be focused within the HMA. Acres suitable for timber production are 25,723. The projected harvest level is about 875 thousand cubic feet per year during the first period.

Approximately 2500 acres per year during the first ten-year period would be regenerated using a combination of clearcutting and two-aged regeneration methods; two-aged would be the dominant silvicultural system. Clearcutting, mechanical site preparation, and planting would be used to restore longleaf only where the seed source is not adequate, where soils are more mesic and where excessive moisture conditions require this method. Thinning is proposed on about 3000 acres during the first

period. Pine straw production is proposed on 200 acres per year with an expected yield of 200 tons per year.

2.3.5: Fire Management

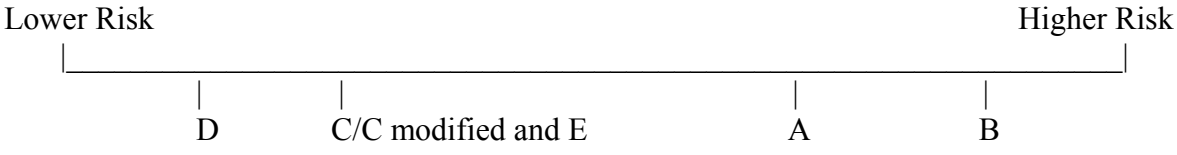
Fuels on the CNF have been mapped and analyzed based on landtype, forest type, soils, and disturbance history. Fuel models (Anderson, 1982) are used to describe fuel conditions and identify wildfire risk based on predicted fire behavior. In all alternatives, wildfire risk would be expected to increase with the increase in future development outside the CNF. Wildfire and prescribed fire management would be expected to become more difficult and expensive as populations increase. Problems associated with smoke management may also become more difficult to address. The alternatives vary by the number of acres that would be treated to reduce fuels. The degree of wildfire risk reduction is reflected in the distribution of fuel models by alternative. Wildland urban interfaces have been identified in alternatives C/C-modified, D, and E.

Table 2.8. Acres of fuel type by alternative, (percentage of total acres).

Fuel Model	Alternative A	Alternative B	Alternative C/ C-Modified	Alternative D	Alternative E
2	8200 (5%)	8200 (5%)	9400 (6%)	9400 (6%)	9400 (6%)
4	42400 (26%)	5400 (34%)	0 (0%)	0 (0%)	0 (0%)
6	26100 (16%)	14500 (9%)	62700 (39%)	62700 (39%)	62700 (39%)
7	36500 (23%)	59600 (37%)	31700 (20%)	31700 (20%)	31700 (20%)
9	39300 (23%)	16100 (10%)	48700 (30%)	48700 (30%)	48700 (30%)
Not Modeled	8600 (5%)	8600 (5%)	8600 (5%)	8600 (5%)	8600 (5%)
Total	161,100	161,100	161,100	161,100	161000

A relative risk analysis resulting from the desired future condition and probable management activities within each alternative is displayed below. This analysis is based on the differences in fuel treatment programs, including identification and treatment of wildland urban interfaces.

Wildfire Risk by alternative



Alternative A: On a five-year average, dormant season prescribed fire would be applied to about 8200 acres of loblolly, pond pine, and mixed pine forests annually. Growing season prescribed fire would be applied to about 200 acres per year of longleaf pine. Prescribed fire would be applied on a 3- to 5-year

rotation. Recent use of aerial ignition has increased these figures since 1996 to about 18,000 total acres per year. Prescribed fire would primarily be used for fuel reduction and wildlife habitat improvement. Mechanical site preparation may be used to assist in reducing fuel loads, but site preparation would not be achieved using prescribed fire. While this alternative does allow for management-ignited prescribed fire in wilderness, neither management-ignited prescribed fire nor wildland fire use for resource benefit in wilderness would be feasible due to the lack of risk reduction in urban interfaces, the highly volatile nature of pocosin fuels, and the size and location of the existing Wildernesses on the landscape. While the prescribed fire program outlined in this alternative would help maintain conditions that have already been made in hazardous fuel reduction, existing and future urban developments would continue to be threatened by the risk of catastrophic wildfire.

Alternative B: By virtue of its low-impact management theme, this alternative would provide the least amount of disturbance activity of all alternatives considered. Approximately 12,000 acres would be burned annually on a 5-year rotation for wildlife habitat improvement, timber stand improvement, natural regeneration site preparation, and fuel reduction. However, because this alternative minimizes the use of mechanical ground disturbance, the use of prescribed fire would be significantly restricted on most of the CNF, particularly in the pocosins. The wilderness allocation of all suitable roadless areas would increase the area where mechanical ground disturbance would be minimized, thus increasing the difficulty of the fire management program administration on the CNF. While both wildland fire use for resource benefit and management-ignited fire in wilderness are considered in this alternative, neither of these practices would be applicable for the same reasons as in Alternative A. Management direction for minimal use of mechanized equipment may result in larger wildfire acreages, greater risk of damage from escaped wildfires, and increased smoke emissions during wildfire activity. Over time, the proposed 5-year burning rotation would not be expected to maintain current fuel conditions due to rapid accumulations of understory fuels in this climate. Existing and future urban developments would continue to be threatened by the risk of catastrophic wildfire.

Alternative C/C-modified: These alternatives propose an aggressive prescribed fire program of about 20,000 to 25,000 acres annually. An emphasis on growing season prescribed fire, combined with a 2- to 4-year burning rotation would be expected to result in more complete consumption of both dead and live fuels and reduction of understory competition. Prescribed fire would also be used for fuel reduction and timber stand improvement in mixed pine stands on a 3- to 5-year rotation, and for site preparation for natural and artificial regeneration.

These alternatives propose identifing wildland urban interfaces, and a range of possible management activities that would reduce potential wildfire risk. The desired condition would be one where fuels are manipulated to change the arrangement, size, and in some cases type of vegetation, thereby reducing available fuel loads within designated areas. This would ultimately reduce extreme fire behavior characteristics such as flame length and fire line intensity, thus reducing the potential risk of catastrophic wildfire.

Prescribed fire may be used for fuel reduction in pocosins as research continues to address organic soil ignition and smoke emission questions. These alternatives would also consider the use of wildland fire use for resource benefit if fuel conditions were changed to reduce extreme fire behavior characteristics and severe fire effects. Risk reduction in wildland urban interfaces would also have to be achieved. The fuel treatment program proposed in these alternatives would be expected to dramatically decrease the

risk of catastrophic wildfires. The possibility of using prescribed fire in the pocosins would decrease the risk even further, particularly as fuel conditions change over time. Increases in forest use and urban development may offset the wildfire risk reduction somewhat. The overall long-term effects of activities proposed in these alternatives would be expected to decrease wildfire risk and result in a more effective fire management program than current.

Alternative D: The overall prescribed fire program, including fuel treatments in existing wildland urban interfaces would be very similar to Alternative C. However, since a 3- to 5-year rotation of growing season prescribed fire is proposed in this alternative, the open grassy understory typical of longleaf pine savannas would be slower to develop. As young, even-aged pine stands regenerate, initial risk of damaging wildfire would be high for a few years, but risk would decrease as stands mature. In general, any activity that improves overall forest health, such as thinning or prescribed fire, would result in a decrease in wildfire risk. It is possible that additional wildland urban interfaces would be identified and treated as urban development continues to occur adjacent to the CNF. Over time, the cumulative effects of activities proposed in this alternative would be expected to produce fuel conditions similar to those in Alternative C.

Alternative E: This alternative also proposes an aggressive prescribed fire program of about 20,000 to 25,000 acres annually, as does Alternative C/C-modified. This alternative, however, would focus on expanding the use of fire into areas that are not currently under a burning regime. All other aspects of this alternative are the same as Alternative C/C-modified.

2.3.6: Access

Public access to the CNF has become increasingly controversial as local populations have grown and land uses adjacent to the forest have changed. Forest access opportunities are public benefits, but also, impact may occur on forest resources including wildlife habitat, fragile plant communities, and the opportunity for non-motorized recreation. Secondary impacts include illegal trash dumping, and unregulated shooting. The CNF is fully roaded to meet future needs and no new road construction is proposed. However, incidental road construction may occur due to site-specific conditions that are not obvious at this scale of analysis (Forest Plan level). The alternatives address access through changes in miles of open FS roads, closure of unauthorized trails, and the number of miles and location of OHV trails.

Table 2.9. Access management objectives by alternative

Alternative	A	B	C C-Modified	D	E
Forest Service Roads - miles	222	222	222	222	222
Roads Closed - miles	14	50	30	12	15-20
Seasonal Access - road miles	9	29	17	5	15-20
OHV Trails - miles	36	8 - 10	20 - 30	20 - 30	8-10

Alternative A: Under the current direction about 6 percent of the Forest Service (FS) roads would be closed. And an additional 4 percent would be closed seasonally. Trash dumping and unsafe shooting on

dead-end roads would not be addressed other than through law enforcement actions. The OHV trails would in some areas continue to overlap sensitive plant species, and approximately 73 miles of undesignated OHV roads and trails would continue to exist, perpetuating resource damage.

Alternative B: Almost 25 percent of the FS roads would be closed and an additional 13 percent would be closed seasonally. Limited access would improve habitat for species that require less disturbance, and help provide non-motorized recreation experiences. Since many of the trash dumps and illegal driving occur on dead-end roads, closing many of these would help decrease those activities. Less than 1/3 of the existing OHV trails would be designated and the current use plus any increased use would not be accommodated. By not designating and maintaining an adequate number of trails, those in use could be more impacted.

Alternative C/C-Modified: About 14 percent of the FS roads would be closed and an additional 8 percent would be closed seasonally. Closed roads would concentrate in areas adjacent to Wilderness and black bear habitat, as well as in areas with sensitive plant species. This would help improve habitat for species that require less disturbance, and help provide non-motorized recreation experiences. Many but not all of the dead-end roads would be closed which would help decrease trash dumping and illegal driving. The OHV system would be designated in such a way as to reduce use in areas with sensitive plant species. Approximately the same number of OHV trail miles that currently exist would be provided. If demand continues to increase, these might not be enough to satisfy the need.

Alternative D: This alternative would provide the most unrestricted access to the CNF while attempting to manage undesignated and unwanted use. About 5 percent of the FS roads would be closed and 2 percent would be closed seasonally. The only roads closed would be dead-end roads that are the most difficult to manage, or that might be causing the most resource damage. Trash dumping and unregulated shooting would be managed in part through cooperation with users and nearby landowners. In keeping with the theme of a high access alternative, it is expected that OHV trail miles would increase higher than numbers shown above in future planning decades. This would be accomplished by designating some of the unauthorized trails for OHV use.

Alternative E: About 8 percent of the FS roads would be closed and an additional 8 percent would be closed seasonally. Roads to be closed would be concentrated in areas adjacent to Wilderness and black bear habitat, as well as in areas with sensitive plant species. This would help improve habitat for species that require less disturbance, and help provide non-motorized recreation experiences. Many but not all of the dead-end roads would be closed which would help decrease trash dumping and illegal driving. OHV use would be designated to one location.

2.3.7: Local Communities

Collaboration with local communities and agencies is common to all alternatives. These efforts are not measured or tracked. For this issue, economic measures are discussed.

The main impacts from management practices on the CNF are changes in employment and income levels of the regional population. The two activities which have the most impact are timber harvesting and providing recreation opportunities.

When national forest timber is sold, jobs are created for the harvesters and haulers of the timber, who then use their income to buy goods and services in the region. Visitors to the CNF require goods and services based on the type of recreation activity pursued and the duration of their visit. These expenditures by visitors have a multiplier effect by creating jobs in the local community.

Table 2.10. Economic Impacts by Alternative

Alternative	A	B	C/ C-Modified	D	E
Timber Employment Number	35	20	126	92	51
Harvesting Income $	694,405	349,179	2,799,528	2,004,104	1,834,845
Recreation Employment Number	582	614	733	738	730
Recreation Income $	12,754,359	13,566,742	16,637,482	16,777,863	16,249,782

Alternative A: A relatively small number of jobs would be supported through timber harvesting under existing direction. Recreation associated jobs are the smallest number of all the alternatives. Demand for recreation activities in rustic settings would not be met in this alternative.

Alternative B: Jobs related to timber harvesting would decrease based on a lower harvest level. Recreation use would continue to grow as the communities grow, so jobs and income associated with recreation would increase, and would be higher than the existing situation in Alternative A. Jobs and income would still be lower than alternatives C, D, and E because of the emphasis on low impact recreation.

Alternative C: The emphasis in this alternative of restoring longleaf pine savannas and habitat for RCW would reflect an almost four fold increase in the jobs and income from timber harvesting. The recreation emphasis, as in alternatives D, and E would include working with local communities to improve environmental awareness. This would translate into more nature-based jobs like outfitters and guides and tourist based recreation support facilities that can help local communities capitalize on the tourist industry. Also, the increase in rustic settings and facilities would likely draw the local residents to the forest.

Alternative D: The longleaf pine restoration effort would be less intensive with lower harvest levels, and would produce about 25 percent fewer jobs and income than Alternative C. The recreation emphasis, as in alternatives C, and E, would include working with local communities to improve environmental awareness. This would translate into more nature-based jobs like outfitters and guides and tourist based recreation support facilities that can help local communities capitalize on the tourist industry. The open access emphasis of this alternative would provide more recreational opportunities, yet would translate into just a few more jobs and income than Alternative C.

Alternative E: The emphasis in this alternative of restoring longleaf pine savannas and habitat for RCW would reflect an increase in the jobs and income from timber harvesting. The recreation emphasis, as in alternatives C and D, would include working with local communities to improve environmental awareness. This would translate into more nature-based jobs like outfitters and guides and tourist based

recreation support facilities that can help local communities capitalize on the tourist industry. Also, the increase in rustic settings and facilities would likely draw the local residents to the forest.

2.4: COMPARISON OF MANAGEMENT PRESCRIPTION BY ALTERNATIVE

The 1986 Land Management Plan allocations are shown in the table below (1986 Plan, 3.17 and 3.18). Management areas were designed using a mix of timber and recreation components. The management areas were widely distributed across the forest. Each management area had goals, objectives and standards for management direction.

Table 2.11. Alternative A: 1986 Plan, management area designations.

MA	MA Description	Acres
1	Commercial timber/Car Touring	23,430*
2	Old Timber/Car Touring	5,805
2L	Longleaf Pine/Old Timber/Car Touring	21,760
3	Commercial Timber/Hiking	7,065
4	Old Timber/Hiking	8,055
5	Modified Natural Areas	54,160
6	Administrative Areas	545
7	Developed Recreation areas	235
8	Wilderness Areas	30,000
9	Waterfowl Impoundments	870
10	Recreation Lakes	5075

**Note: 1,361 acres of the White Oak River corridor would be managed as Wild and Scenic Rivers until completion of further study of suitability.*

A different approach was taken for Alternatives B through E. Each prescription has management direction in the form of reference conditions and standards derived from the ecological classification system and standards that provide thresholds for management actions.

Table 2.12. Acres by management prescription for alternatives B through E.Note: Total acreages cannot be computed using this table. This is due to the different ways primary and embedded prescriptions are used in different alternatives.

	Alt. B	Alt. C	Alt C-Mod	Alt. D	Alt. E
Prescription [1]					
Lakes	4,894	4,894	4,894	4,894	4,894
Wilderness	51,992	31,912	34,892	31,912	31,912
Wild and Scenic Rivers	3,351	3,351	3,351	0	3,415
Bear Habitat	0	39,175	37,120	39,175	38,765
Hardwood/Cypress Wetlands	5,717	8,014	7,447	11,427	8,278
Hardwood Restoration	1,575	1,575	1,575	517	1,699
Heritage/Water Based Recreation	1,007	1,439	1,439	1,317	N/A[2]
RCW Habitat Management Area (Longleaf Pine Savannas)	37,845	46,656	46,203	43,324	64,639
Mixed Pine Forests	4,049	4,451	4,449	9,114	N/A[2]
Developed Sites	1,014	1,020	1,020	1,020	2,152
Wildland/Urban Interface	0	5,181	5,181	5,181	2,351
Pocosin/Pond Pine Patches	14,229	13,377	13,311	13,298	N/A[2]
Natural Areas (Primary Prescription)	63,924	0	0	0	0
Natural Areas (embedded)	0	47,730	47,730	42,452	47,730
OHV(primary prescription)					3,194

[1] *Acres are not included in this table because the types of primary prescriptions and embedded prescriptions vary by alternative.*
[2] *Total for Alternative E, Pocosin/Pond Pine Patches and mixed pine forests were rolled into RCW HMA prescription. Heritage/Water-Based Recreation were rolled into Developed Areas.*

Prescriptions are used to manage key features of the landscape. The locations of prescriptions are displayed on maps on the following pages. Descriptions are located in the CNF Plan, Chapter 3. In Alternatives C/C-modified, D, and E, the management of natural areas were embedded within other prescriptions, such as Hardwood Cypress Wetlands, Wilderness, etc. In these cases, prescriptions were secondary; they became a second level of land allocation.

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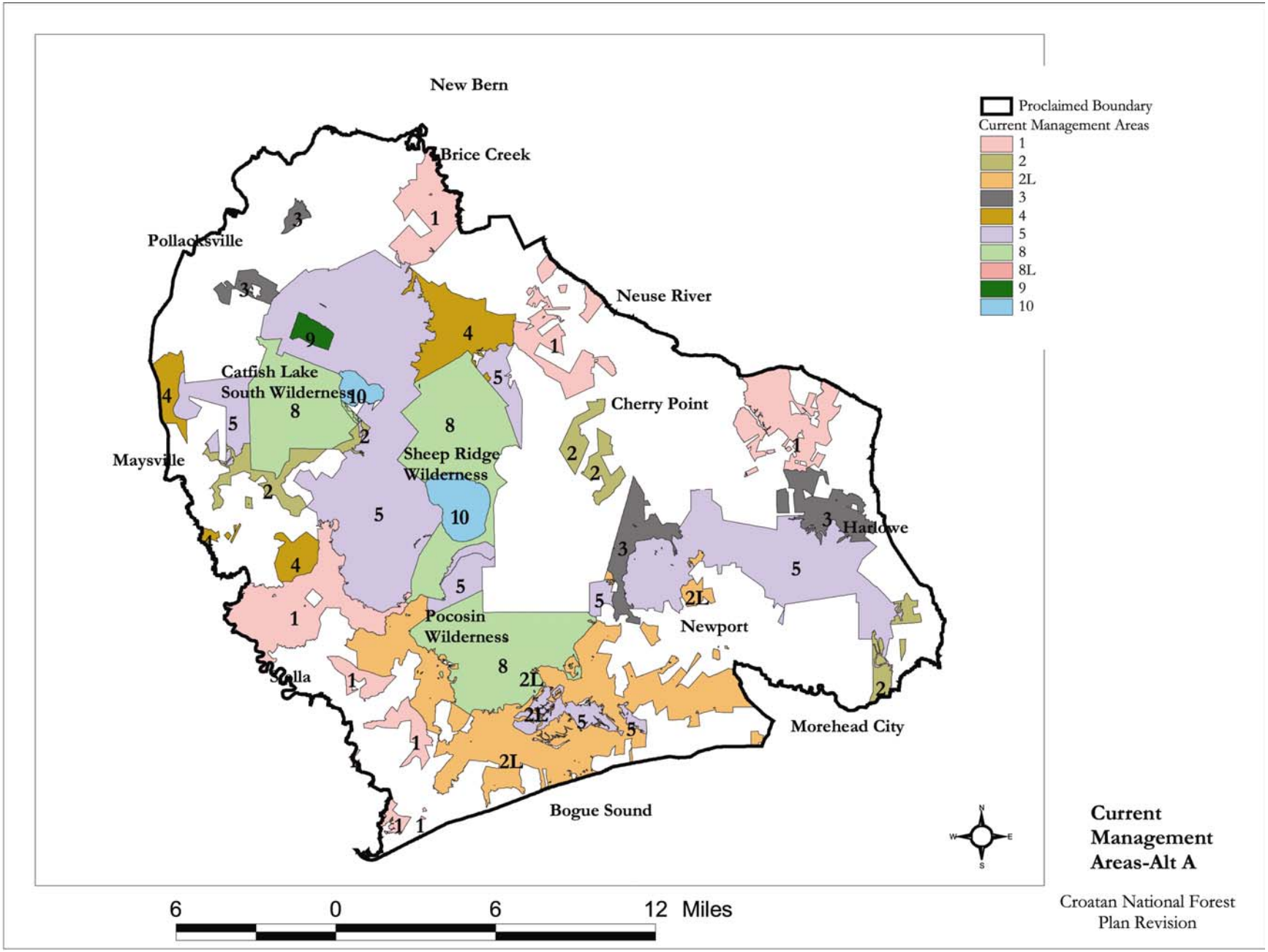
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South Wilderness
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Sheep Ridge
Wilderness
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Pocosin
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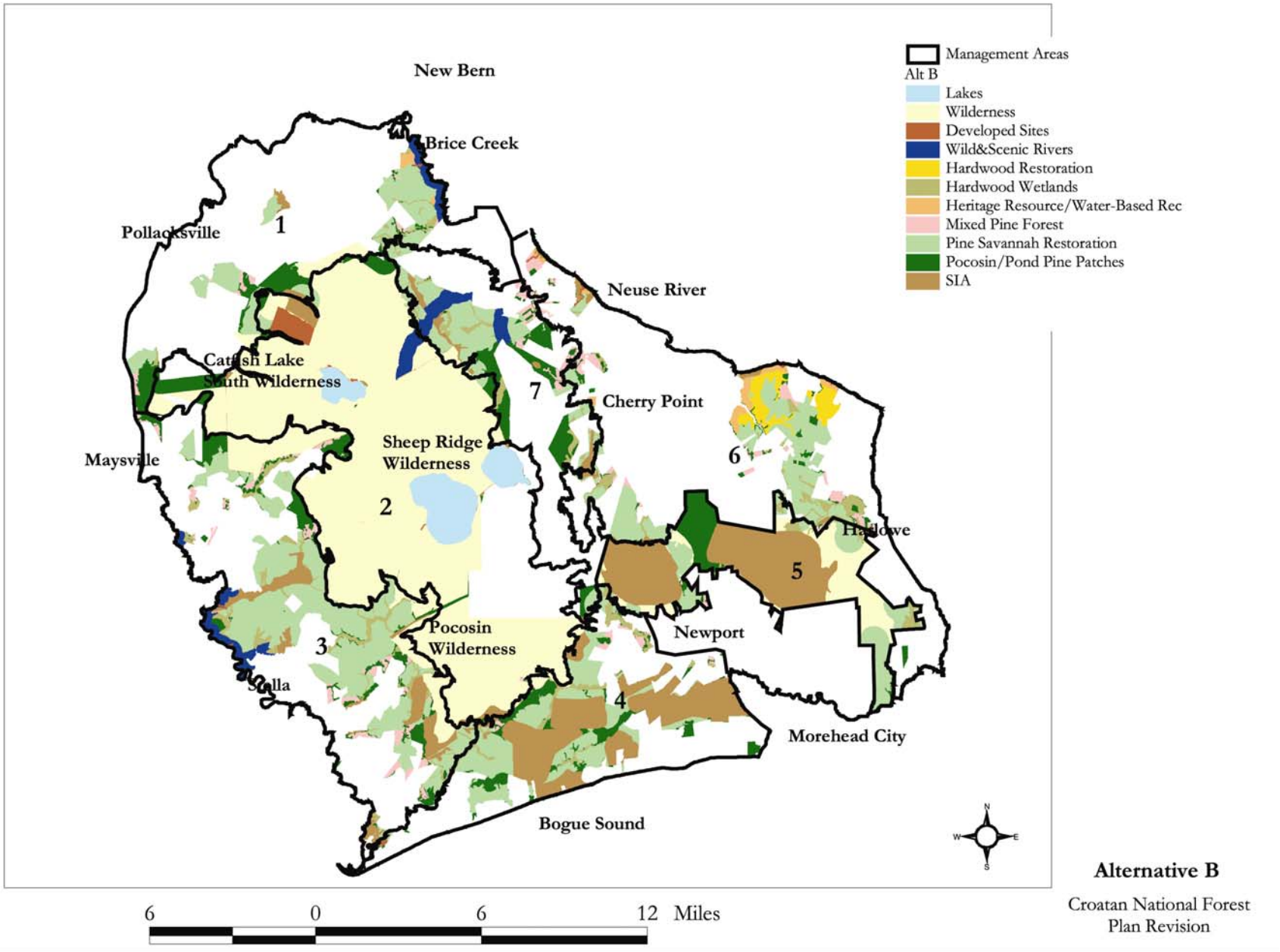
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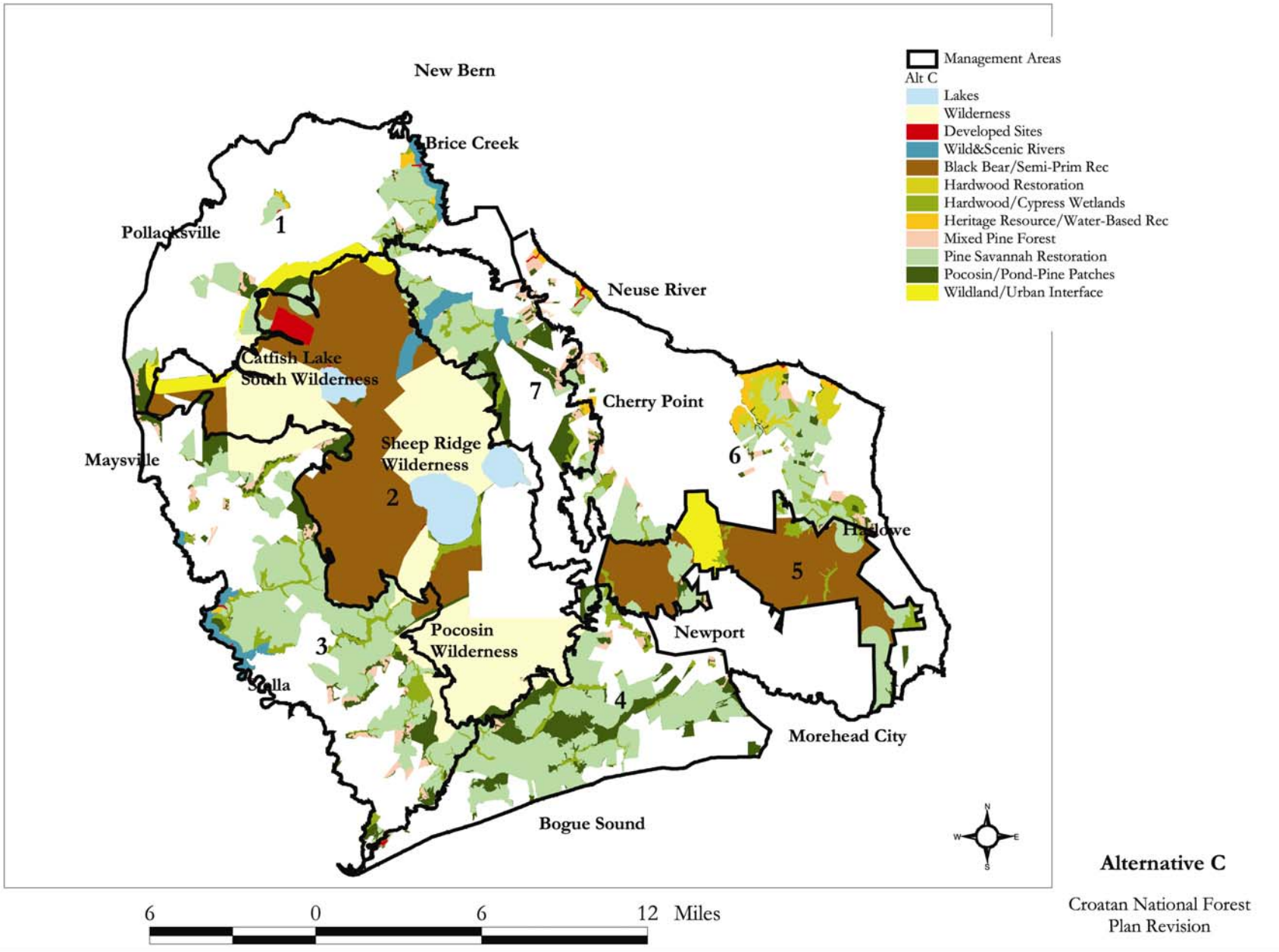
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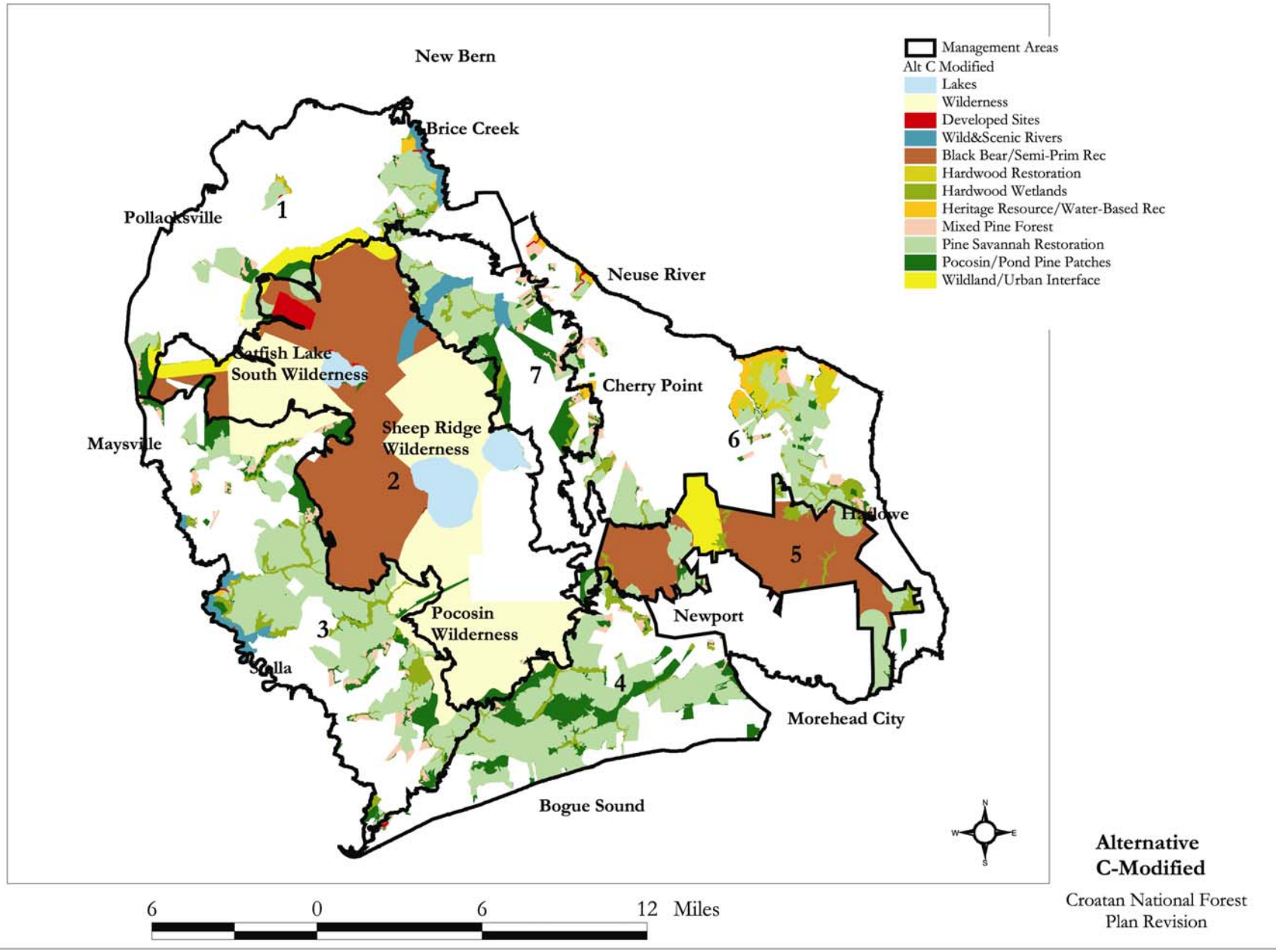
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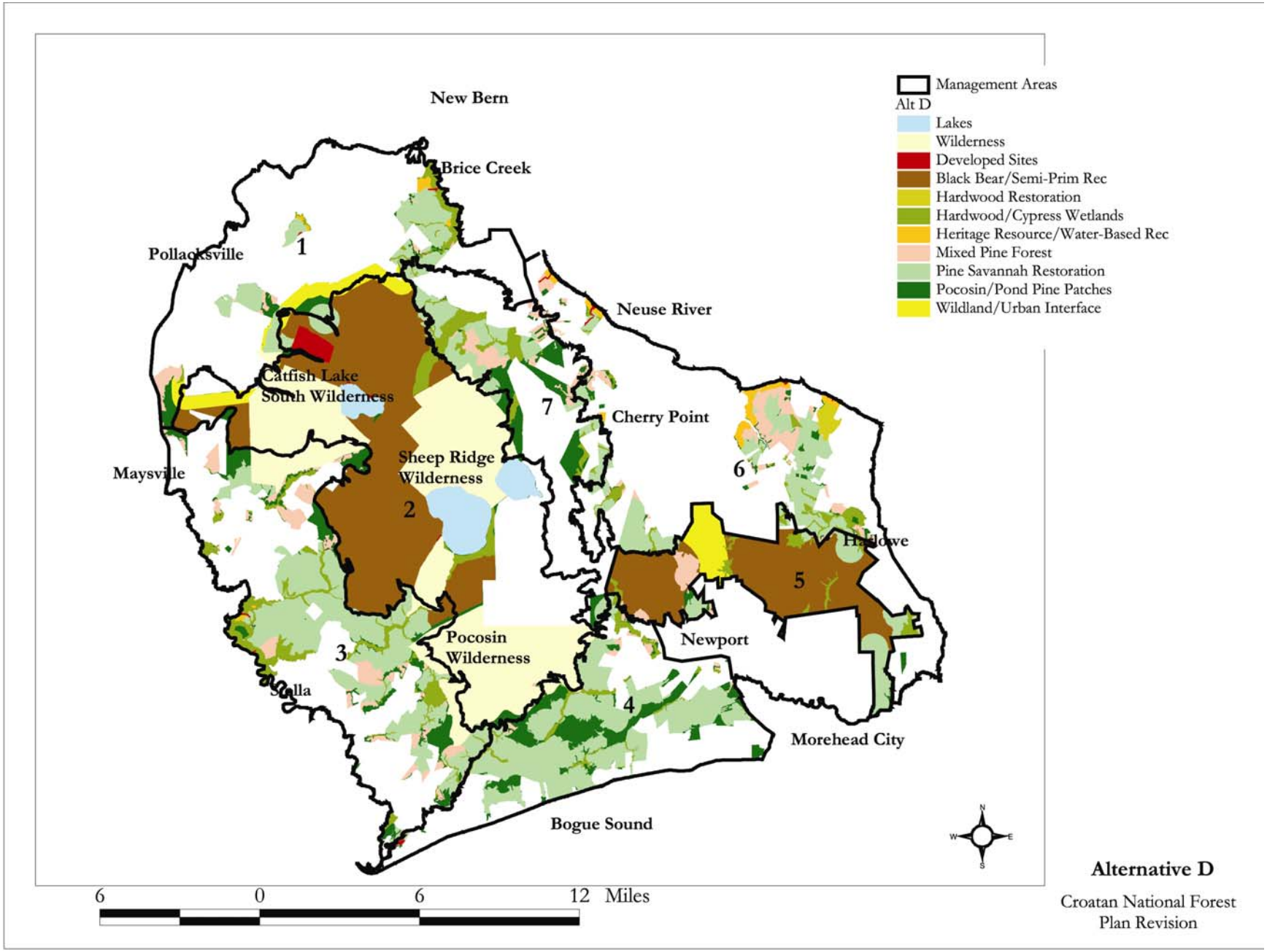
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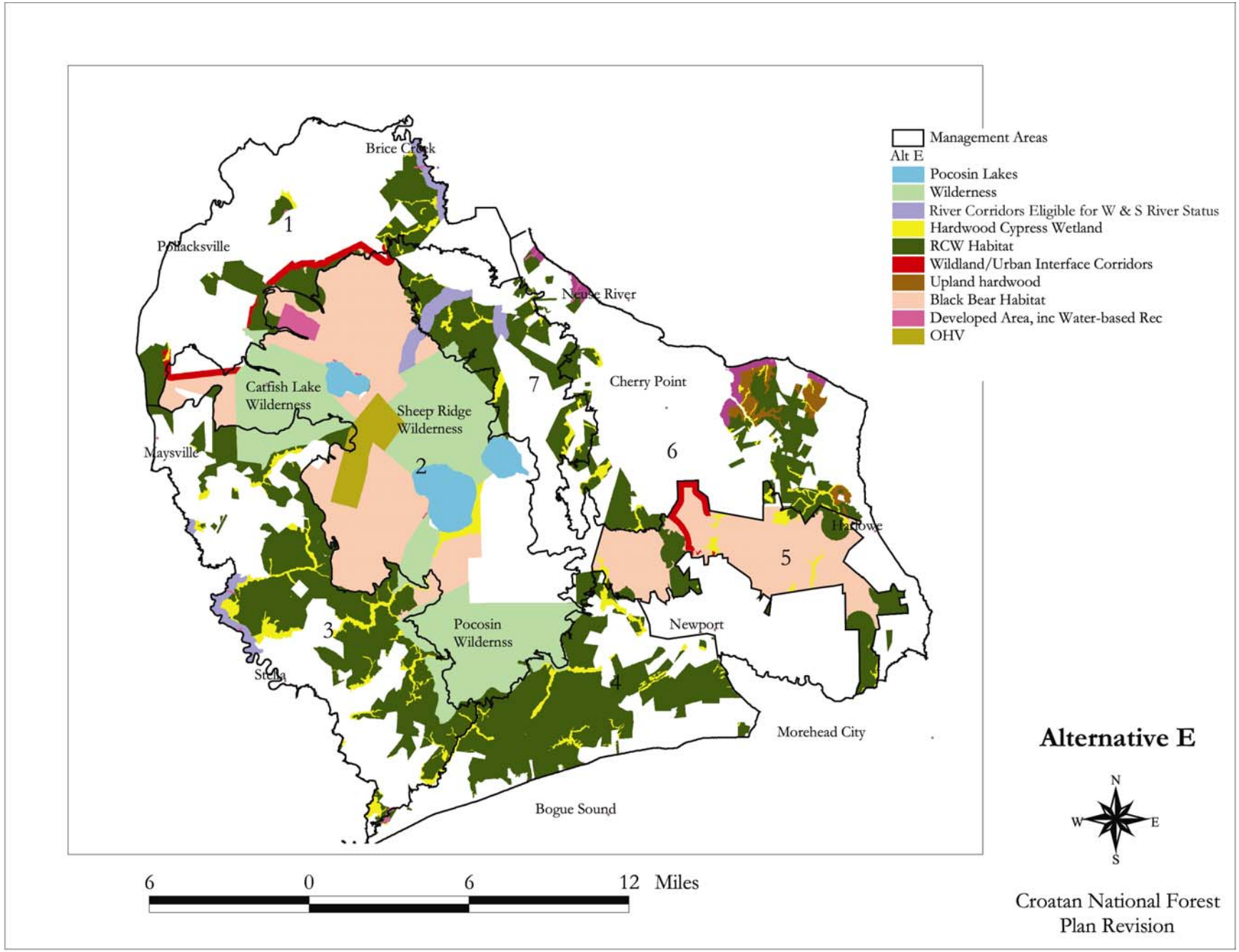
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Wilderness
River Corridors Eligible for W & S River Status
Hardwood Cypress Wetland
RCW Habitat
Wildland/Urban Interface Corridors
Upland hardwood
Black Bear Habitat
Developed Area, inc Water-based Rec
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Neuse River
Catfish Lake Wilderness
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CHAPTER 3: AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Chapter 3 describes the existing environment of the natural resources affected by the alternatives. Descriptions include physical, biological, social, and economic characteristics. This chapter should help reviewers understand the effects of implementing each alternative described in Chapter 2. Where there is a discussion of Alternative C, this usually includes effects of Alternative C-modified.

Environmental consequences are the effects of implementing an alternative (with mitigating measures in place) on the physical, biological, social, and economic environments. Direct environmental effects are those that occur at the same time and place as the initial action. Indirect effects are those that occur later than the actions or are spatially removed from the activity. Cumulative effects result from the incremental effects of actions added to other past, present, and reasonably foreseeable actions, regardless of what agency (Federal or nonfederal) or person undertakes the other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

There are potential adverse environmental effects that cannot be avoided. These effects result from managing the land for one resource at the expense of the use or condition of other resources. Many adverse effects can be reduced or mitigated by limiting their extent or duration. This is discussed throughout the chapter.

The relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity is discussed. Short-term uses (effects) are those that occur annually or within 10 to 15 years of a forest plan implementation. Long-term productivity refers to the capability of the land and resources to continue producing goods and services for 50 years and beyond.

For estimating the effects at the programmatic-Forest Plan level, the assumption has been made that the kinds of resource-management activities allowed under the prescriptions are reasonably foreseeable future actions to achieve the goals and objectives. However, the specific location, design, and extent of such activities are generally not known at the time. The decisions are made on a site-specific (project-by-project) basis. Therefore, the discussions here refer to the potential for the effect to occur and are in many cases only estimates. The effects analyses are useful when comparing and evaluating alternatives on a forest-wide basis, but is not intended to be applied directly to specific locations on the Forest.

3.1: Physical Environment

3.1.1: AIR QUALITY

Affected Environment

National Ambient Air Quality Standards (NAAQS) are set by the Environmental Protection Agency (EPA) to promote a level of air quality sufficient to protect public health and public welfare. Public welfare issues include forest and agriculture productivity, capital improvement protection, and maintenance of recreation opportunities. The North Carolina Department of Environment and Natural

Resources (DENR) has been delegated the responsibility of implementing and enforcing the Clean Air Act (CAA) and the amendments for air quality in the CNF.

In 1977, the CAA and amendments established three classes of air quality to protect visibility and other values. Class I is the most restrictive for allowing increased levels of pollution from new or modified stationary sources (for example, a manufacturing plant, a pulp mill, or an electrical utility). All of the CNF is designated as Class II, a designation that allows for a moderate level of additional air pollution to accommodate industrial and urban development. The closest Class I area to the CNF is the Swanquarter National Wildlife Refuge, about 35 miles to the northeast of the proclamation boundary.

The CAA of 1977 also provided NAAQS to protect the public health and welfare from the harmful effects of air pollution. DENR responsibilities include monitoring the air to determine if NAAQS have been violated. When air monitoring equipment measure values above NAAQS, the area (usually a county) is designated as nonattainment. No areas in the forest are designated as nonattainment for any criteria pollutant. The criteria pollutants are carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter, and sulfur dioxide. The Raleigh and Durham areas are the closest places to the forest designated nonattainment; the pollutants causing the NAAQS violations there were ozone and carbon monoxide. DENR has the responsibility and authority to develop plans to maintain NAAQS in North Carolina through the State Implementation Plans.

A considerable amount of air pollution research has been conducted since the publication of the Land and Resource Management Plan - Croatan and Uwharrie National Forests in 1986. Media reporting on air pollution research generated public concern that air pollution could be adversely impacting terrestrial and aquatic resources. Consequently, some people believe air pollution could be causing stress to forest ecosystems or limiting the production of goods and services on the national forests. It does not appear that current levels of air pollutants transported into the forest are causing adverse stress to the environment or limiting the production of goods and services (based upon information presented later in this document). A potential does exist that continued increases in ammonium emissions from livestock waste containment ponds, combined with current levels of sulfate and nitrate deposition, could result in negative long-term impacts on forest soils. Particulate matter releases from prescribed fires, by the Forest Service and others, and wildfires are of greatest concern because:

1. The small particles produced from prescribed fires can have an adverse effect on human health.
2. The large releases of particulate matter occurring with forest fires can impair visibility for people driving their vehicles.
3. There is a potential to violate the NAAQS for particulate matter within 1 mile of a prescribed fire.

Air Quality Assessment Techniques

County level estimates of sulfur dioxide, nitrogen oxides, volatile organic compounds, and particulate emissions were obtained from the EPA for counties within 200 kilometers of the CNF proclamation boundary. The emissions estimates were based upon updating the EPA 1985 National Atmospheric Precipitation Assessment Program estimates for point sources (also called stationary sources), and area sources (such as vehicle traffic, agriculture and forestry activities) that were projected to the year 1994.

Each county was then placed into one of three categories (Table 3.1) based upon the categories used by the EPA (1996).

An analysis was conducted to determine how close to the former NAAQS are ozone and particulate matter (only for PM10) concentrations in the atmosphere. Ambient monitoring data were obtained for ozone for the years 1983 through 1995, and for particulate matter for the years 1985 through 1993. The monitoring sites selected were within 50 kilometers of the proclamation boundary. Descriptions of the ambient monitoring data can be found in The Southern Appalachian Assessment Atmospheric Technical Report (SAMAB 1996). Preliminary estimates of counties that may violate the new NAAQS were provided by staff at the DENR.

Emissions of particulate matter from land management activities are of concern. Two approaches were used to estimate how particulate matter emissions may impact air quality. The first approach used surface meteorology data (obtained from a private company) to develop a historical database (for the years 1984 through 1991) on how many days met the Region 8 prescribed burning guidelines (set forth in Forest Service Manual 5100 - Fire Management, Region 8 Supplement 5100-93-3), except for estimates of KBDI. Upper atmosphere data (obtained from the EPA) and the surface meteorological data were then used to assess the ability of the atmosphere to disperse pollutants (called dispersion index), and the risk of smoke forming smog along highways when the relative humidity is high (called low-visibility risk index, or LVORI). Lavdas (1996) describes the theory and how to calculate dispersion index and LVORI. The calculations for dispersion index and LVORI were obtained from the VSMOKE model (Lavdas 1997). The FORTRAN computer code for VSMOKE was modified to estimate hourly values of dispersion index and LVORI. The dispersion index and LVORI estimates were combined with fuel moisture values to estimate the number of days during the year when prescribed fires could be conducted. The second approach to evaluate particulate matter impacts used the VSMOKE-GIS dispersion model to estimate the maximum distance downwind that specific particulate matter concentrations may occur. The VSMOKE-GIS model is based upon the model developed by Lavdas (1996) called VSMOKE. Estimates obtained from VSMOKE-GIS are for total suspended particulates (TSP), and are defined as particulate matter 40 microns or smaller in size. VMOKE-GIS is useful for predicting downwind concentrations of TSP, and evaluating the potential impact of smoke on roadway visibility.

Status Of Air Quality In Relation To State And Federal Laws

Recently, the EPA promulgated tighter NAAQS because the scientific evidence supports stronger standards to protect human health from both ground-level ozone and particulate matter. The previous PM10 annual standard (50 micrograms per cubic meter) would be maintained in the future, but the 24-hour standard will be revised. A violation of the NAAQS would occur if the PM10 concentration at the 99^{th} percentile (using a 3-year average) is greater than 150 micrograms per cubic meter. Furthermore, the NAAQS for particulate matter would reflect the scientific evidence that smaller particles, PM2.5 (2.5 microns or smaller in size), are important in impacting human health. The smaller particles are known to penetrate deep into the lungs and can have an adverse effect on human lung function. There are two forms of the PM2.5 standard. The annual PM2.5 standard would be violated if a community-oriented monitored mean concentration (averaged over 3 years) exceeds 15 micrograms per cubic meter. The 24-hour standard would be exceeded if the 98^{th} percentile concentration (averaged over 3 years) exceeds 65 micrograms per cubic meter.

The DENR has conducted a preliminary statewide analysis of potential air quality based on current emissions and monitoring data. This analysis suggests the potential exists for the number of counties which would violate the new standards to increase. There is a possibility that 38 counties would violate the new ozone standard, including Onslow County, which is adjacent to the Forest. Only four counties have a high likelihood of violating the annual PM2.5 standard and none of the counties are near the CNF. It should be noted that there is high amount of uncertainty about which areas would violate the PM2.5 standard since there are few actual measurements of ambient 2.5 concentrations. The results in Table 3.2 were obtained by multiplying PM10 estimates by 0.56 to estimate annual PM2.5 concentrations. If the PM2.5 fraction is larger than 56 percent of the PM10, concentrations in many other counties could violate the PM2.5 annual standard.

A violation (called nonattainment) of the ozone or particulate matter standard would require DENR to develop a plan to bring the area back into attainment. The current laws do allow the DENR to define how large an area is needed in order to reduce emissions so a specific area would attain the NAAQS. For example, portions of the CNF could be included in a maintenance plan if Onslow County violated the NAAQS for ozone. If this were to occur, any Forest action that emits pollutants, which can lead to the formation of ozone, would need to be approved by DENR before the action is implemented.

What Are The Important Air Pollutants?

The words "air pollution" can invoke different images among people. Some people may imagine smog hanging over a city, smoke coming from a stack at a factory, or a dark cloud following a vehicle. These sources of pollution and many others have an influence on air quality at the CNF. Modern society depends on the combustion of fossil fuels for transportation, electricity, manufacturing, and heating of homes and businesses. The combustion of fossil fuels generates energy, but also produces toxic gases and particulates. The emissions of air pollutants from human activity, along with gases and particulates from biogenic (natural) sources, have the potential to impact the Forest. It is unlikely that any air pollution impacts on the Forest can be traced back to a single source. Instead, any pollution impacts that are occurring on the forest are a result of emissions both within and outside of the Forest. Emission from sources further than 200 kilometers have the potential to influence air quality on the Forest. The pollutants emitted into the air, which could have the greatest impact to forest resources, include sulfur dioxide, nitrogen oxides, volatile organic compounds, and particulate matter. These primary pollutants are emitted into the atmosphere and can undergo chemical transformation into secondary pollutants which result in acidic deposition impacts to terrestrial and aquatic ecosystems, ozone damage to forest trees, and visibility reductions. The following sections will address each of these primary pollutants and how important the secondary pollutants formed are in impacting the forest resources.

Global climate change, resulting from emissions of carbon dioxide and other greenhouse gases, has received widespread media attention, but will not be discussed at length in this report. There is concern that if the climate is warming the possibility exists for a change in the plant species that compose a forest. However, there is a large uncertainty associated with the amount of future climatic changes and this uncertainty makes it very difficult to estimate what changes can be expected in the Forest over the next 50 years.

Sulfur Dioxide, Nitrogen Oxides and Acidic Deposition

Acidic compounds are deposited on forests in rain, clouds, or directly from the atmosphere (called dry deposition). The total amount of pollutant material deposited by these three mechanisms comprises

acidic deposition. Sulfates, nitrates, and ammonia are the primary acidifying compounds. Sulfates are secondary pollutants first emitted as sulfur dioxide, and nitrates are secondary pollutants first emitted as nitrogen oxides. Concerns arise when excessive amounts of acidic deposition occurs within an area for a long period of time. Repeated high annual deposition can eventually have adverse effects on soil productivity because essential nutrients for plant growth are depleted from the soils. Furthermore, aluminum occurs naturally in soil and can be released when soil acidity increases. Aluminum in a water solution may interfere with a plants ability to take up essential nutrients. Increases in aluminum water solutions in the soil further decreases in soil acidity (pH) can result in toxic effects to fish and other aquatic organisms. It should be noted though that many streams in and flowing from pocosins are normally acidic and naturally limit the amount and diversity of fish and other aquatic species. Acidic rainfall can also have negative impacts on cultural resources and other structures. Estimates in 1990 indicate the pH of rainfall between 4.3 and 4.5, which is more acidic than natural rain (pH of about 5.5).

A majority of the counties within 200 km of the CNF have average to above average emissions of sulfur dioxide in comparison to the rest of the United States. Coal-fired electrical utilities within 200 kilometers of the CNF are the largest source of sulfur dioxide. Nationally, coal-fired electrical utilities are also the largest emitters of sulfur dioxide (EPA 1995). The CNF is located downwind of numerous minor and small sources (less than 10,000 tons per year) and a few moderate-sized sources (10,000 to 25,000 tons per year) of sulfur dioxide. These sources, as well as others at further distances, are contributing the precursors of sulfates that have the potential to affect the CNF. Implementation of the CAA of 1990 would result in national emissions of sulfur dioxide being reduced by 50 percent; therefore, sulfate deposition in the forest is expected to decrease in the future.

Nitrogen oxide emissions can also be transformed in the atmosphere to form nitrates that can acidify forest soils. The primary (greater than 95 percent) form of nitrogen oxides emissions is nitric oxide (SAMAB 1996). Nationally, both coal-fired electrical utilities and highway vehicles emit similar levels of nitrogen oxides (EPA 1995), but within 200 kilometers of the CNF the dominant source of nitrogen oxides is highway vehicles. Compared to other counties in the United States, the emissions of nitrogen oxides from most counties are average to above average within 200 km of the CNF. The CAA of 1990 would also result in decrease emissions nitrogen oxides from industrial boilers, but national emission levels would be allowed to increase after the year 2010. There may be some benefit to the CNF in that the regional transport of nitrates and ground-level ozone may decrease. Furthermore, the EPA Administrator has instructed the air quality agencies in North Carolina, South Carolina, Virginia, and other states that further reductions in nitrogen oxides are needed. Reductions of about 35 percent are being implemented so large cities in the Eastern United States can attain and maintain the ozone NAAQS.

The emissions inventory obtained from EPA did not provide emission estimates of nitrogen from agricultural sources. In recent years, there has been a large increase in the number of hogs being raised for livestock in eastern North Carolina. The waste from the confined pigs is collected into containment ponds. There is concern that large amounts of ammonium (a nitrogen compound) are being released, and there are projections that there would be further increases. The analysis provided in this report could not provide estimates of ammonium emissions near the forest. Therefore, there is a large uncertainty about whether these emissions may increase acidification of sensitive soils in the coastal environment.

Results from the Southern Forest Commercial Research Cooperative (SFCRC) have concluded that current amounts of acidic deposition are not adversely affecting the growth of southern pines. Furthermore, current levels of nitrogen deposition may be improving the growth of southern pines since low concentrations of soil nitrogen are known to be a limiting factor. Estimates of wet sulfate and nitrate deposition in 1992 were less than 15 and 10 kilograms per hectare, respectively. Though these values are low, there is concern that long-term negative impacts on soil productivity may occur because some coastal soils are unable to offset the effects of acidic deposition (Fox and Mickler 1996).

Nitrogen Oxides, Volatile Organic Compounds, And Ozone

In addition to contributing to acid deposition, nitrogen oxides are an important component in the formation of ground-level ozone. Ozone, a chemical composed of three oxygen atoms linked together, is highly beneficial in the upper atmosphere. At ground level, however, when sensitive plants are exposed to sufficient doses, ozone is capable of killing tissue. Ground-level ozone is formed through a chemical reaction between nitrogen oxides and volatile organic compounds on hot sunny days.

Interestingly, the main source of volatile organic compounds is trees. In North Carolina, and elsewhere in the Southeastern United States, nitrogen oxides are believed to be the limiting factor in the formation of ground-level ozone.

Ozone enters a leaf through openings called stomates. Once inside the leaf, the ozone can kill cells that produce food for a plant's growth. The results of the cell death can be seen on the upper leaf surface and are referred to as symptoms. Symptoms of ozone injury have been found on sensitive plant species throughout the southeast. Though no surveys have been completed in the CNF, symptoms of ozone injury can probably be found on sensitive plant species in most years (Dowsett and others 1992). The presence of ozone injury indicates that ozone exposures are high enough to cause a physiological damage to the plant. The presence of injury in most years does not mean that forest trees are suffering a growth loss from ozone exposures.

The SFCRC has concluded that pines throughout the South may be having a 2- to 5-percent annual reduction in biomass growth. It should be noted though that the SFCRC studies used pine seedlings and growth reductions were only seen when ozone exposures were significantly increased above ambient levels. The 2- to 5-percent reduction was not seen in experimental trials, and the small growth reduction that was observed was within the range of experimental error. It was suggested that the statistical techniques employed could not distinguish the small growth reduction because of the small sample size (Fox and Mickler 1996). Therefore, there does not appear to be a large degree of confidence that any biomass reductions are occurring to southern pines in the forest.

Another relevant question to answer is: “What ozone exposures are known to cause growth losses and how close are current ozone exposures to those that cause growth reductions for southern pines?" The Southern Appalachian Assessment (SAMAB 1996) utilized experimental studies, including those of the SFCRC, to determine at what ozone exposures growth reductions occur. Two statistics were necessary to differentiate experimental treatments. The first statistic is the number of hours during the growing season when hourly average ozone concentration are greater than or equal to 0.10 parts per million (ppm). The second statistic adds together all of the hourly average concentrations for a growing season, but places a greater weight on the higher hourly average concentrations. The second statistic is called the W126 (Lefohn and Runeckles 1987). Loblolly pine was classified as a Level 3 species (SAMAB

1996), which is a tree species most resistant to the effects of ozone. The threshold levels for growth reductions for Level 3 species are a W126 value of greater than or equal to 66.6 ppm hours, and 135 hours where the hourly average ozone concentration is greater than or equal to 0.10 ppm (SAMAB 1996). An examination of available ozone monitoring data within and near the CNF shows that both the cumulative (W126) value and the peaks (greater than or equal to 0.10 ppm) are well below the levels needed to cause growth reductions in loblolly pine. Current monitored values indicate growth reduction could have occurred to the most sensitive tree species, such as black cherry, but probably not to moderately sensitive species like tulip-poplar. Little ozone exposure work has been accomplished with longleaf pine, but this species is expected to have sensitivity similar to loblolly pines.

Ozone is potentially the most significant pollutant affecting forests in North America (Barnard and others 1991), and it poses the greatest threat to vegetation on the CNF. Based on the information presented, it does not appear that ground-level ozone is causing biomass loss there. Furthermore, the lack of sufficiently high peak concentration levels of ozone also suggests that growth losses are not likely to occur to southern pines in the next 10 to 50 years. More research is needed to determine if current ozone exposures are large enough to cause damage to the CNF. Also, more research is needed to know how many species are sensitive to ozone, especially in areas like pocosins where there is a large diversity of plant species. Ozone exposures should remain stable or decrease slightly by the year 2010, but exposures could increase if the population expands rapidly. An increase in population is likely to result in more nitrogen oxide emissions from vehicles. Electrical facilities may need to generate more power to meet air-conditioning demands, possibly causing increased nitrogen oxide emissions. The nitrogen oxides would react with the abundant volatile organic compounds emitted by vegetation and result in higher ozone exposures.

Particulate Matter and Visibility Impairment

Many counties within 200 km of the Forest have low to below average emissions of PM10, in comparison to other counties in the United States. Within 200 kilometers of the CNF fugitive dust sources such as unpaved roads and agricultural fields are the primary sources of particulate matter 10 microns or smaller in size (PM10). The 24-hour NAAQS for PM10 is 150 micrograms per cubic meter. No monitors near the CNF have measured a violation of the PM10 standard. Although PM10 monitors are present near the CNF the total suspended particulate (TSP) matter data was displayed in Figure 3.9 because more TSP data are available near the CNF. TSP monitoring data includes all particles less than or equal to 40 microns in size and were used for NAAQS purposes prior to the PM10 standard. Wergowske (1995) has reported that 300 micrograms per cubic meter of TSP are equivalent to 150 micrograms of PM10. TSP maximum concentrations for a year are well below the limit of 300 micrograms per cubic meter. In fact, the second highest PM10 values are considerably lower that the annual maximum allowable PM10 value.

The EPA has promulgated a new particulate matter standard that emphasizes particles 2.5 microns or smaller (PM2.5) in size. The previous change in NAAQS placed an emphasis on smaller particles (TSP to a PM10 standard) and also lowered the maximum values of particulate matter permitted in the air. The reason for considering a PM2.5 standard is because current medical research has shown that fine particles have the greatest impact on human health. Also, fine particles are primarily responsible for visibility reductions caused by regional haze that is present throughout the Eastern United States.

Fine particles, PM2.5, are known to be more efficient at scattering light than larger sized particles. Results from the Southeastern United States show that sulfates (which are very efficient at scattering light) comprise the majority of the fine particle mass in the atmosphere, especially on days when regional haze is the worst (SAMAB 1996). The light scattering appears as a uniform haze that veils distant scenes, but this situation probably is difficult to notice on the CNF because large dark objects (such as mountains) are not present in CNF vistas. Visibility reductions by regional haze are occurring on the CNF and are a factor at reducing visibility at airports, and along highways.

Sources of air pollution outside of the Forest have an effect on visibility, and Forest Service prescribed burning also has the potential to reduce highway visibility for short periods (less than 12 hours). About 80 percent of the particulates generated from prescribed fires are one micron or less in size (USDA Forest Service 1976). Therefore, there is a potential for emissions from prescribed fire to impact human health and reduce visibility along highways if smoke at ground level has high particulate matter concentrations. Furthermore, it is possible that the PM10 NAAQS can be violated within 1 mile of a prescribed fire. Studies conducted downwind of prescribed fires in Florida (Florida Department of Environmental Protection 1993) and Texas (Hunt and others 1994) have demonstrated that monitored maximum 24-hour concentrations exceeded the NAAQS.

Environmental Effects of Alternatives

Many Forest Service management activities emit air pollution into the atmosphere, but in most cases the amounts are believed to be insignificant. Current pollution levels in the CNF are unlikely to violate the NAAQS for sulfur dioxide, carbon monoxide, nitrogen oxides, and lead. There is a possibility that the NAAQS for ozone could be violated, but nitrogen oxide emissions from current and proposed management activities are unlikely to be a significant contributor to a violation of the ozone NAAQS. Currently, the DENR does not anticipate a violation of the PM2.5 NAAQS in the CNF, but the Forest Service believes that their management activities have a potential to exceed one or more of the NAAQS for particulate matter. Therefore, the remainder of the analysis will focus on how changes in particulate matter would affect air quality.

Many land managers and other technical specialists have discussed the need to increase the amount of prescribed fire in the coastal ecosystems. Some reasons given include reducing fuels to reduce the hazards and impacts of wildfire, and improving habitat conditions for threatened, rare, and endangered species. The Forest Service currently has smoke management guidelines designed to minimize impacts to smoke-sensitive targets, such as reductions to highway visibility.

The six alternatives have different levels of prescribed fire acres planned on an annual basis. The current level (Alternative A) has 15,000 acres annually. The lowest level (12,000 acres) is for Alternative B, and the highest number (25,000 acres) is for Alternatives C and E. Alternatives A, C, and E will be the focus of the remainder of this analysis.

The Forest Service has assumed that 5 tons of fuel would be consumed (which is probably too high in many cases) for each acre ignited. This much combustion is equivalent to releasing 0.15 tons per acre of PM10 into the atmosphere. Therefore, current prescribed fire activities are releasing 2,250 tons per year of PM10 into the atmosphere, and Alternatives C and E would increase PM10 emission by 1,500 tons per year (for a total of 3,750 tons per year). It is expected that Alternatives C and E would increase emissions in Craven County by 975 tons per year (65 percent), in Jones County by 225 tons per year (15

percent), and in Carterret County by 300 tons per year (20 percent). The emissions inventory data obtained from the EPA have no PM10 emissions for Carterett or Jones County, but Craven County was listed as having 8,139 tons per year of PM10 emissions. The PM10 emission estimates for Craven County was the 28th highest in North Carolina. Craven County would become the 27th highest county of PM10 emissions if there is an increase by 975 tons per year, and the PM10 emission levels in all the other counties remains the same. Therefore, the Forest Service is predicting that an increase in PM10 emission has a low likelihood of violating the PM10 NAAQS.

The Forest Service cannot predict if any of the alternatives would result in a violation of the PM2.5 NAAQS. The information supplied by DENR on which counties have the potential to violate the new NAAQS has a high degree of uncertainty because of the assumptions made in converting the PM10 values to PM2.5. If the DENR assumptions are correct, then Alternative A and B are unlikely cause a violation of the PM2.5 NAAQS. Actual monitoring of PM2.5 concentrations would be needed for all the Alternatives, because prescribed fires have 80 percent of the emissions less than 2.5 microns in size.

Prescribed fires are ignited when smoke management criteria are met (set forth in Forest Service Manual 5100 - Fire Management, Region 8 Supplement 5100-93-3). A historical database of meteorological data was compiled to estimate how many days per year prescribed fires can be conducted. The analysis estimated 52 days per year have favorable atmospheric conditions for smoke dispersion, and adequate fuel moisture to conduct the burning safely. A day was counted when, for at least 5 hours, the Smoke Management Guidelines were met (except KBDI estimates), the dispersion index was greater than 30, and the LVORI was less than 4 (Lavdas 1997). Historically, the Forest has been able to accomplish 300 acres of prescribed fire in a day. To obtain the 25,000 average annual burning in Alternatives C and E would require the Forest to average 500 acres per day. Aerial ignition of one or more areas can easily accomplish 500 or more acres of prescribed burning on any acceptable day.

Recently, the VSMOKE-GIS model has become available to assist with evaluating TSP (those particles 40 microns or smaller in size) concentrations downwind of a prescribe fire or wildfire. Historically, prescribed fires on the CNF have been about 300 acres in size and consumed about 4 tons of fuel per acres of long needle pines. For modeling purposes it was assumed that a heading fire technique would be used, the active fire phase would last 4 hours, and that the active smoke phase would last 6 hours. Starting with this basis, the values in Table 3.2 were used in the VSMOKE-GIS model to determine the maximum distance downwind for three TSP concentrations. The TSP concentrations of concern were 750, 1,450 and 2,900 micrograms per cubic meter, and these concentrations correspond to approximately 1.0, 0.5, and 0.25 miles visibility, respectively. The visibility distances assume a person is standing perpendicular to the length of the plume, and looking through the plume.

The VSMOKE-GIS model estimates the maximum downwind distance for a specified TSP concentration. The length of time for a specific TSP concentration at a specific point in the forest cannot be determined with VSMOKE-GIS. With these facts in mind, the maximum downwind distance is 3.2 miles for 750 micrograms per cubic meter, is 1.6 miles for 1450 micrograms per cubic meter, and is 0.8 miles for 2900 micrograms per cubic meter. These results suggest that visibility could be reduced for some time period to less than 1 mile if a highway is within 3 miles of a prescribed fire. However, the Forest Service usually favors wind directions that would not carry a significant amount of smoke across a highway. Furthermore, it should be remembered the risk of smoke impacts would be reduced in the future as the amount of fuel consumed is less than 4 tons per acre. The reductions in fuels would occur

with repeated burning of areas under prescribed fire management. Finally, the overall impacts to highway visibility from prescribed fires are expected to be less than during wildfires. Overall emissions from wildfires can be very large and smoke emissions continue during the night. Atmospheric conditions ford dispersal of smoke and the high relative humidity increases the likelihood of fog forming due to the increase in particulate matter in the atmosphere.

Table 3.1. Range in values (tons per square mile) used for each pollutant to place a county in an emissions category (U.S. EPA 1996)

Category	PM10	NOx	VOC	SO2
Low	0 to 6.9	0 to 1.13	0 to 1.21	0 to 0.07
Below Average	6.9 to 10.3	1.13 to 2.4	1.21 to 2.61	0.07 to 0.2
Average	10.3 to 14.2	2.4 to 4.6	2.61 to 4.76	0.2 to 0.7
Above Average	14.2 to 19.7	4.6 to 11.4	4.76 to 11.53	0.7 to 4.8

NOx = nitrogen oxides, VOC = volatile organic compounds, PM10 = particulate matter 10 microns or smaller, SO2 = sulfur dioxide

Table 3.2. Listing of some of the important values used in the VSMOKE-GIS model

Model Variable	Value Used
Check if time period is before sunset (daylight) [LTOFDY]	T (true)
Check if plumes is assumed to rise gradually [LGRISE]	T (true)
Total source emission rate of particulate matter [EMTQPM]	2520
Total sensible heat emission rate [EMTQH]	1108
Background concentration of particulate matter [BKGPM]	40
Portion of emissions subject to plume rise [EMTQR]	-.075
Size of fire [ACRES]	300
Stability Class [ISTAB]	3
Mixing Height [AMIX]	1000
Transport windspeed [U]	4
Initial horizontal crosswind dispersion [OYINT]	5
Initial vertical dispersion [OZINT]	5

3.1.2. SOILS

Affected Environment

The CNF lies on the Lower Atlantic Coastal Plain of North Carolina. It is mostly on the Talbot Terrace, with a maximum elevation of about 40 feet; a small portion in the Southeast is on the Pamlico Terrace with a maximum elevation of less than 20 feet. The Suffolk Scarp, roughly paralleling the CNF's southeastern boundary between the Neuse River and Bogue Sound, separates the older uplands of the Talbot Surface to the west from the younger marine and stream terraces of the Pamlico Surface to the east. Terraces of the Pamlico Surface extend farther inland along some of the larger streams. Floodplains of streams throughout the CNF are long and variable in width; areas of salt marsh (mostly small) occur adjacent to rivers, creeks, and bays below an elevation of approximately 2 feet.

The older uplands of the Talbot Surface make up most of the area of the CNF. A sizeable portion -- essentially the "core" of that part to the west of U.S. Highway 70 -- is overlain by large expanses of organic soils on broad, undissected upland areas. The uplands are characterized by large areas of poorly drained soils on broad, nearly level interstream divides. These large expanses grade into nearly level areas of poorly drained soils at their fringes, which further grade into gently sloping, moderately well-drained and well-drained soils near the streams or, less commonly, into well drained soils on short,

moderately steep side slopes along the larger drainages. Nearly level to gently sloping stream terraces occur along some rivers and larger creeks. Nearly level, very poorly drained and poorly drained soils are on the flood plains.

Upland soils of the CNF formed in surficial sediments of the Talbot and Pamlico marine terraces or in accumulations of organic matter on broad interstream areas. As a rule, the depth of the organic materials is greatest near the center of the very broad undissected divides and thins-out toward their fringes, then grading into mineral soils. Correspondingly, although these large areas of organic soils appear to be perfectly level, they slope outwardly from the middle.

Environmental Consequences

Timber harvest activities disturb soils on log landings, skid roads, skid trails, and other scattered areas in the proposed harvest units. Direct displacement of soil material (and the nutrients it contains) during construction of skid roads and landings should be minimal on the nearly level (predominantly) to gently sloping terrain characteristic of the CNF; however, skidding could result in some displacement on heavily used trails. Except on sandy soils and soils with thick sandy surfaces (coarser than, and not including, fine sandy loam), much of the disturbed area would be subject to compaction by logging traffic during periods when soils are wet but not saturated. Puddling or rutting could result from equipment use during wet weather or wet soil conditions.

While some areas could be adversely affected by compaction puddling and rutting, most soil disturbances associated with timber harvest operations on the CNF would be of short duration and would not adversely affect the sites. Region 8 Draft Soil Quality Standards require that “at least 85 percent of an activity area is left in a condition of acceptable productivity potential for trees or other managed vegetation, following any land management activities.” Operating standards would limit the areal extent of disturbances associated with timber harvest activities and preclude significant impairment of the productive capacity of the soil. (Significant impairment, as used here, is in agreement with Region 8 Draft Soil Quality Standards definition of "significantly impaired areas" as those that cannot recover within the planning horizon.)

Harvested areas also may be disturbed by site preparation activities. The treatments and equipment cover or traverse entire treatment areas, with variable effects. Depending on the site preparation treatments selected and implemented to meet management objectives and regeneration requirements for a site or stand, considerably more area may be disturbed than during the harvest and removal of timber. Severe slash burns can adversely affect the soil through soil sterilization, altering of soil structure, consuming soil organic matter, and loss of nutrients.

Mechanical methods of site preparation can seriously degrade soil productivity and displace significant quantities if: (1) they displace surface materials (litter, duff, organic matter, topsoil) and the nutrients contained therein from the site; (2) they cause significant soil compaction increasing bulk density, and decreasing aeration.

The CNF Plan proposes seedbed preparation for natural regeneration or site preparation for planting to be done either by broadcast prescribed burning (no piling) or by burning followed by a mechanical treatment--either shearing (all clearcutting-planting units) or chopping (some natural regeneration units; mostly in seedtree). Clearcutting and planting units on poorly drained soils also would be bedded,

generally with the bedding being done in tandem with shearing as a single operation. On these low phosphorus sites, phosphate fertilizer would be applied at a rate of about 92 pounds per acre of P205, with the applications concentrated in the 7 foot wide beds. The proposed site preparation methods have been determined to pose a low risk to soil productivity on most sites when properly applied (Final Environmental Impact Statement, Vegetation Management in the Coastal Plain/Piedmont). Potential effects of the selected mechanical methods are addressed in the following paragraphs; prescribed fire effects are addressed elsewhere in this document.

There should be little or no effect on soil productivity due to soil erosion caused by the proposed mechanical site preparation on the CNF. Chopping and shearing expose little soil, soil erosion is minimal, and treated sites recover within 1 year. Bedding exposes and tills much soil, which effect generally is offset by increased surface storage, and hence minimal erosion, on level sites; treated areas require 3 years for recovery. However, where disturbed interbed areas are continuous over long stretches and provide direct "conduits" for water flow, some erosion and off-site sediment delivery can occur.

In addition to the previously noted relationships of moisture and surface texture to soil compaction hazard, the number of machine passes and the presence or absence of protective ground cover (duff, litter, slash) are important. "Compaction hazard is less for methods that remove little slash, litter, and duff and require 1 to 2 passes than for those that remove much litter and duff and require several passes" (Final Environmental Impact Statement, Vegetation Management in the Coastal Plain/Piedmont). Chopping rarely increases bulk density or decreases aeration porosity (based on nine studies in the South cited in the Final Environmental Impact Statement, Vegetation Management) and compaction from shearing is also minimal. Bedding can ameliorate the compaction resulting from harvest operations and from other site preparation treatments.

Some nitrogen could be lost by leaching from chopped and sheared sites (potentially 3 pounds/acre) and from bedded sites (potentially 20 pounds/acre), but long-term effects would be negligible. Short-term and long-term effects on other nutrients from these treatments would be negligible. Fertilization in conjunction with bedding on some poorly drained soils would ameliorate or correct natural phosphorus deficiencies and increase productivity of those sites.

All alternatives include prescribed fire for site preparation (alone, or followed by mechanical treatment) and for vegetation management in established pine stands in some Landtypes. Some alternatives also include prescribed fire of the Raised Peatlands Landtype (pocosins).

The effects of fire on soils are related to time and frequency of burning and fire severity (heat pulse downward). A single fire of high severity can have serious long-term adverse effects on the site and soil due to the consumption of organic matter, nutrient losses (volatilization during the burn; some leaching afterwards), alteration of soil structure (affecting soil air-water relationships of mineral soils), and soil sterilization. However, unlike wildfire occurrences, fire by prescription more commonly can be conducted within parameters selected to protect resources by affording some degree of control over both the intensity (heat pulse upward) and severity of the burn.

Site preparation prescribed fire, under any alternative, would be predominantly moderate, with intermingled areas of light burning. Severe burning could occur in small, widely scattered areas

comprising less than ten percent of the burned unit. Periodic underburns in established pine stands would be light to moderate in severity, would include variable amounts of dormant season burning and growing season burning, and would occur at frequency intervals as short as 2 to 4 years to as long as every 5 years. Pocosin burning, as proposed in some alternatives, would occur at 5- to 12-year intervals.

Prescribed fire to prepare sites for establishment of even-aged pine stands would occur one time per rotation on any given site, or once every 60 to 100 years (varies with the species and among alternatives). Moderate burns would reduce the litter and duff on the site, with some exposure of mineral soils, but soil organic matter would be little affected. Soil physical properties (structure) would not be affected. Some nitrogen could be lost by volatization (up to 350 lb/ac; less than 150 lb/ac where burning is light). Other nutrients would be little affected (favorable effects in light burns). Soil biota would be reduced but would recover quickly. Overall risk to soil productivity would be minimal to low.

Most of the established pine stands, approximately 61,400 acres, would be prescribed burned from 2 to 5 times during the Plan period. Burning interval varies with species and among alternatives, but most commonly would be 3-5 years, with two major exceptions: a 5 year interval for all pine species in Alternative B; a 2- to 4-year interval for longleaf and for loblolly on longleaf sites in Alternatives C and E. Except in longleaf, all of the prescribed burning would be done during the dormant season. In the 9,500 acres of longleaf, both dormant-season and growing season burning would be done (the proportional amount of each varying among the alternatives).

Frequent (<3 yrs) growing season burns of any severity could pose a high to extreme risk to the long-term productivity of any site/soil on the CNF. Less frequent (>3 yrs) light to moderate burns during the dormant season would pose little risk. Burning in pine fuel types at frequencies proposed in any alternative (all are >5 yrs), by stemming progressive fuels buildup, could reduce the number, extent, and severity of wildfires. As a result, not as much area of soil would be disturbed by wildfire and suppression activities, and adverse effects from wildfires would be smaller on sites where they do occur. With no burning (burning proposed in all pine types), there could be a gradual, long term reduction in soil productivity from weathering and leaching or an increase in adverse effects from wildfire occurrences.

Sustainable longleaf pine straw harvest from suitable stands is proposed under alternatives C, C-modified, D, and E. In addition to the effects involving the use of mechanized equipment, the actual removal of the blanket of pine needless and loss from the site of incorporated nutrients also must be considered. The potential effects from the operation of mechanized equipment would vary among sites and would differ with time of operation. While there would be less concern on soils with sandy surfaces, which comprise a significant portion of the CNF stands suitable for pine straw management, soil compaction must be considered on soils with finer textures within 10 inches of the surface. Soil compaction could be minimized by limiting equipment operations to dry periods on all sites.

Nutrients in the harvested pine straw are lost to the site. While a single harvest removal would have little effect on productivity of most soils, frequent harvests without replenishment of the lost nutrients (nitrogen and phosphorus of greatest concern) could adversely affect soil productivity and result in significantly reduced yields. On the CNF, soil productivity would be maintained and sustained yield attained by harvesting suitable stands no more frequently than every 3 years, and by applying sufficient fertilizer to offset nutrient losses.

Roller chopping to reduce fire hazard in the urban wildland interface is proposed for some acreages in alternatives C, C-modified, and D. On the basis of previous discussion showing chopping for site preparation to pose minimal risk to soils, roller chopping in wildland urban interface zones for fire hazard reduction also should pose minimal risk.

Effects of Alternatives

A landtype is an ecological unit identified and mapped based on topographic, hydrologic, soils and plant associations. Refer to the Biological Environment section of this chapter for descriptions of each landtypes. The landtypes most affected are described below.

Landtypes Most Affected Among Alternatives

Most of the probable management practices involving ground disturbance would occur on 3 landtypes: Peat mantled forest wetlands (pond pine, approx 32,000 acres); Pine Savannas and Flatwoods (longleaf pine, approximately 27,000 acres) and Drainage headlands and broad interstream flats (mixed pine, approximately 10,150 acres).

Estimates of soil disturbance for timber management range from 8 to 12 percent of the area planned for operations. The estimates are based on monitoring data of CNF timber sales from 1993 to 1995. It includes regeneration and thinning. Table 3.3 displays the amount of soil disturbance by alternative.

Table 3.3. Soil disturbance from timber management by landtype.

Landtype	Acres of Soil Disturbed				
	Alternative A	Alternative B	Alternative C C-modified	Alternative D	Alternative E
Pine Savannas	232	408	488	375	288
Peat Mantled Forest Wetlands	80	308	80	160	--
Drainage Headlands/Interstream Flats	184	348	160	240	--
Total	496	1064	728	776	288

The following discussion addresses each landtype by alternative:

Pine Savannas and Flatwoods (26,970 acres) - longleaf pine

Effects common to all alternatives: Soil would be disturbed along fire plow lines necessary to prescribed burn most of the acreage of pine types. Although harvest methods and systems differ among the alternatives, there would be some soil disturbance associated with timber harvesting activities, including commercial thinning, under each alternative. There would be some soil disturbance associated with intensive site preparation under each alternative.

Effects common to alternatives A, C, C-modified, and E: Some burned and sheared areas also would be bedded.

Effects common to alternatives C, C-modified, D, and E: There could be impacts on soils in pinestraw harvest areas. There could be some soil disturbance associated with mechanical treatments for fire hazard reduction in the wildland urban interface.

Areal extent of soil disturbance from proposed timber harvest activities would be least under Alternative A and greatest under alternatives C and C-modified. Under Alternative A, there would be approximately 230 acres of soil disturbance in the proposed clearcutting and thinning units, less than half of the estimated 490 acres of disturbance associated with the clearcutting, shelterwood, and thinning harvests under alternatives C and C-modified. Alternatives B and D are intermediate, with approximately 375 and 410 acres of soil disturbance.

Peat-Mantled Forested Wetlands (31,840 acres) - pond pine
Effects common to all alternatives: Soil would be disturbed along fire plow lines necessary to prescribed burn most of the acreage of pine types. Although harvest systems differ among the alternatives, there would be some soil disturbance associated with timber harvest activities, including commercial thinning, under each alternative.

Effects common to alternatives A, C, C-modified, and E: Since harvest activities would be limited to commercial thinning, there would be no soil disturbances associated with site preparation for regeneration of harvested areas.

Effects common to alternatives B and D: Prescribed burning alone would be used for site preparation of some or all areas (all areas in Alternative B; some areas in Alternative D, which also includes burning and chopping of some areas).

Effects common to alternatives C, C-modified, D, and E: There could be some soil disturbance associated with mechanical treatments for fire hazard reduction in the wildland urban interface.

Areal extent of soil disturbance from proposed timber harvest activities, including thinning, would be least under alternatives A, C, C-modified, and E and greatest under Alternative B. Under alternatives A, C, C-modified, and E, there would be approximately 80 acres of soil disturbance in the proposed thinning units, roughly one half of the acreage that would be disturbed by the seedtree and thinning harvests under Alternative D and one quarter of that associated with group selection and thinning under Alternative B.

Drainage Headlands & Broad Interstream Flats (10,150 acres) - mixed pine
Effects common to all alternatives: There would be soil disturbance along fire plow lines necessary to prescribed burn most of the acreage of pine types. Although harvest methods and systems differ among the alternatives, there would be some soil disturbance associated with timber harvest activities, including commercial thinning, under each alternative. Prescribed burning for site preparation would be followed by mechanical treatments in some alternatives.

Effects common to alternatives A, C, C-modified, and D: Some soil would be disturbed by intensive site preparation (burning and chopping in D, and burning and shearing in A and C).

Effects common to alternatives C, C-modified, and D: Some soil would be disturbed by mechanical treatments for fire hazard reduction in the wildland urban interface.
Areal extent of soil disturbance from proposed timber harvest activities would be least under alternatives C and C-modified and greatest under Alternative B. Approximately 160 acres of soil would be

disturbed under alternatives C and C-modified, slightly more area, roughly 185 acres, would be disturbed under Alternative A, which proposes a comparable amount of thinning plus some clearcut harvest units. There would be approximately 240 acres of soil disturbance associated with the proposed seedtree and thinning harvests under Alternative C and 350 acres associated with the group selection and thinning harvests under Alternative B.

Alternative E: There is no projected activity for restoration in this landtype for Alternative E.

Effects to Landtypes Least Affected

Effects common to all Alternatives
Four landtypes have few activities scheduled in any alternative: Raised Peatlands (75,230 ac), Lake and Stream Swamps (7,750 ac), Hardwood Terraces and Slopes (3,500 ac) and Tidal Streams and Estuaries (1,300 ac). Prescribed fire and plowlines are the activities that may affect the raised peatland (pocosins). Alternative C, C-modified and D have objectives for about 74,000 acres prescribed fire in the pocosins. About 500 acres of soil would be disturbed by plowlines, if the pocosin were burned in blocks of 20,000 acres. This is less than 1 percent of the pocosin landtypes. About 125 acres of plowline disturbance would occur for Alternative E.

The following discussion addressed each of these landtypes by alternative.

Raised Peatlands (75,230 acres) - pocosin
Effects common to all alternatives: There would be no soil disturbance from timber harvest activities or from other non-fire activities.

Effects common to alternatives A and B: Probability of the occurrence of occasional large, severe wildfires -- including ground fire -- would remain high due to the continued growth of dense, highly flammable pocosin vegetation and high fuel loading over large expanses of organic soils. Ground fire associated with catastrophic wildfires could result in the ignition and loss of organic soils over large areas. Not only would burning generally be more extensive in such wildfires than in either prescribed burns or wildfires in a prescribed burned area, but there would be a much higher risk of fire escape into adjacent managed forest land. A precise comparison is impossible, but the areal extent and severity of the fire and fire suppression related soil disturbances could far exceed those in prescribed burned areas.

Effects common to alternatives C, C-modified, D, and E: There would be some soil disturbance associated with fire plow lines. The increased frequency of burning (regular prescribed fire versus. occasional wildfire) and the exposure of soils in firelines could increase the risk of organic soil ignition. However, with the higher degree of control (conditions, timing, etc.) inherent to prescribed burning, the area's extent and losses from ground fires during the Plan period would be expected to be less than can occur (and in recent history has occurred) during a single large wildfire of high severity. Areal extent and severity of soil disturbances from prescribed burning could be less than would result from wildfires and fire suppression activities in the absence of prescribed burning.

Lake and Stream Swamps (7,750 acres)
No management activities that would directly affect soils are proposed in any alternative. However, these areas could be indirectly affected by activities on adjacent landtypes. Sedimentation from the transportation system, areas disturbed by timber harvest and site preparation activities, interbed areas in

plantations, fire lines, etc. could occur; the extent of sediment delivery to the lake and stream swamps would be a function of the nature and areal extent of soil disturbances on -- and existence of direct "linkages" for sediment delivery from -- other landtypes, as modified by the effectiveness of measures to prevent movement of sediments from those sites.

Hardwood Terraces and Slopes (3,500 acres)
Soil disturbance would be minimal under any alternative. Under alternatives C, C-modified, D, and E, approximately 10 acres would be cleared, plowed, and revegetated with selected plant species to establish wildlife openings. Under Alternatives A, B, C, C-modified, and E limited skid trails across these areas may be used to remove pines from restoration areas. No other management activities that would directly affect soils are proposed in any alternative.

Tidal Streams and Estuaries (1,300 acres)
No management activities that would directly affect soils are proposed in any alternative. However, these areas could be indirectly affected by activities on other adjacent landtypes, as previously discussed (see the Lake and Stream Swamps Landtype discussion).

3.1.3. WATER RESOURCES

Affected Environment

CNF is characterized by low elevation, low relief, large expanses of organic soils, high water tables, and ill-defined watershed boundaries. The area is bounded on the north by the Trent and Neuse Rivers, on the west by the White Oak, on the south by Bogue Sound, and on the east by the Neuse River and the Clubfoot Creek/Harlowe Canal/Harlowe Creek system.

Soils range from excessively drained deep sands to thick peat organic soils. Percolation rates range from very rapid (>20.0 inches per hour) to extremely slow (<0.06 inches per hour), with the latter quite common (SCS, 1981). The slow percolation of water results in high water tables over much of the area. These water tables are often at or near the ground surface during the winter in the very poorly and poorly drained soils. Precipitation rates of sufficient duration to exceed the soil permeability frequently result in temporarily perched water tables during any season of the year. Due to very low soil permeability rates, groundwater recharge of underlying aquifers is not considered significant: probably not more than 0.5 inches per year (Heath, 1975).

The highest elevation on the district is approximately 42 feet above mean sea level in the area about a mile northwest of Great Lake. Land slopes are generally less than 1 foot per mile, but they may be considerably greater along the outer boundary near the major rivers. Watershed divides are commonly ill defined due to the low relief and high water tables. These divides can change with rising or falling water table levels. On Great Lake, the direction or location of outflow can change with wind direction. The result is that during wet periods or large storms, water may be discharged into different outlets or canals flow in different directions than during baseflow conditions.

Stream systems on the Croatan range from well-defined channel systems to ill-defined wet depressions on the land surface. Some stream reaches have been altered in the past by "channelizing" which includes straightening, deepening, and widening. The work was accomplished to provide adequate outlets for drainage ditches and canals. The geometry of natural channels is controlled by the soils

adjacent the channel, the drainage area, the channel gradient, and the extent of tidal influence. Stream characteristics are more fully described in the Aquatic Ecosystem Classification section and in the Fisheries Resource Report.

Streams in the pocosins and other areas with organic soils tend to be poorly defined with large width-depth ratios. Floodplains tend to be wide. These streams also have few distinct tributaries. Runoff, both base flow and stormflow, enters the channel system along the entire channel length rather than at discrete outlets. In very general terms, this results in slower rises and slower falls of stream levels in response to small or minor storm events, which may last for days or more than a week. Storms with enough precipitation to saturate the soil or root mat would produce rapid runoff. Most stream reaches are eco-classed as: non-tidal, bottomland hardwood, narrow, shallow, low pH, and low conductivities.

Streams in areas of mineral soil tend to be better defined with smaller width-depth ratio. These areas also tend to have more distinct tributaries. Floodplains tend to be narrower than those of pocosin streams. There are few of these stream reaches and they are generally eco-classed as: non-tidal, bottomland hardwood, narrow, shallow, high pH, and medium conductivity.

The third type of stream reaches are those that open into tidal waters such as the White Oak, Neuse, Trent or Newport rivers. These reaches are wide and deep due to the ebb and flow of the tide eroding the channel bottom and banks. They are generally eco-classed as: tidal, bottomland hardwood, wide, deep, high pH, and medium or high conductivity.

Canals were constructed on a limited area of the CNF during the 1950's and 1960's. Adjacent private land has been ditched in more recent years, with the outlets into streams or canals passing through CNF land. These canals were established in both organic and mineral soils for various purposes including: agricultural cropping, forest management, and road construction. These existing canals are in various states of maintenance. Those still needed, such as for road drainage, still function and are maintained. Others, such as those in the old agricultural areas, do not function, while still others have been purposefully plugged in an attempt to restore the wetland hydrology to the sites.

Lakes on or adjacent to the CNF include: Catfish, Great, Long, Little and Ellis Lakes. These are blackwater lakes whose origins have not been conclusively determined. They occupy shallow depressions on the landscape with maximum depths ranging from about 5 to 10 feet (Loftin 1985). The lakes receive some surface water inflow from adjacent higher pocosins. Much of the input, however, is from precipitation. Each lake has one or more outlets, but the rate and direction of discharge depends on the direction and velocity of the wind and the lake water level. Normally, Catfish Lake discharges into Blackswamp Creek and Great Lake outlets into Hunter Creek, both of which are tributaries to the White Oak River.

Runoff from the Croatan is either surface or subsurface, depending on water table levels. Generally the water moves through the more porous soil layers as interflow or "sheet flow" into streams, ditches, or estuaries. When the water table is high, movement can be rapid through the root mat or over the ground surface if the soil is saturated. In well-drained sandy soils, all the runoff is from subsurface flow. Runoff is highest during the winter, and stormflow peaks may be delayed for several days after the event due the slow movement of the water into the drainage system. Runoff is lowest during the growing

season because evapo-transpiration (ET) creates water storage in the soil profile to detain or retain the storm water from the streams.

Water quality of area lakes and streams is only minimally influenced by activities on the CNF. Within the Forest, the soils are the overwhelming factor in the quality. Once off the CNF, private land development, both urban and suburban, is the most significant factor. The Neuse River, for example, is a very important river for the Forest. However, virtually all its watershed is upstream of the Forest. The River is and has been degraded for many years by human use and development. While there are no direct actions that the Forest Service can take to significantly improve the Neuse, the Agency continues to encourage and support State and individual efforts to clean up the River.

Land management practices that change a site's evapo-transpiration rate or the infiltration rate of the soil may affect the hydrology of that site. Timber harvesting, site preparation, burning, and ditching and draining are the practices most likely to be considered for use on the CNF which could affect the hydrologic regime. The magnitude of the impact of any of the activities depends on the areal extent of the activity and intensity of the activity if it involves changes in vegetation.

Compliance with Federal and State best management practices (BMPs) and regulations regarding wetlands, timber harvesting, soil disturbance, and pesticide use would limit or eliminate environmental effects from these activities.

Timber harvesting changes the site's rate of evapo-transpiration in proportion to the percentage reduction in basal area removed. Generally there would be an increase in total runoff if the excess soil water can drain below the root zone. On wet sites where the water table is near the ground surface, the extra water is lost through increased transpiration of lower vegetation and by increased evaporation from the soil surface. Studies in the Florida flatwoods (Swindel and others, 1983) showed an increase in flow of only about an inch for clearcutting a slash pine stand followed by mechanical site preparation.

Water table depths generally would be higher on sites after timber harvesting and would remain high until the ET rates return to preharvest levels. How high the water table rises depends on the rainfall inputs and the hydraulic conductivity of the soil. The low hydraulic conductivities of the poorly and very poorly drained sites cause the water table to rise, possibly to the ground surface, and remain there until dry periods or until vegetation is re-established. It is this rise in water table that makes forest regeneration on very poorly drained soils difficult.

The changes in runoff, soil moisture and water table depths associated with removal of vegetation would generally last for several years, with the greatest changes occurring in the first years and less change in each subsequent year. Soil moisture and water table changes would only be observed on the project site and not off-site. Runoff changes should not be observable in receiving streams except as slightly wetter conditions further upstream early in the growing season.

Site preparation generally prolongs whatever initial change resulted from the timber harvest, no new or additional effects should occur. By preventing the regrowth of vegetation for a growing season or more, site preparation delays the normal decrease in effects. There should be no off-site impacts from site preparation if the project complies with the appropriate BMPs and forest practice guidelines.

Bedding is commonly used where seasonally high water tables may kill new trees. Beds, or raised soil mounds, provide a zone of aerated soil where the tree roots can develop. Bedding would not affect off-site hydrology if the beds are not directly connected to a ditch or stream channel. Thus, rapid runoff of surface water and the transport of sediment are avoided.

Timber harvesting without surface water management would not significantly change the runoff peak rates or timing of flows leaving the site. Unless the site is compacted to a large extent, infiltration rates would not be changed, but soil moisture and water table levels would increase. Runoff from the harvested area would not reach stream channels any more rapidly than before harvesting.

Permanent changes in vegetation type or amount can affect the site's runoff. The effect on runoff is related to change in the site's ET. Total runoff from the site would be increased if the rate of ET is reduced, such as by changing from a fully stocked timber stand to a grass cover. Total runoff would be decreased if the type of vegetation is changed to one that has a higher ET rate or the vegetation stocking is more dense.

Ditching and draining are applied to forest sites for several reasons. One purpose is to keep the water table below the ground surface during the operation to improve site operability, prevent site damage, and extend the operating season. A second purpose is to increase aeration in rooting zones during the establishment of the new trees.

Ditching can lower growing-season water table depths for a distance of about 150 to 200 feet out from the ditch. The greatest effect is immediately adjacent the ditch, however. Skaggs et al. (1980) showed that the water table depths on drained and undrained mineral soils were nearly identical and concluded that ET was the principal factor controlling water table depth. Duncan and Terry (1981) state that tree transpiration is most effective if the soil is not saturated. One researcher has suggested that the primary benefit of ditching is to lengthen the growing season of the trees immediately adjacent to the ditch. These trees start growing earlier in the season, drawing down the water table for the adjacent trees, and so on. The net effect is an advancing drawdown of the water table across the site away from the ditch so all the trees start growing earlier than they would without ditching.

Using the results of drainage models, Skaggs (1995) states that total water yield from drained pine forests is less than from undrained pine forests. His comparisons are, in order of greatest to least water yield: natural pocosin, pocosin with 660-foot drain spacing; pocosin with 330-foot drain spacing; pine plantation with 660-foot spacing; and pine plantation with 330-foot drain spacing. He also cites studies showing that controlled drainage has less total water yield than does uncontrolled or free ditch drainage.

A controversy exists over the effects of ditch and draining on the estuarine system. The estuarine system is very valuable for the production of both marine fish and mussels. Some opinion holds that the reduction in productivity of the sounds and estuaries is due to the increased fresh water stormflow discharge that results from the construction of canals and ditches for pine plantations and agricultural activities. Other opinions hold that some ditching and draining may actually improve freshwater runoff regimes by retarding stormflow since the precipitation would infiltrate the soil and hence take longer to reach stream channels and the estuarine system.

Hydrology restoration by plugging existing ditches and canals or restricting flow in these channels would have the opposite effects of the construction of new ditches and canals. Water tables up stream -- higher on the hydraulic gradient from the plug or flow control structure -- would be higher during the growing season, resulting in a shift to a wetter wetland vegetation type. This higher water table could also result in more and longer delayed stormflow, since less storage would be available for precipitation. The hydrologic regimes of these sites should eventually become more natural and less like the altered system.

Burning, either as wildfire or as prescribed burning, would change the amount of vegetation on the site and hence the site's ET. If a large amount of vegetation were killed on the site, the water table would raise, particularly during the growing season. This rise may cause a limited increase in streamflow (water yield) from the area.

The chemical nature of the water may change somewhat, depending on the intensity of the burn and the type of vegetation burned. Burning can increase the conductivity of the water and increase the levels of nitrate and nitrite nitrogen and phosphate phosphorous. These increases diminish quickly both with vegetation regrowth and dilution from rainfall. Unpublished data (Rutledge, 1995) indicates that these increases are small and highly variable. Most of the increased nutrients in the water are taken up by vegetative regrowth.

The duration of the effect would depend on how quickly the vegetation regrows or reoccupies the site. Dormant-season burning effects would be delayed, not becoming observable until the early part of the following growing season because non-growing season water tables are normally high. Growing-season burning effects would be more immediate. Effects from both burns would diminish as soon as vegetation regrowth begins.

Environmental Consequences By Alternative

Potential Environmental Effects of Probable Land and Resource Management Activities

Alternative A: Implementation of Alternative A would not change the hydrologic conditions from present. Current trends in ET, water table levels, streamflow, and water quality would not change from present.

***Alternative B*:** Implementation of Alternative B would not observably change the hydrologic effects from those of Alternative A. Locally in project areas, the water yields from timber harvest areas would not be as large as those of Alternative A. Changes due to burning would be slightly greater. Restoration of hydrology by plugging existing ditches and canals or installing flow control structures would result in slightly higher growing season storm-flows, but should not change dormant season flow. Some new wetland areas may be created in the hydrology restoration area, but increased wetness would be the most observable effect.

The effects of implementation on water quality depend on the areal extent of individual projects and their dispersion across the landscape. This rule is particularly true for the drainage systems. Large areas of dormant season burning may temporarily increase stream water conductivity, and nitrogen and phosphate concentrations in water. These increases are not expected to be observable beyond the first or second untreated stream or canal confluence.

Hydrologic changes that do occur would be observable primarily on the project area. Due to the small magnitude of the changes on the specific area and the limited area on which they occur, the changes should not be observable in streams or canals beyond the first or second tributary or branch confluence. Chemistry of the receiving waters would not be observably changed. Changes would not cause new or increase existing localized flooding. New wetlands would not be created downstream by changes in drainage patterns.

Alternatives C, C-modified, and E: Implementation of Alternative C would have slightly greater effects than those of Alternative B due to the increased level of vegetation alteration activities, particularly burning and timber harvesting. Even with these increased activities, the hydrologic effects of this alternative would not be readily observable in the streams or canals beyond the first or second tributary confluence.

Alternative D: Implementation of Alternative D would have approximately the same hydrologic effects as the implementation of Alternative C. Construction of drainage ditches would be limited on any one site, limiting the effects to the immediate site and for a short distance downstream in the receiving canals and streams. However the effects should not be readily observably beyond the first or second tributary confluence.

3.1.4. FIRE/FUELS/WILDFIRE RISK

Affected Environment

Evidence of human settlement in and around the Croatan dates back over 7,000 years. Anthroprogenic fire practices have had significant influence on the development of the area's ecosystems. Current studies indicate as much as 95 percent of the original (i.e., pre-European settlement) vegetation of the Croatan appears to have been either distinctive fire communities or vegetation whose structure and species were influenced by light ground fire. Notable exceptions were some freshwater marshes in the lakes, and small areas of beech and other mesophytic hardwoods that were naturally protected from fire by ravines and steep, moist slopes (Frost, 1996).

When fire prevention programs were initially implemented in the region, the number of wildfires and the amount of indiscriminate burning began to decline. However, in some fire regimes, such practices led to virtual fire exclusion, which in turn led to an artificial advance of forest succession and unnatural fuel loadings. Such is the case with the longleaf pine-grassland ecosystems and the pocosin ecosystems that cover most of the CNF.

Fuel conditions affect wildfire risk and the potential for damage to resources. While the Croatan experiences wildfires all year long, mid-October through mid-December and mid-February through most of May are considered to be the times of greatest fire occurrence and resource damage.

Fire records for 1970 through 1994 show that the Croatan has had a total of 472 fires that burned 52,448 acres (PCHA/NFMAS). The averages are 19 fires and 2,098 acres per year. As can be seen by the table below, humans have the largest impact on the Croatan's wildfire occurrence. Lightning-caused or natural fires are relatively infrequent, but can burn significant acreages. While they can occur anywhere on the landscape, lightning-caused fires in isolated areas such as pocosins can go undetected for several

days, and access may be difficult thus contributing to fire size. Under current direction, all wildfires are suppressed.

Table 3.4. Number of fires by statistical cause on the Croatan National Forest 1970-1994 (Total For All Years) Acres (1,000s)

Lightning	Equipment	Smoking	Camp-fire	Debris Burning	Railroad	Arson	Children	Misc.	Total
15	14	17	19	87	9	203	56	52	472
3	0	0	1	3	0	42	0	3	52

The biggest wildfire risks on the CNF are large, contiguous areas of heavy, highly flammable fuels resulting from years of fire exclusion, and in wildland urban interfaces resulting from 20 years of community development adjacent to forest land. A wildland urban interface is defined as the line, area, or zone where structures and other human developments meet or intermingle with undeveloped wildland or vegetative fuels (Federal Wildland Fire Management Policy and Program Review, 1995). Marine Corps Air Station Cherry Point borders the northeast portion of the Forest, and accounts for part of the large influx of people to the area in recent years. In addition, the coast draws both permanent and part-time residents to the area. Industrial timberland also adjoins the CNF in several places. Except for a few areas along Highway 58 (the western edge of the Forest), the CNF is virtually surrounded by urban interface. Close proximity to forest land with hazardous fuel loadings make many urban developments extremely vulnerable to destruction by wildfire. With this increase in values at risk, the Forest Service's role in wildland fire protection and suppression has increased.

Fuels Associated with Plant Communities

The longleaf pine-grassland (chiefly wiregrass and bluestems) ecosystem historically dominated upland sites on the Coastal Plain in the Southern United States (Landers and others, 1993). This ecosystem is distinguished by open pine forests, woodlands, and grass-dominated savannas, all of which are intricately integrated with multiple vertebrate and invertebrate species use. These systems and their components exist, and in most cases, thrive on effects resulting from disturbances such as fire. Under the current land classification system, there are approximately 6,000 acres of existing longleaf and 30,000 acres suitable for longleaf pine forest systems.

In the Croatan Wildernesses, which are primarily pocosins, the entire wilderness character is being lost with fire exclusion. Hughes (1996) estimated that presettlement North Carolina peatlands originally supported around 5 million acres of canebrake, a fire dependent vegetation community. Frost (unpublished) estimated the presettlement fire recurrence rate on the CNF to be 1-3 years. As a result of fire exclusion, what was once one of the principal and most extensive types of presettlement coastal peatlands has now largely evolved to pocosin, red maple, and bay forest types.

Apart from rain, the only water movement in a pocosin system is an outwardly flow. Fire is the primary force for nutrient cycling; without fire, decomposition equals or is less than the rate of litter production. This continual buildup of the organic layer, combined with a succession towards a dense shrub or mesic hardwood forest leads to decreased species diversity. In addition, drought, low fuel moistures, and the chemical composition of pocosin vegetation can result in explosive fuel conditions. Wildfires often are so severe that much of the deep organic soil is consumed, the hydrology is changed, and succession regimes are slowed.

Another land type associated with frequent fire return intervals on the CNF is pond pine woodland. It occurs in transitional areas where soils range from wet organics to poorly drained mineral soils. Serotinous cones and epicormic sprouting make pond pine highly adaptable to fire.

Wildfire Suppression and Prescribed Fire

Several factors, including flame length and rate of spread, determine the difficulty of wildfire suppression. Fire intensity or the amount of heat produced over a period of time, influences the amount of resource damage that occurs during burning. These fire characteristics are affected by weather conditions and fuel properties. While we have no control over weather, we can manipulate fuels by changing the type, amount, arrangement and size available for ignition.

Fuel conditions on the Croatan vary by vegetation type, position on the landscape, and disturbance history. In addition to wildfire, other types of disturbance that affect fuel conditions include prescribed burning, mechanical fuel treatments, insect and disease infestations, weather events such as hurricanes and tornadoes, and silvicultural activities such as timber harvest and stand improvement.

Recently, prescribed fire has been applied to an average of 8,200 acres per year during the dormant season (October-March) and 200 acres per year during the growing season (June-August). Dormant season burning is conducted when weather conditions are cool and fuel moistures are high. These fires result in consumption of small dead fuels and an immediate reduction of fire danger. Dormant-season burning also stimulates browse and forb production. While dormant season burning benefits most wildlife, it can actually result in increased fuel loads in some areas unless it is done at 1- to 2-year intervals.

Growing-season fires are often applied to longleaf pine ecosystems when the weather is hotter and fuels are drier. These conditions result in greater consumption of both dead and live fuels and more effective understory kill. Once the initial fuel conditions are reduced, low-intensity prescribed fire can be applied at frequent intervals, producing the open, park-like understories characteristic of longleaf pine forests of the past. Treated longleaf forests become much less susceptible to devastating wildfires due to reduced fuel loads in the understory. These conditions can be maintained by continuing to apply low-intensity fire at frequent intervals. However, growing season burning in the Coastal Plain can be very physically demanding for personnel due to extreme temperatures. Prescribed fire is also often applied to areas after timber harvesting. Residual slash is reduced and mineral soil exposed to aid in reforestation.

Disturbances such as tornadoes and hurricanes can have a significant impact on fuel conditions and prescribed fire activities. The summer of 1996 brought two category 3 hurricanes (Bertha and Fran). The effects of these two hurricanes vary across the forest. On the southern part of the forest, much of the vegetation was heavily inundated with saltwater, leaving the trees weakened and the understory vegetation salt-cured. Fuels became even more flammable than before. Many hardwood drains, once considered barriers in fire spread, are now full of large trees that have toppled over due to weakened root systems. Many natural barriers have been eliminated, providing continuous fuels for fire spread. Several pine plantations, which initially appeared undamaged, received enough wind to result in a timber condition known as "shake" in which the growth rings of the tree separate causing it to slowly die or become insect and disease infested.

In addition to increased fuel loads produced by recent storms, the CNF is beginning to experience insect outbreaks resulting from the weakened conditions of many pine stands. Tree mortality, as well as some integrated pest management practices would contribute to additional fuel loadings in some areas of the forest. Widely scattered areas are beginning to exhibit conditions closely representative of a slash fuel model.

Current fuel conditions on the CNF have been shaped by all of the above activities. The prescribed fire program has developed into a fairly aggressive one. However, there are still large parts of the CNF that have had little or no fire activity in the last century, resulting in hazardous fuel conditions.

Fuel Models

Fuel types fall into four groups -- grasses, brush, timber, and slash (Anderson, 1982). Differences in fire behavior among these groups are related to fuel loads and their distribution among the fuel particle size classes. Fuel load and fuel bed depth are significant fuel properties that help to predict whether a fire would sustain ignition, what its rate of spread would be, and what amount of heat it would produce. We can build a relative risk analysis based on information produced by this type of modeling.

Grasses (FMs 1-3) and brush (FMs 4-7) are vertically oriented and rapidly increase in depth with increasing load. Timber litter (FMs 8-10) and slash (FMs 11-13) are horizontally positioned and depth slowly increases as load is increased. These fuel models are widely used to predict fire behavior. Each fuel model is described by the fuel load and ratio of surface area to volume of each size class; the depth of the fuel bed involved in the fire front; and fuel moisture including that at which fire would not spread, called moisture of extinction.

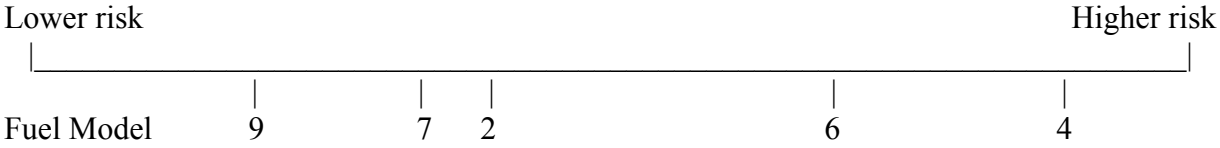
The criteria for choosing a fuel model include the fact that fire burns in the fuel stratum best conditioned to support it. Fuel models help the user to estimate fire behavior. Situations may arise where one fuel model represents rate of spread most accurately and another best describes fire intensity. Fuel conditions on the CNF were mapped and analyzed based on landtype, forest type, soils, and disturbance history.

In wildfire suppression, rate of spread and flame length largely influence fire suppression tactics. For example, direct attack by hand crews is usually considered effective at flame lengths of 4 feet or less. At flame lengths greater than 4 feet and up to 8 feet, direct attack by mechanical equipment is considered effective. Aerial resources are needed for direct attack for flame lengths greater than 8 feet, and up to 11 feet. When flame lengths are greater than 11 feet, indirect attack is usually considered to be the only effective fire suppression tactic. The table below demonstrates the difference in rates of spread and flame length among Anderson's fuel models:

Table 3.5. Rates of spread and flame length by fuel model

FUEL MODEL	RATE OF SPREAD (Chains/Hour)	FLAME LENGTH (FT)
1	78	4
2	35	6
3	104	12
4	75	19
5	18	4
6	32	6
7	20	5
8	1.6	1.0
9	7.5	2.6
10	7.9	4.8
11	6.0	3.5
12	13.0	8.0
13	13.5	10.5

For wildfire risk, suppression difficulty, and amount of resource damage, fuel models in this analysis can be relatively ranked as follows:



Although rates of spread and flame lengths are slightly greater in FM2 than in FM6, suppression is often easier in FM2 due to a lower moisture of extinction, complete consumption of available fuels, and the effectiveness of indirect attack using backfires to stop fire spread. Also, FM6 is used to describe low pocosin conditions that exist on deep organic soils on the CNF. Because wildfires generally occur when fuels are dry, organic soil ignition often follows. Once the organic layer ignites, suppression becomes extremely difficult and labor intensive. Suppression actions can cause as much or more damage to resources than the fire itself.

Wildfires occurring in high pocosin or FM4 create the same problems with organic soil ignition as mentioned above. Heavy loads of highly volatile fuel also produce rapid rates of spread and extreme flame lengths, making fire suppression very difficult, and dangerous. Large firebreaks, combined with risky backfiring operations, often provide the only effective means of fire suppression. Again, suppression actions can result in as much or more resource damage than the fire itself.

One could reason that in such a fire-dependent, fire-adapted ecosystem, fire could be applied under specific conditions to achieve well-defined objectives such as hazardous fuel reduction and species diversity, rather than waiting for a wildfire to occur under extreme conditions resulting in resource damage and the possible loss of private property.

Table 3.6. Current distribution of fuel conditions on the CNF.

Fuel Model	2	4	6	7	9	Not Modeled	Total
Acres/%	8,200 (5%)	42,400 (26%)	26,100 (16%)	36,500 (23%)	39,300 (24%)	8,600 (5%)	161,100

Three areas that display prominent wildland/urban interface problems have been identified and the current fuel distribution is described in Table 3.7.

Table 3.7. Fuel Model Distribution in wildland urban interfaces (WUI) rounded to nearest 10 acres.

Fuel Model	2	4	6	7	9	Not Modeled	0	Total
Acres WUI#1	0 (0%)	3,100 (70%)	0 (0%)	800 (18%)	500 (11%)	50 (1%)	0 (0%)	4,450
Acres WUI#2	0 (0%)	160 (8%)	0 (0%)	1,600 (78%)	300 (14%)	0 (0%)	0 (0%)	2,060
Acres WUI#3	20 (<%)	2,500 (53%)	0 (0%)	1,000 (21%)	600 (13%)	100 (2%)	500 (11%)	4,720
Acres Total	20 (<1%)	5,760 (51%)	0 (0%)	3,400 (30%)	1,400 (12%)	150 (1%)	500 (4%)	11,230

While both the Pocosin WUI (WUI #3) and Catfish Lake WUI (WUI #1) consist largely of fuels representative of FM4, they currently interface primarily with industrial timberland. The resources on this land are extremely valuable. However, the threat of wildfire in both of these interfaces is more a threat to property than human lives at this time. In contrast, while the Havelock WUI (WUI #2) also interfaces with valuable industrial timberland, the more immediate threat is to the lives and property of homeowners in the area. That is not to say that human lives would not be threatened by wildfire in the Catfish Lake and Pocosin interfaces, just that the industrial forests would probably receive the brunt of the damage. By the time fire burned through these industrial pine forests, fuel conditions would have transitioned, making fire suppression a little easier.

Environmental Consequences

Probable Activities and How They Would Affect the Resource Environment

Fuel conditions as they relate to wildfire risk can be affected by numerous activities. The most significant changes in fuels that would affect wildfire risk are changes in the amount, size, or arrangement. Changes in vegetation type would also affect wildfire risk. Management activities can produce all of these types of changes. We can see from past history that wildfire suppression or fire exclusion in such fire-dependent, fire-adapted ecosystems would lead to an unnatural state of advanced succession in many places. The resulting fuel conditions can dramatically increase the risk of damaging wildfire.

Any type of fire activity would produce an immediate reduction in available fuels, sometimes with damaging results to other resources. By applying fire under specific weather and fuel conditions in appropriate areas, the desired results can usually be achieved. As set forth in the Land Management Plan, fuel conditions currently represented on the CNF may change with repeated treatments, and possibly exhibit fire behavior characteristics described by fuel models different and, in most cases, less severe than current. There are trade-offs associated with prescribed fire. These include short-term reduced visibility, areas of blackened forests for a time, disruption of recreation activities, and even the risk of a fire becoming larger than expected.

The effect of timber activities on fuels can vary. While harvest activities initially increase fuel loads by generating large amounts of slash, thinning in young plantations can actually reduce the risk of damaging wildfire by breaking up the ladder effect that numerous, closely space trees have on fire spread. These open understory conditions can be maintained with repeated prescribed burns. Timber stand improvement activities such as drum chopping or herbicide application would also affect the arrangement of fuels. In some cases, herbicide treatments may actually increase fuel loads by killing live fuels, making them more readily available to burn. In general, however, any activity including prescribed burning that improves overall forest health would result in decreased wildfire risk.

Regeneration efforts would produce young trees, which are more susceptible to wildfire than older, larger trees. Young, even-aged stands are at high risk from damaging wildfire, but this risk decreases as stands mature. Uneven-aged stands may not be quite as susceptible to damage from wildfire due to age class ranges within stands, but prescribed fire may result in damage or mortality in the younger age classes.

As discussed in the Affected Environment section, over 85 percent of wildfires and acres burned by wildfire are human-caused. Almost 60 percent of these fires have been arson-related, leading to the conclusion that any activity that results in an increase in forest users or access may result in increased wildfire occurrence. There is also a chance of increased arson fire activity as a form of revenge in response to certain management activities or decisions such as road or trail closures.

Construction of new recreation sites would reduce fuels in the immediate vicinity, thus reducing the risk of damaging wildfire to the site. However, additional recreation areas would require protection from wildfire, because increased users would increase potential risk of wildfire.

Construction and maintenance of roads, trails, and wildlife openings would not only provide places free of fuel, but also possible anchor points for defensible firelines. In some cases, roads and trails may be used as firelines themselves. Again, however, increased forest access or use may result in increased human-caused fire activity. Motorized vehicle use may result in a higher wildfire risk from vehicles. An increase in dispersed camping may increase risk of escaped campfires.

Land ownership adjustment may have a myriad of effects on fuels and wildfire risk. Small, isolated tracts generally make fuel treatments more difficult and costly due to the amount of fireline needed to control a prescribed burn. Wildfire suppression tends to be more difficult and costly for the same reasons. Land consolidation should benefit both private and public landowners by decreasing the amount of fireline that would have to be defended in the event of wildfire or prescribed fire. However, since the probable future use of private land is unknown at this time, it is difficult to say exactly what effect possible activities might have on fuels on private land, or how wildfire risk might be affected. The same is true for special use activity. Any type of activity that might hinder prescribed burning or wildfire suppression would increase the risk of damage by wildfire.

Fuel loads, and thus wildfire risk, would be reduced in areas where pine straw raking is allowed. To provide a hindrance-free area to raking, prescribed fire would be applied every fourth year. This burning would decrease fuel loads, and perhaps move the fuel model from a FM7 (southern rough) to a FM9 (pine/hardwood leaf litter) in areas previously occupied by a shrubby understory. The activity of

raking, itself, would also decrease fuel loads, but would probably not cause changes in the fuel model represented.

Current research indicates that drainage, and disturbance reduce moisture content of peat soils, thereby increasing the susceptibility of organic soils to ground fire (Hungerford and others, 1995). This type of activity appears to have created very difficult fire management situations, including long term smoldering fires that destroy vegetation over large areas, emit acrid smoke for long periods, and possibly cause soil erosion. Activities that would restore hydrology in pocosin areas where pine plantation conversion was attempted in the past may help reduce these types of wildfire risks. Bedding would have little effect on fuel loads, but may slightly decrease mechanical maneuverability in such stands during wildfire suppression.

The primary effect on wildfire risk common in all alternatives is the increase in future development outside the CNF. As populations and developments increase, values at risk would increase. Most important among these are public and firefighter safety. Interagency cooperation would become increasingly important, and it may become more difficult and expensive to manage both wildfire and prescribed fire as populations increase. Problems associated with smoke management may also become more difficult to address.

Existing roads, trails, and wildlife openings may be utilized in fire suppression and prescribed fire activities in each alternative. All alternatives propose some level of road closure, which may result in an increase in arson-related wildfire potential. Mitigation measures would be taken during wildfire suppression and prescribed fire activities to protect heritage resources in all alternatives.

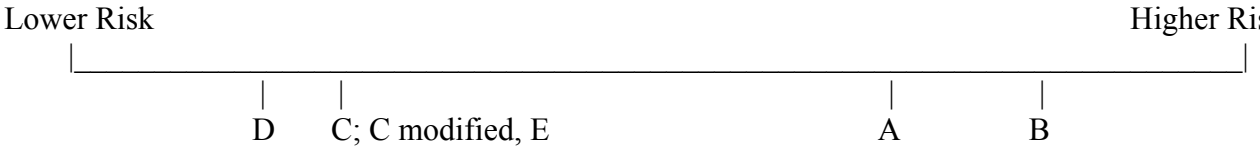
Effects Common to Alternatives B, C, D, and E: Alternatives B, C, C-modified, D, and E each have about 11,200 acres identified as wildland urban interface. Alternative D recognizes that there may be additional potential problem areas identified over time as development increases. Wildland urban interfaces may overlap with other resource prescriptions in these three alternatives, but it is expected that only areas with wilderness, and possibly hardwood-cypress and NHP allocations, would present conflicts. These conflicts arise from limits on management actions to provide natural conditions; site-specific analyses would address these situations.

Effects Common to Alternatives B, C, and E: The phasing out of special uses in alternatives B, C, and C-modified may result in increased arson-related wildfire risk.

Effects Common to Alternatives C,D, and E: Overall, fuel treatment levels in alternatives C and D would result in similar levels of reduced wildfire risk. As noted above, Alternative D provides for the potential of additional areas of treatment with increases in wildland urban interface development. The difference in magnitude between these two alternatives is unknown at this time.

Effects for Each Alternative

A relative risk analysis resulting from the desired future condition and probable management activities within each alternative is displayed below. This analysis is based on the differences in fuel treatment programs, including identification and treatment of wildland/urban interfaces.



Alternative A*:* Timber management activities may initially increase fuel loads through the generation of slash as described above. This alternative does not provide for site preparation burning, however, mechanical site preparation treatments may assist in reducing fuel loads. For a time, young stands would be more susceptible to wildfire than those stands with older, larger trees. Timber stand improvement treatments including chopping and burning would reduce fuels in those stands as well as improve overall stand health, thus reducing wildfire risk.

The level of prescribed fire is expected to remain the same during the 10-year planning period. The distribution of fuel conditions may change somewhat as areas of shallower organic soils currently represented by low pocosin (FM6) that were burned during the 1994 Fish Day Fire succeed towards a high pocosin condition (FM4). This change should occur within the 10-year planning period provided there is no fire occurrence in these areas. While this alternative does allow for management-ignited prescribed fire in wilderness, neither management-ignited prescribed fire nor wildland fire use for resource benefit in wilderness is really feasible due in urban interfaces, the highly volatile nature of pocosin fuels, and the size and location of the existing Wildernesses on the landscape.

This alternative does not project the construction of new recreation sites or trails. However, public use of existing facilities can be expected to increase with time. Existing roads and trails may be used as defensible firelines. Any increase in public use would increase potential wildfire risk. No new wildlife openings would be constructed, but existing openings would be maintained. These openings may provide potential anchor points for defensible fireline construction.

Landownership adjustments are expected to result in consolidations that would help reduce fire management program administrative problems and costs.

Overall wildfire risk on the CNF is expected to increase during the next 100 years as both public land use density on the forest and private development outside the forest increase. It may become increasingly difficult and expensive to burn as values at risk increase. Smoke management is expected to become increasingly important as populations increase, and developing air quality regulations may result in a decrease in the prescribed burning program.

Cumulative effects of this alternative are expected to reflect the increase in forest use and private development. While the level of prescribed burning in this alternative would help to maintain efforts that have already been made in the reduction of hazardous fuels, existing and future urban developments would continue to be threatened by the risk of landscape-scale wildfires in the pocosins.

Alternative B*:* By virtue of its low-impact management theme, this alternative provides the least amount of disturbance of all alternatives considered. Vegetation and timber management would occur over lengthened periods of time, therefore average stand age in this alternative would be older in stands classed as suitable for timber production than in other alternatives. It is expected that approximately 12,000 acres would be burned on about a 5-year rotation for wildlife habitat improvement, timber stand

improvement, natural regeneration site preparation, and fuel reduction. However, because this alternative minimizes the use of mechanical ground disturbance, the application of prescribed fire would be significantly restricted on most of the CNF, particularly in the pocosins.

The Wilderness allocation of all suitable roadless areas would increase the area where mechanical ground disturbance would be minimized, thus increasing the difficulty of the fire management program administration on the CNF. While both wildland fire use for resource benefit and management-ignited prescribed fire in Wilderness are considered in this alternative, these practices would probably not be applicable for the same reasons as in Alternative A. Management direction for minimal use of mechanized equipment would result in larger wildfire acreages and increased smoke emissions during wildfire activity.

Table 3.8. Fuel conditions as a result of changes in the prescribed fire management program.

Fuel Model	2	4	6	7	9	Not Modeled	Total
Acres/ % Total	8,200 (5%)	54,000 (34%)	14,500 (9%)	59,600 (37%)	16,100 (10%)	8,600 (5%)	161,000 (100%)

The increase in fuels represented by FM4 (high pocosin) can be attributed to the regrowth of high pocosin burned during the 1994 Fish Day Fire. Because all burn rotations except growing-season burns would be applied at 5-year intervals in this alternative, most pine types with fuel conditions currently represented by FM9 (hardwood-pine leaf litter) are expected to move more towards FM7 (southern rough) conditions. This change, combined with a smaller prescribed fire program than current, would result in increased potential risk of damaging wildfire.

While this alternative does not project the construction of new recreation sites or trails, public use of existing facilities can be expected to increase with time. Any increase in public use would increase potential wildfire risk. Existing roads and trails may be used as defensible firelines. Elimination of unauthorized vehicle access could reduce the risk of wildfire caused by equipment or carelessness. However, there may be an increase in arson-related fires as a form of revenge for such management activities. The same holds true for special uses that may be phased out over time. No new wildlife openings would be constructed, and existing openings would receive only low-level maintenance. Resulting fuel accumulations may limit opportunities to utilize openings for potential anchor points in fireline construction.

Priorities for land ownership adjustment would focus on protection of critical habitat, riparian ecosystems, historic or cultural resources, and Congressionally designated areas. It is unknown at this time if these adjustments would aid in reducing fire management program administrative problems and costs.

Overall wildfire risk on the CNF is expected to increase during the next 100 years as both public land use density on the forest and private development outside the forest increase. It may become increasingly difficult and more expensive to burn as values at risk increase. Smoke management is expected to become increasingly important as populations increase, and developing air quality regulations may result in an actual decrease in the prescribed burning program.

Cumulative Effects of wildfire risk would reflect increases in forest use and private development. Over time, the 5-year prescribed burning rotation proposed in this alternative is not expected to maintain current fuel conditions due to rapid accumulations of understory fuels in this climate. Existing and future urban developments would continue to be threatened by the risk of wildfire.

***Alternative C and E**:* Active restoration of natural communities, particularly longleaf pine, would be achieved with a combination of management activities, including an aggressive prescribed fire program. Growing season burning would be emphasized in longleaf pine restoration. This treatment combined with a 2- to 4 year burning rotation is expected to result in more complete consumption of both dead and live fuels and reduction of understory competition. Prescribed fire would also be used for fuel reduction, timber stand improvement in mixed pine stands on a 3- to 5 year rotation, and for site preparation for natural and artificial regeneration.

Existing wildland urban interfaces have been identified in these alternatives, and a range of possible management activities that would reduce potential wildfire risk have been developed. The desired condition is one where fuels have been manipulated to actually change the arrangement, size, and, in some cases, type of vegetation, thereby reducing available fuel loads in designated areas. This approach would ultimately reduce extreme fire behavior characteristics such as flame length and fireline intensity, thus reducing the potential risk of catastrophic wildfire.

As research continues to address organic soil ignition and smoke emission questions, it is possible that prescribed burning for fuel reduction may extend into pocosins. This alternative also considers the use of wildland fire use for resource benefit on the CNF provided fuel conditions have been changed to reduce extreme fire behavior characteristics and severe fire effects, and risk reduction in urban interfaces has been achieved.

Fuel treatments in this alternative are expected to result in changes in fuel conditions as mentioned above. Several assumptions have been made in developing the analysis. For example, it is assumed that with repeated treatments as prescribed in wildland urban interfaces, fuels currently represented by FM4 (high pocosin) would exhibit characteristics closer to FM7 (southern rough). With at least one fire application in pocosins during the 10-year period, FM4 conditions would more closely resemble FM6 (low pocosin). Those currently in FM6 would probably return to a FM6 condition if only burned once during the 10-year period. Fuel conditions currently represented by FM7 might move towards conditions better described by FM9 (pine-hardwood leaf litter). It is also assumed that conditions currently described by FM2 (grass) would probably remain FM2 as grasses and herbs are early successional. The same is expected to hold true for fuels currently represented by FM9.

Table 3.9. Predicted distribution of fuel conditions in Alternatives C and E

Fuel Model	2	4	6	7	9	Not Modeled	Total
Acres/% Total	9,400 (6%0	0 (0%)	62,700 (39%)	31,700 (20%)	48,700 (30%)	8,600 (5%)	161,000 (100%)

Therefore, treatments within the identified wildland urban interfaces are predicted to result in the changed distribution of fuel conditions (Table 3.10).

Table 3.10. Fuel model distribution in wildland urban interfaces in Alternative C and E.

Fuel Model	2	4	6	7	9	Not Modeled	0	Total
Acres WUI#1	0 (0%)	0 (0%)	0 (0%)	3,100 (70%)	1,300 (29%)	45 (1%)	0 (0%)	4,400
Acres WUI#2	0 (0%)	0 (0%)	0 (0%)	160 (8%)	1,900 (92%)	5 (<1%)	0 (0%)	2,065
Acres WUI#3	20 (<1%)	0 (0%)	0 (0%)	2,500 (54%)	1,600 (34%)	65 (1%)	465 (10%)	4,650
Acres Total	20 (<1%)	0 (0%)		5,760 (52%)	4,800 (43%)	115 (1%)	465 (4%)	11,115

This shows a significant shift towards less extreme fuel conditions in these urban interfaces.

The proposed increase in recreation opportunities in Alternative C is expected to result in increased user density. As mentioned in the other alternatives, any increase in public use may result in an increased potential risk of wildfire. Fuels would be reduced in the immediate vicinity of new recreation sites and expanded existing recreation sites. Existing roads and trails may provide access into remote areas and may be utilized as firelines or anchor points for firelines, as may any additional trails.

The maintenance of existing wildlife openings and use of existing roads and log landings for turkey habitat may also provide anchor points or potential firelines. Any activities such as road closures and phasing out of special uses should decrease user density, thereby possibly reducing wildfire risk.

Current research indicates that drainage, disturbance, and reduced moisture content of peat in pocosins increases the susceptibility of organic soils to ground fire (Hungerford and others, 1995). The restoration of natural hydrology to wetlands has the potential to reduce residual smoke in pocosins that have been artificially altered in the past.

Priorities for land ownership adjustment would focus on protection of critical habitat, riparian ecosystems, historic or cultural resources, and Congressionally designated areas. It is unknown at this time if these adjustments would aid in reducing fire management program administrative problems and costs.

The adjustment of Wilderness boundaries to reflect ownership changes might simplify fire management program administration in these areas. Consolidation of land ownership could make prescribed fire treatments more feasible in these areas by providing straighter boundaries and, thus, more defensible firelines.

The cumulative effects of intensive longleaf restoration efforts with emphasis on growing season burns and 2-4 year burning rotations, combined with fuel treatments in existing wildland urban interfaces are expected to dramatically decrease the risk of damaging wildfires. The possibility of a prescribed burning program in the pocosins would decrease the risk even further, particularly as fuel conditions change over time. Increases in forest use and urban development might offset the wildfire risk reduction somewhat. The overall long-term effects of activities proposed in these alternatives are expected to significantly decrease wildfire risk and result in a more effective fire management program than current.

***Alternative C Modified**:* This alternative designates another 2,980 acres to Pond Pine Wilderness, which would act as a linkage to the other Wildernesses. The effects of this Alternative on fuels and wildfire risk are expected to be similar to those of Alternative C.

***Alternative D**:* Natural regeneration using seedtree cuts would result in about 4000 acres of even-aged loblolly pines and about 2700 acres of even-aged longleaf pines. These young, even-aged stands would be at high risk from damaging wildfire for a few years, but risk would decrease as stands mature. Thinning in young plantations is expected to reduce the risk of damaging wildfire by breaking up the ladder effect that numerous, closely space trees have on fire spread. These open understory conditions would be maintained with repeated prescribed fire treatments. Timber stand improvement activities such as drum chopping or herbicide application would also affect the arrangement of fuels. In some cases, herbicide treatments could actually increase fuel loads by killing live fuels, making them more readily available to burn. Without treatments, stands might decline in health and vigor, setting the stage for potential increased wildfire risk in these areas. In general, however, any activity -- including prescribed fire -- that improves overall forest health would result in decreased wildfire risk.

The overall prescribed fire program, including treatments of the currently identified wildland urban interfaces, would be very similar to Alternatives C and E. Fuel conditions are expected to have the same distribution in this alternative as in Alternatives C and E. However, the emphasis on growing season burning on a 3- to 5-year rotation in longleaf pines would be slower to produce the open, grassy understory conditions typical of longleaf pine savannas. It is possible that additional wildland/urban interfaces would be identified and treated as development outside the CNF continues.

As in Alternatives C and E, recreation development would result in an increase in forest user density, thus increasing the potential risk of wildfire caused by mechanized equipment or carelessness. Existing trails and roads might be utilized for access into remote areas or firelines, as may any additional ones. Existing and new wildlife openings might also be used during fire suppression.

Most roads would be kept open to the public, and the numbers and types of special uses would increase. While this increase might result in increased potential for human-caused wildfire, arson-related activity as a form of revenge should not increase.

Land ownership adjustment priorities would include minimizing wildland urban interface with National Forest ownership, making the overall administration of the CNF's fire management program less difficult than at present. Costs associated with fire management might also decrease.
As in all alternatives, overall wildfire risk on the CNF is expected to increase during the next 100 years as both public land use density on the forest and private development outside the forest increase. It may become increasingly difficult and expensive to burn as values at risk increase. Smoke management is expected to become increasingly important as populations increase, and developing air quality regulations may result in a decrease in the prescribed burning program.

The cumulative effects of this alternative emphasizes an aggressive fuel treatment program, including possible prescribed fire applications in pocosins. Unlike other alternatives, there is leeway to prescribe additional fuel treatments as future urban development progresses. Longleaf pine restoration would be less aggressive than in Alternative C, and the savanna conditions typical of longleaf stands of the past

are expected to take longer to achieve. Over time, the cumulative effect of these activities are expected to produce fuel conditions similar to Alternatives C and E.

3.2: Biological Environment

3.2.1. PLANT COMMUNITY

Affected Environment

The CNF is located on the Coastal Plain of North Carolina. Because of its unique landform and vegetation, it is recognized as part of the Atlantic Coastal Flatwoods Section, an ecological unit that extends from northern Virginia to northern Florida. The Atlantic Coastal Flatwoods Section is divided into 11 Subsections; the CNF is in the largest of these, called the Lower Terraces Subsection. The Lower Terraces Subsection covers nearly 13,000 square miles and extends from southern Virginia to northern Florida. This Subsection is a predominately flat, weakly-dissected alluvial plain consisting of marine sediments; many soils have poor drainage. It is less influenced by ocean tides than most other Subsections in the Atlantic Coastal Flatwoods Section.

In the Croatan area, climate is characterized by hot summers and cool winters with adequate moisture throughout the year (Trewartha 1954). Precipitation is high in July, August, and September, when over one third of the annual average 55 inches fall. The mean length of the freeze-free period is greater than 240 days (Nelson and Zillgit 1969); winter temperatures are moderated by the nearby Gulf Stream. The vegetation is typically needle-leaved evergreen and evergreen broad-leaved forest and shrubland. On the CNF, pines and evergreen shrubs clearly dominate the landscape. Hardwood forests account for only 20 percent of the land in the CNF, and these plant communities are confined chiefly to drainage courses in swamps and steeper sideslopes.

Wildfire and hurricanes are the two primary large-scale disturbances. Historically, lightning was a cause of extensive natural fires (Komarek 1974). In the southeastern Coastal Plain, fires occur primarily during frequent periods of low rainfall in the fall and spring. Hurricanes are responsible for extensive areas of windthrown trees. Such storms passed through the CNF approximately 20 times between 1901 and 1955 (Bradley 1972). On average in 100 years, 45 hurricanes are expected to deliver at least category I force winds and six of these hurricanes are expected to bring at least category III force (Hooper and McAdie 1995). The most recent hurricanes, Bertha and Fran in 1996, left many trees growing with their trunks at an angle greater than 20 degrees from perpendicular or completely blown down.

Centuries of human settlement and land use have altered most of the land and natural plant communities in North Carolina's Coastal Plain. However, the CNF still maintains a large portion of its ownership in forests and shrubland that have a composition and structure comparable to pre-settlement conditions. As a result, The Nature Conservancy (1997) has identified 61 forest, woodland, shrub, and herb-dominated plant associations on the CNF.

Plant Associations found on the CNF are listed in Table 3.11, along with their ranking of global and local abundance. The Plant associations are grouped by Landtype, an ecological category of land having similar drainage, topography, fire regime, and potential natural vegetation communities. In Table 3.11, landtypes are arranged from most to least abundant on the CNF. Following Table 3.11 is a description

of these ecological and vegetative categories and the common and rare species they contain. A full description of Plant Associations and Landtypes appears in Appendix A of the CNF Plan.

Table 3.11. Local and global abundance of plant associations on the CNF.

LANDTYPE & Plant Association	Local Abundance	Global Abundance
RAISED PEATLANDS		
Atlantic White Cedar/Swamp Bay/Fetterbush-Sweet Gallberry Forest	Rare	G2
Atlantic White Cedar-Pond Pine Forest	Rare	G2?
Loblolly Bay Woodland	Common	G?
Pond Pine/Titi-Fetterbush-Inkberry Woodland	Common	G3
Pond Pine-Loblolly Bay/Fetterbush Woodland	Common	G3
Pond Pine/Titi-Fetterbush-Black Highbush Blueberry Woodland	Common	G?
Titi-Fetterbush Shrubland	Common	G3?
Honeycups-Leatherleaf Shrubland	Common	G2?
Titi-Honeycups Shrubland	Common	G2G3
Inkberry-Fetterbush-Honeycups	Common	G2
Leatherleaf-Pocosin Sedge-Virginia Chain Fern Shrub Herbaceous Vegetation	Uncommon	G1G2
PEAT-MANTLED FORESTED WETLANDS		
Pond Pine/Titi-Fetterbush-Inkberry Woodland	Common	G3
Pond Pine-Loblolly Bay/Fetterbush Woodland	Common	G3
Pond Pine/Titi-Fetterbush-Black Highbush Blueberry Woodland	Common	G?
XERIC to WET LONGLEAF PINE SAVANNAS AND FLATWOODS		
Longleaf Pine-Pine(Shortleaf,Loblolly)-Oak(Bluejack,Sand Post,Southern Red,Turkey)	Common	G3?
Longleaf Pine Upland Woodland	Common	G3?
Longleaf Pine/Dwarf Indigo Bush/Wiregrass-Yellow Indian Grass Woodland	Common	G2G3
DRAINAGE HEADLANDS & BROAD INTERSTREAM FLATS		
Loblolly Pine-Water Oak/Shrubs/Mixed Herbs Upland Forest	Common	G?
Loblolly Pine-Oak (Willow, Water, Diamondleaf) Temporarily Flooded Forest	Common	G?
Loblolly Pine-Sweetgum-Red Maple Saturated Forest	Common	G?
LAKE AND STREAM SWAMPS		
Water Tupelo Forest	Uncommon	G?
Sweetgum/Swampbay Forest	Rare	G1
Swamp Tupelo/Virginia Willow - Button Bush Depression Forest	Uncommon	G?
Black Willow Flooded Forest	Rare	G?
Black Willow/Coastal Sweet Pepperbush/Water Tupelo Successional Forest	Uncommon	G?
Pond Cypress/Myrtle Dahoon Depression Forest	Uncommon	G?
Pond Cypress(Sw.Tupelo)/Swamp Doghobble-Buttonbush-Waxmyrtle Depression Forest	Uncommon	G?
Water Tupelo-Swamp Tupelo Forest	Common	G?
Bald Cypress-Water Tupelo/Carolina Ash Forest	Uncommon	G?
Bald Cypress-Water Tupelo-Swamp Tupelo/Carolina Ash/Virgina Willow Forest	Uncommon	G?
Narrowleaf Pondlily Herbaceous Vegetation	Rare	G3?
Broadleaf Pondlily-Big Floatingheart-Loose Watermilfoil Herbaceous Vegetation	Rare	G3?
STREAM AND RIVER TERRACES & DRAINAGE SLOPES		
American Beech-White Oak-Maple (Southern Sugar, Chalk)/Mixed Herbs Forest	Uncommon	G?
Sweetgum Forest	Common	G?
White Oak-Mockernut Hickory/Mayberry Forest	Uncommon	G?
White Oak-Pignut Hickory-Mockernut Hickory/Red Buckeye Forest	Uncommon	G?
Sweetgum (Tuliptree, Red Maple) Temporarily Flooded Forest	Common	G?
Black Willow Temporarily Flooded Forest	Uncommon	G?
Laurel Oak/Ironwood Forest	Uncommon	G?
Overcup Oak-Water Hickory Seasonally Flooded Forest	Uncommon	G?
Overcup Oak-Water Hickory/Pepper-vine Forest	Uncommon	G?
Sand Laurel Oak-Pignut Hickory (American Beech) Forest	Uncommon	G?

TIDAL STREAMS AND ESTUARIES		
Seaside Oxeye/Saltmeadow Cordgrass Shrubland	Rare	G3G5
Needlerush Herbaceous Vegetation	Rare	G5
Saltmarsh Cordgrass Carolinian Zone Herbaceous Vegetation	Rare	G?
Wild Rice Tidal Herbaceous Vegetation	Rare	G?
MARITIME RIDGES AND DUNES		
Live Oak - (Youpon) Shrubland	Rare	G?
Mulletbush-Bigleaf Marsh Elder-Wax Myrtle-Yaupon Shrubland	Rare	G?
Bigleaf Marsh Elder Shrubland	Rare	G?
LIMESINK PONDS		
Wright's Witchgrass - Erect-leaved Witch Grass Herbaceous Vegetation	Rare	G2?
Maidencane - Spikerush - Narrow-fruit Horned Beakrush Herbaceous Vegetation	Rare	G2?
Threadleaf Beakrush - Bullrush Herbaceous Vegetation	Rare	G2?

[1] *Rare = < 50 acres, Uncommon 50-1000 acres, Common = 1000-10,000 acres, Abundant = > 10,000 acres*
? - denotes incomplete information about community status

Prior and Present Conditions

The potential distribution of natural plant communities on the CNF can be fairly well predicted within ecological units. The ecological units or Landtypes account for important site and disturbance factors affecting vegetation composition and structure. It is convenient to use the Landtype level of the ecological classification to account for these factors and to describe environmental conditions on the CNF. Current vegetation composition is reflected in the different Forest Types found within and between sites (Landtypes). However, Forest Types have not been classified in all areas and, in the discussion below, these acres are identified as "Not classified". Vegetation structure is reflected in seral stages in the following categories: early successional (0-10 years in age), mid successional (11-50 years in age), late successional (50+ years in age), and old growth (longleaf pine > 110 years in age, pond pine > 70 years in age, hardwoods > 100 years in age).

Raised Peatlands: These communities are commonly known as pocosins and occur on very poorly drained peat soils and on mineral soils with a mucky surface. They are the most common and most extensive vegetation type on the CNF. There are 11 vegetation associations representing shrub and herb-dominated pocosin communities on the CNF. They are roughly equivalent to pond pine forest types (CISC) and occur in landtype phases 801, 802, and 803. The following Plant Associations can be found in the CNF:

Atlantic White Cedar/Swamp Bay/Fetterbush-Sweet Gallberry Forest *(Chamaecyparis thyoides/Persea palustris/lyonia lucida-Ilex coriacea*)
Atlantic White Cedar-Pond Pine Forest *(Chamaecyparis thyoides-Pinus serotina*)
Loblolly Bay Woodland (*Gordonia lasianthus)*
Pond Pine/ Titi-Fetterbush-Inkberry Woodland *(Pinus serotina/Cyrilla racemosa-Lyonia lucida-Ilex glabra)*
Pond Pine-Loblolly Bay/Fetterbush Woodland *Pinus serotina-Gordonia lasianthus/Lyonia lucida*)
Pond Pine/Titi- Fetterbush-Black Highbush Bludberry Woodland (*Pinus serotina/Cyrilla racemosa-Lyonia lucida-Vaccinium fuscatum*)
Titi-Fetterbush Shrubland (*Cyrilla racemosa-Lyonia lucida*)
Honeycups-Leatherleaf Shrubland (*Zenobia pulverulenta-Chamaedaphne calyculata*)
Titi-Honeycups Shrubland (*Cyrilla racemosa-Zonobia pulverulenta*)
Inkberry-Fetterbush Honeycups Shrubland (*Ilex glabra-Lyonia lucida-Zenobia pulverulenta*)
Leatherleaf-Pocosin Sedge-Virginia Chain Fern Shrub Herbaceous Vegetation (*Chamaedaphne calyculata-Carex striata var. striata-Woodwardia virginica*)

Table 3.12. Forests in Raised Peatlands grouped into the following successional classes, shown in acres.

	Seral Stage				
	Early	Mid	Late	Old Growth	Total
Pond Pine Forest Type Condition	25,241	8,101	32,21	0	67,670
Other Pine Forest Type Condition	441	810	747	24	2,023
Hardwood Forest Type Condition	695	495	3,200	0	4.390
Not Classified (no Forest Type) = 1,146 acres					

Pocosin community composition and distribution are controlled by site fertility, which is related to depth of peat and location within the landscape. Fire is a secondary control that triggers plant succession and affects vegetation stature and nutrient cycling.

The least fertile sites occur in the center of the larger raised peatlands. In these areas, precipitation is the chief source of plant nutrients (Richardson 1981). Mixed evergreen-deciduous low pocosins and deciduous low pocosins occur in these areas. Titi, honeycups, little gallberry, and shining fetterbush are the dominant shrubs, and their height is maintained by extremely poor nutrient status and by occasional fire. Scattered pond pine, less than 5 meters tall, occurs but seldom exceeds 10 percent cover. Honeycups and leatherleaf shrubland dominate large peat-filled Carolina bays on slightly less infertile sites. Pond pine also forms a scattered, but less stunted, layer in these areas. Other characteristic species includes white wicky, Carolina sheeplaurel, red chokeberry, yellow pitcher plant, and Virginia chainfern.

Pocosins on shallower peats are dominated by similar species, but most plants are taller than in low pocosins. Pond pine and loblolly bay dominate the overstory and shining fetterbush forms a dense understory over very large areas on peat domes and peat-filled Carolina bays. This vegetation forms unbroken blocks thousands of acres in size. Mixed within this matrix are shrublands dominated by titi, shining fetterbush, and swampbay without trees. Peat-mantled mineral soils support pocosins dominated by pond pine, titi, shining fetterbush, and black highbush blueberry. These pocosins occur in small depressions in sandy upland landscapes and differ in floristic composition, use by wildlife, and community dynamics (such as fire) from the more expansive low and high pocosins occurring in other landscapes. They often occur in a matrix with longleaf pine sand ridges. In all these situations, peat burn openings may be dominated by Southern peatland sedge and tawny cottongrass communities; these tend to fill back in with shrubs within a decade or so of fire exclusion.

Rare peatland communities include switch cane shrublands and Atlantic White-cedar forests. Switch cane shrublands were formerly very widespread and abundant but are now uncommon due to fire suppression. The best remaining examples are in bomb impact areas at Fort Bragg. These peat wetlands are dominated by giant cane and switch cane without an overstory, or with widely scattered trees such as pond pine or swamp tupelo. Atlantic White-cedar occurs on nearly 100 acres of permanently saturated organic soils on the CNF. The canopy is dominated by white cedar with a moderate subcanopy of swamp blackgum, red maple, and swampbay. The shrub layer and herb layers have only moderate cover. These forests establish following crown replacement fires that partially consume the organic soil.

Historically, vegetation in these communities burned at regular 2 to 4 year intervals similar to the adjacent uplands (Frost 1996). Dr. Lewis Anderson of Duke University explored the Open Ground Pocosin in the 1930s, and they still burned every 2-3 years at that time. Overlapping fires were common and could occur in successive years since the blackened but unburned woody stems form part of the fuel

for the next burn. Although the water table is high and the soils are frequently saturated, pocosins occasionally become dry enough to burn. Most of the pocosins were kept to low or medium stature by frequent fire. Some of the low pocosins burned often enough to maintain them in a more open nearly treeless, bog-like condition.

Ditching, drainage, and conversion to pine plantations has occurred in some portions of the CNF within these communities, but significantly less than outside the Forest. In general, the stature of trees and shrubs has increased following years of fire suppression. Increases have occurred in the acreage of forests dominated by swamp red bay, loblolly bay, and sweet bay. On the less deep peats, high pocosins may form nearly closed canopies and resemble woodlands or forests. Blaspheme vine, loblolly bay, and titi have grown to dense and impenetrable thickets in most high pocosins on the CNF. Only the most nutrient limiting sites still retain the dwarfed pond pine and low shrub structure typical of low pocosins.

Peat-mantled Forested Wetlands: These communities occur on broad, peat-mantled uplands on poorly drained mineral soils and are dominated by pond pine. Three vegetation associations are found on the CNF. These vegetation types are equivalent to pond pine and loblolly pine forest types (CISC) and occur in landtype phases 715 and 716. The following Plant Associations are attributed to the CNF:

Pond Pine/Titi-Fetterbush- Inkberry Woodland (*Pinus serotina/Cyrilla recmosa-Lyonia lucida-Ilex glabra*)
Pond Pine-Loblolly Bay/Fetterbush Woodland (*Pinus serotina-Gordonia lasianthus/Lyonia lucida*)
Pond Pine/Titi- Fetterbush-Black Highbush Bludberry Woodland (*Pinus serotina/Cyrilla racemosa-Lyonia lucida-Vaccium fuscatum*)

Table 3.13. Forests in Peat-mantled Forested Wetlands grouped into the following successional classes, shown in acres.

	Seral Stage				
	Early	Mid	Late	Old Growth	Total
Pond Pine Forest Type Condition	1,400	1,182	5,388	9,793	17,766
Loblolly and Longleaf Forest Type Condition	815	241	4,500	75	7,730
Hardwood Forest Type Condition	335	124	5,076	0	5,535

Not classified (no Forest Type) = 811 acres

These evergreen forests and woodlands form a transition between pond pine dominated pocosins on shallower peats and mixed pine forests and woodlands. Tree stature is also intermediate between the dwarf forms found in the pocosin and tall, straight forms found in mixed pine stands. Loblolly bay may co-dominate with pond pine and form a nearly complete canopy. More often, pond pine dominates the canopy with only scattered loblolly bay. Other canopy species include sweetbay, swamp red bay, and red maple. A dense shrub layer forms the midcanopy and it is dominated by sweetbay, swamp red bay, and loblolly bay. The lower midcanopy includes titi, shining fetterbush, myrtle dahoon, Coastal sweet-pepperbush, evergreen bayberry, black chokeberry, and Northern wild raisin. Herbs generally are uncommon.

Originally, pond pine may have been the most abundant pine on the CNF, and there were probably a dozen different pond pine-dominated communities (Frost 1996). Stands of large trees with open to partially closed canopies would have been supported. W.W. Ashe (1894) described pond pine savannas in the Croatan region as very open, sunny stands. The canopy was nearly pure pond pine and the density varied from almost treeless to nearly closed. The understory was free of hardwoods and shrubs and there was a well-developed grassy layer with a large number of species. Where frequent fires occurred over a long time period, the pond pine woodland was dominated by giant cane, with few shrubs (Schafale and Weakley 1990). Frequently burned pond pine forests at Ft. Bragg, North Carolina, just

100 air miles from the CNF, have a pure pond pine canopy and an understory dominated by giant cane and cinnamon fern. These stands are burned an average of every 2 years.

Vegetation in these communities is adapted to intense fire. Nearly all the shrubs and broadleaf trees are readily ignited and burn intensely. These species sprout from their roots after stem damage. Pond pine also sprouts readily after a fire and its seeds are held in serotinous cones that do not fully open until sufficient heat has accumulated. As a result, burned over areas are quickly revegetated. Under pre-settlement fire regimes, pond pine forests and woodlands burned nearly as frequently as the adjacent and often intergrading longleaf pine woodlands. As with other plant communities on the CNF, periodic and widespread hurricanes may cause extensive blowdown or other damage to trees. The recent Class II hurricanes, Bertha and Fran, affected thousands of acres on the CNF. Damage varied from entire stands blown down to only occasional "root sprung" trees. The heavier fuel loadings from downed trees would increase the probability of stand replacement fires in these communities until the smaller fuels decay. Although decay may take only a few years in the humid Coastal Plain environment, these conditions would be duplicated periodically by future hurricanes.

The larger pond pine in these communities was extensively logged at the turn of the century. On upland flats where pond pine grew tall and straight, lumbermen seldom distinguished it from loblolly (Ashe 1894). Ashe noted, "there are possibly 300 million board feet of the savanna pine (pond pine)...". Craven and Jones were mentioned as two of the six counties having the most pond pine in North Carolina (Pinchot & Ashe 1897). The best and most extensive remaining examples of tall forms of pond pine communities in the North Carolina Coastal Plain occur on the CNF. Fire suppression has led to dense understory growth and nearly impenetrable stands over extensive areas.

Xeric to Wet Pine Savannas and Flatwoods: These plant communities occur in excessively drained to poorly drained sandy and loamy flatwoods and savannas and are dominated by longleaf pine and loblolly pine. Three plant associations currently or formerly supporting longleaf pine are found on the CNF. These vegetation types are equivalent to longleaf pine and loblolly pine forest types (CISC) and occur in landtype phases 920, 921, 1022, 1023, 1124, and 1225. The following Plant Associations are attributed to the CNF:

Longleaf Pine-Pine (Shortleaf,Loblolly-Oak (Bluejack,Sand Post,Southern Red,Turkey) (*Pinus palustris-Pinus echinata, taeda-Quercus incana, margarettiae, falcata, laevis*)
Longleaf Pine Upland Woodland (*Pinus palustris*)
Longleaf Pine/Dwarf Indigo Bush/Wiregrass-Yellow Indian Grass (*Sorghastrum nutans*) Woodland (*Pinus palustris/Amorpha herbacea var. herbacea/Aristida stricta-Sorghastrum nutans)*

Table 3.14. Forests in Xeric to Wet Pine Savannas and Flatwoods grouped into the following successional classes, shown in acres.

	Seral Stage				
	Early	Mid	Late	Old Growth	Total
Longleaf Pine Forest Type Condition	1,033	2,434	5,743	263	9,475
Loblolly and Pond Pine Forest Type Condition	1,431	4,604	6,584	0	12,619
Hardwood Forest Type Condition	68	38	3,967	0	4,073
Not Classified (no Forest Type) = 804 acres					

Vegetation composition varies along a moisture and fire-effects continuum. Xeric sites are dominated by longleaf pine with a scattered turkey oak low midcanopy, and a wiregrass herb layer shared with wireplant, Carolina sandwort, sand spikemoss, common prickly pear and goats-rue. Wet and mesic sites

are dominated by longleaf pine or loblolly pine or by a mixture of these two species and the herb layer is diverse. The herb layer includes dwarf huckleberry, thread-softly, big bluestem, little bluestem, sweet goldenrod, stiffleaf aster, and summer farewell on the dry mesic sites and bracken fern, skeleton grass, switch cane, green sicklescale, pitchfork crown grass, yellow Indian grass, roundhead bushclover, summer farewell, flowering spurge, and sweet goldenrod on wetter sites. On mesic sites where fire has been excluded for more than 3 years, woody shrubs and midstory trees have rapidly invaded, and the stand is often impenetrable within a decade. Dense midstory trees include southern red oak, black oak, post oak, blackjack oak, turkey oak, sand hickory, mockernut hickory, and sweetgum.

Savannas and flatwoods on the CNF are generally open forests with a fire-maintained bilayered structure. The understory is herbaceous in savannas and the canopy is more open. The understory is more shrubby in flatwoods and the canopy may be nearly closed. Pure longleaf pine forests and mixed longleaf and loblolly or mixed longleaf, loblolly and pond pine occur in these conditions on the CNF. Virgin longleaf pine forests were described as "vast forests of the most stately pine trees that can be imagined... expansive, airy pine forests...of the great long-leaved pine...the earth covered with grass, interspersed with an infinite variety of herbaceous plants, and embellished with extensive savannas, always green" (Bartram 1791). On the CNF, and throughout the Southeast, these conditions still exist but only in a few isolated stands.

The longleaf pine forests have changed significantly since the beginning of European settlement. Presettlement longleaf pine forests occupied up to 90 million acres in the Southern United States (Wallenberg 1946). In 1986 less than 4 million acres remained, and the best estimate today is less than 3 million acres. On the CNF, longleaf pine now occupies less than 30 percent of its original range (Frost 1996).

Large-scale commercial logging began in the South in the 1880s and followed naval store operations that had eliminated or weakened longleaf pine forests and woodlands. The slash left behind fueled large forest fires, which triggered an extensive and successful fire suppression campaign. Fire control further reduced longleaf pine because hardwoods were quick to invade these sites. Instead of the two-layered structure typical of natural longleaf communities, there are now heavy shrub and midstory layers of loblolly pine, scrub oaks and southern red oak. The resulting shade and deep pine needle litter has completely eliminated wiregrass and the original diverse herb layer on many sites.

The disappearance of longleaf pine, however, began well before the 1800s. Historical records suggest three causal agents: 1) the inherently low rate of restocking under natural conditions, 2) the fondness of feral livestock, especially hogs, for the seedlings, and 3) 20th century fire suppression.
In the 1600s, English settlement in the coastal region of the Southeast included land clearing and establishment of large hog and livestock herds that fed on longleaf pine seedlings in the open range. Hogs have been observed to consume up to 400 longleaf pine seedlings, each, in a day (Hopkins 1947a, 1947b). By the 1700s, hogs were so plentiful that they were often left out of landowners property appraisals. It was not until after the Civil War, in the late 1800s, that laws required fencing of livestock pastures. But by then, the damage to longleaf pine regeneration had been done by tens of thousands of hogs that exceeded the carrying capacity of the land. Longleaf communities on the most fertile soils were converted to farmland and pasture during this same period.

Tar, pitch, rosin and turpentine were collectively called naval stores (Ashe 1894, Mohr 1896) and were produced in the Southeast almost exclusively from longleaf pine. These were essential commodities until the development of petroleum-derived substances in the mid 1800's. Wagons could not move without tar to grease the axles, and ships could not sail without tar and pitch for waterproofing cordage and sails, for caulking leaks, and for coating hulls to prevent destruction by shipworms (Wertenbaker 1931). Naval stores operations began in Virginia in the 1600s, but by 1840 no further naval stores production was listed (U.S. Census Office 1841). In 1893, forester B.E. Fernow concluded that, "In Virginia the long-leaf pine is, for all practical purposes, extinct". Recent surveys have confirmed that longleaf pine has been completely eliminated from 11 of the 15 counties where it originally occurred in Virginia.

Introduction of the copper still in 1834 greatly expanded naval stores operations and by 1850 North Carolina became the world's leading supplier (U.S. Census of Manufactures). By 1900, the industry had passed on to the South, leaving vacant land or scarred longleaf pine survivors. It took approximately 33 large-diameter longleaf pine trees to produce a 50-gallon barrel of distilled turpentine, and thousands of barrels of turpentine per year were produced in North Carolina.

The logging boom of the late 19th century left cutover lands and dense, scrubby second growth. Fire exclusion over much of the region was the final and probably most important factor that transformed the sunny, open, fire-maintained longleaf pine woodlands to dense closed forests. On all but the drier land, longleaf reproduction was eliminated by loblolly pine reproduction and hardwood and shrub invasion within a few years after fire exclusion (Sherrard 1903). Forest succession on abandoned cropland between 1940 and 1965 and revegetation of dry-mesic sites once used as naval stores, offset some of these losses of longleaf pine. Active fire suppression did not occur in most of the South until 1910 to 1930. Many longleaf pine stands regenerated between the end of open range and the beginning of 20th century fire suppression. Most naturally regenerated stands that still remain date to this period.

Drainage Headlands and Interstream Flats, Broad Interstream Flats: Communities in this group occur in dissected drainage headlands and undissected interstream flats. Headlands are dominated by mixed pines and hardwoods while loblolly pine and pond pine dominate the wet, undissected uplands. Three plant associations characterized as mixed pine-hardwood occur on the CNF. These vegetation types are roughly equivalent to loblolly pine and bottomland hardwood-yellow pine forest types (CISC) and occur in landtype phases 510, 511, 512, 613, and 614. The following Plant Associations are attributed to the CNF:

Loblolly Pine-Water Oak/Shrubs/Mixed Herbs Upland Forest (*Pinus taeda-Quercus nigra)*
Loblolly Pine-Oak (Willow, Water, Diamondlea) Temporarily Flooded Forest *(Pinus taeda-Quercus phellow, nigra, laurifolia*)
Loblolly Pine-Sweetgum-Red Maple Saturated Forest (*Pinus taeda-Liquidambar styraciflua-Acer rubrum*)

Table 3.15. Forests in Drainage Headlands and Interstream Flats grouped into the following successional classes, shown in acres.

	----------Seral Stage----------				
	Early	Mid	Late	Old Growth	Total
Loblolly and Pond Pine Forest Type Condition	500	1,637	4,537	0	6,675
Hardwood Forest Type Condition	0	55	2,310	0	2,365
Longleaf Pine Forest Type Condition	19	60	1,030	0	1,109

Not Classified (no Forest Type) = 263 acres

The mixed pine forests and woodlands vary in composition along a subtle moisture gradient. Hardwoods are more often equally mixed with pines on moderately well drained to somewhat poorly drained sites. These mesic to dry-mesic loblolly-oak-hickory forests are often dominated by mixtures of loblolly pine, shortleaf pine, white oak, southern red oak, post oak, and occasionally longleaf pine. Associates include sourwood and dogwood. Successional forests on the most mesic sites are dominated by loblolly pine, sweetgum, and tulip poplar. On poorly drained sites, pines are more often dominant. These sites support pond pine, loblolly pine, and longleaf pine mixed woodland stands with giant cane, toothache grass, inkberry, sweetgum, and water oak in the understory. Loblolly pine plantations with very sparse understories occur on many of these sites.

Very little is known about pre-settlement conditions in mixed pine woodlands and forests. We do know that many were two-layered communities with trees over grass (Frost 1996). Where fire was irregular enough to permit establishment of hardwoods, compositions were often mixed pine and hardwood and not two-layered. Ashe (1915) described the following various mixtures of loblolly, longleaf, pond pine, and shortleaf pine in the original mixed pine forest and woodlands in the Croatan region: " Only in a few localities are all four pines found growing together. Near the coast the loblolly, pocosin (pond pine), and longleaf pine are sometimes associated on sandy hummocks; the wettest places, however, are as a rule occupied by the pocosin pine; the pocosin and the loblolly pine are associated on savannas and slightly drier knolls; on better drained soils the longleaf replaces the pocosin pine in the mixture and on thoroughly drained soils only the longleaf pine is found."

Plant communities in this group occur along the broad middle section of the fire frequency/fire effects continuum and range from mixed pine savanna to somewhat fire-protected woodlands. Fire was the most common disturbance and its frequency was variable, probably ranging from every 5 to 12 years. Periodic and widespread hurricanes may cause extensive blowdown or other damage to trees. The recent Class II hurricanes, Bertha and Fran, affected thousands of acres on the CNF. Most damage occurred in poorly drained Landtypes such as Drainage Headlands and Broad Interstream Flats. Damage varied from entire stands blown down to only occasional "root sprung" trees. The heavier fuel loadings from downed trees would increase the probability of stand replacement fires in these communities until the smaller fuels decay. Although decay may take only a few years in the humid Coastal Plain environment, these conditions would be periodically duplicated by future hurricanes. Even more recently, a southern pine beetle outbreak damaged many of the overcrowded loblolly plantations in this zone.

Most mixed pine stands have changed significantly since European settlement, experiencing similar disturbances and effects to those that occurred in longleaf pine stands. The original range of mixed pine forests has also been significantly reduced. Most of the better soils (finer textured sands and loams) were converted to farmland 100 to 200 years ago. Areas too wet to farm were logged, and succeeded to loblolly pine. Only small remnants of mixed pine savanna persist today. They are hard to distinguish from fire-suppressed former longleaf pine communities that have been logged and invaded by other pine species. Most are now dominated by loblolly pine and pond pine with a dense tall shrub and hardwood layer in the understory.

Lake and Stream Swamps: These swamplands include cypress and hardwood forests associated with small streams, lake margins, and upland depressions. Most swamps on the CNF are relatively narrow and long. They occur on both deep mucks and mineral soils and are seasonally to semi permanently

flooded. Ten vegetation associations representing tree-dominated swamp communities and two representing herb-dominated swamp communities are found on the CNF. These vegetation types are roughly equivalent to sweetgum-Nuttall oak-willow, sweetbay-swamp tupelo-red maple, and bottomland hardwoods-yellow pine forest types (CISC) and occur in landtype phases 204 and 205. The following Plant Associations are attributed to the CNF:

Water Tupelo Forest (*Nyssa aquatica*)
Sweetgum/Swampbay Forest *(Liquidambar styraciflua/Persea palustris*)
Swamp Tupelo/Virginia Willow-Button Bush Depression Forest (*Nyssa biflora/Itea virginica-Cephalanthus occidentalis*)
Black Willow Flooded Forest (*Salix nigra*)
Black Willow/Coastal Sweet Pepperbush/Water Tupelo Successional Forest (*Salix nigra/Clethra alnifolia/Nyssa aquatica*)
Pond Cypress / Myrtle Dahoon Depression Forest (*Taxodium ascendens/Ilex myritifolia*)
Pond Cypress (Swamp Tupelo)/Swamp Doghobble-Buttonbush-Waxmyrtle Depression Forest (*Taxodium ascendens (Nyssa biflora)/Leucothoe racemosa-Cephalanthus occidentalis-Myrica cerifera*
Water Tupelo-Swamp Tupelo Forest (*Nyssa aquatica-Nyssa biflora*)
Bald Cypress-Water Tupelo/Carolina Ash Forest (*Taxodium distichum-Nyssa aquatica/Fraxinus caroliniana*)
Bald Cypress-Water Tupelo/ Carolina Ash/Virginia Willow Forest (*Taxodium distichum-Nyssa aquatica/Fraxinus caroloiniana/Itea virginica*)
Narrowleaf Pondlily Herbaceous Vegetation (*Nuphar lutea ssp. sagittifolia*)
Broadleaf Pondlily-Big Floatingheart-Loose Watermilfoil Herbaceous Vegetation *(Nuphar aquatica-Nuphar lutea ssp.advena-Myriophyllum laxum*)

Table 3.16. Forests within Lake and Stream Swamps grouped into the following successional classes, shown in acres.

	----------Seral Stage----------				
	Early	Mid	Late	Old Growth	Total
Hardwood Forest Type Condition	206	60	5,863	0	6,129
Pine Forest Type Condition	204	184	1,228	0	1,617
Not Classified (no Forest Type) = 124 acres					

Flooding depth and duration control the distribution and composition of swamp communities. Swamps that are seasonally flooded for brief periods are transitional to uplands and are dominated by mixtures of oak (overcup, nuttall) and water hickory. Peppervine, sweetgum, red maple, planer-tree, storax, shoreline sedge, swamp smartweed, and sensitive fern are associated in these areas. Swamps that are semi permanently flooded are more common on the CNF and include associations belonging to the Water Tupelo - (bald-cypress) Semi permanently Flooded Forest Alliance. On permanently saturated soils on low wet flats and sloughs, swales and backswamps, water tupelo may dominate the forest canopy without bald-cypress. Water tupelo occurs on the borders of shallow alluvial swamps and flats near uplands. Associates include green ash, black willow, titi, swamp doghobble, poison oak, and peppervine. Swamp blackgum communities are also found as the dominant canopy member in peaty or mucky, wet depressions. Other bottomland species may occur in these communities, but they make up less than one third of the canopy. Shrubs are scarce, and floating logs and stumps provide habitat for a sparse herbaceous stratum. Forests with a dense canopy of straight, tall bald-cypress and water tupelo are found in oxbow lakes and ponds, along the banks of rivers and lakes, on low wet flats and sloughs, swales and backswamps. Forests dominated by black willow occur in some areas where Bald-cypress and water tupelo have been clearcut. Swamp tupelo, water ash, and Virginia willow are associated with bald-cypress and water tupelo in swamps along many small blackwater streams.

Less extensive swamp types include depressions dominated by pond-cypress, tidally flooded areas dominated by swamp blackgum and bald cypress, and lake shores dominated by sweetgum. Pond-cypress occurs in depressions or backswamps and have a closed to open tree canopy, little understory with shrubs and herbs established on fallen logs, tree bases or areas where the substrate is elevated.

Common associates include myrtle dahoon, swamp tupelo, sweetbay, red maple, swamp red bay, coastal sweet-pepperbush, cinnamon fern, sedges, bullrushes, and pondweeds. Tidally flooded forests in lower, estuarine reaches contain communities in the Swamp Blackgum - (Bald-cypress) Forest Alliance. Other species common in these areas are wax myrtle and swamp rose. Sweetgum swamp communities occur in an extensive peatland along the shores of Great Lake. Sweetgum dominates the canopy, and the subcanopy is dominated by swampbay. Also uncommon are herbaceous communities associated with blackwater river, streams, and lakes that are dominated by narrowleaf pond lily.

Swamps on the CNF rarely experience wildfire, being protected by their wetness and location at the bottom of fire-sheltered slopes. Fire intervals are estimated to be from 100-300 years, and extensive fires only occur during years of extreme drought. Pure stands of bald-cypress are evidence of such events. Hurricanes cause the most disturbances in swamps, and apparently affect hardwoods more than bald-cypress or Pond-cypress.

Most bald-cypress was logged before the end of the 19th century on the CNF. In 1884, there was scarcely any cypress suitable for sawmills in Carteret County (Ashe 1894) and in Craven County. Ashe stated that "the supply of cypress and ash in the river swamps is nearly exhausted". There are few swamps on the CNF where old bald-cypress trees remain. In most areas, removal of the large cypress resulted in the closure of the water tupelo and swamp tupelo canopy. Little regeneration of bald-cypress has occurred on these tupelo-dominated sites during the last century. Recent hurricanes, Bertha and Fran (1996), resulted in extensive blowdown and damage to red maple, blackgum, and water tupelo in some of these swamps.

Stream and River Terraces and Drainage Slopes: This group includes partially fire-sheltered terraces associated with stream swamps and rivers and dominated by mesophytic hardwoods and dry mesic to mesic hardwood dominated slopes between drainages and uplands. Ten vegetation associations that represent forests belonging to this group occur on the CNF. These vegetation types are roughly equivalent to bottomland hardwoods-yellow pine, and sweetgum-nuttal oak-willow forest types (CISC) and occur on landtype phases 306, 307, 408, and 409. The following Plant Associations are attributed to the CNF:

American Beech-White Oak-Maple(Southern Sugar,Chalk)/Mixed Herbs Forest (*Fagus grandifolia-Quercus alba-Acer barbatum,leucoderme*)
Sweetgum Forest (*Liquidambar styraciflua*)
White Oak-Mockernut Hickory/Mayberry Forest (*Quercus alba-Carya alba/Vaccium elliottii*)
White Oak -Pignut Hickory-Mockernut Hickory/Red BuckeyForest *(Quercus alba-Carya glabra-Carya alba/Aesculus pavia*)
Sweetgum-Tuliptree-Red Maple Temporarily Flooded Forest (*Liquidambar styraciflua-Lireodendron tulipifera-Acer rubrum*)
Black Willow Temporarily Flooded Forest (*Salix nigra*)
Laurel Oak/Ironwood/Common Water-willow Forest (*Quercus laurifolia/Carpinus caroliniana/Justicia ovata*)
Overcup Oak-Water Hickory Seasonally Flooded Forest (*Quercus lyrata-Carya aquatica*)
Overcup Oak-Water Hickory/Pepper-vine Forest (*Quercus lyrata-Carya aquatica/Ampelopsis arborea*)
Sand Laurel Oak-Pignut Hickory-American Beech Forest (*Quercus hemisphaerica-Carya glabra-Fagus grandifolia*)

Table 3.17. Forests within Stream and River Terrace grouped into the following successional classes, shown in acres.

	----------Seral Stage----------				
	Early	Mid	Late	Old Growth	Total
Hardwood Forest Type Condition	0	0	1,730	0	1,730
Pine Forest Type Condition	111	479	1,214	0	1,804
Not Classified (no Forest Type) = 158 acres					

Hardwood forests in this group vary in composition according to their degree of protection from fire. Many stands in this group have provided the only refuge for upland hardwood species on the CNF. Communities on slopes are closest to uplands that experience frequent burning and are dominated by white oak, black oak, pignut hickory, and red hickory. The understory is sparse and includes heartleafs, downy rattlesnake orchid, pipsissiwa, woodland tick-trefoil, and rattlesnake hawkweed. Historical accounts from the Croatan area mention upland oaks and hickories on fire-protected sites only. On sites completely protected from fire, such as those adjacent stream swamps, American beech was dominant and still exists today in isolated stands.

Under natural fire regimes, fire frequency was between 7 and 12 years. Fires were typically low intensity and carried slowly through the matted hardwood leaf litter. High winds from frequent storms are the most important disturbance. They create small gaps which are much more common than the total stand damage of hurricanes. Most hardwood communities on the CNF had been logged by the turn of the century. Modern forestry practices have favored these stands as habitat for wildlife and therefore little recent logging activity has occurred.

Hardwood forests on the CNF are still distributed according to a fire-effects gradient. On some sites, pines have been favored and hardwoods have been eliminated from the canopy but persist in the understory. However, with a long period of fire suppression, there has been a general increase in the proportion of hardwoods to pines across all sites on the CNF.

Tidal Streams and Estuaries: These salt, brackish, and brackish-fresh water marshes are associated with coastal estuarine systems and are dominated by sedges, grasses, and herbs. Four plant associations representing marsh communities are found on the CNF. They occur in landtype phases 101, 102, and 103. Forest type is coded '0' in CISC, but many of the marshes are coded as upland forest and reflect apparent invasion by woody shrubs and trees in this zone. The following Plant Associations are attributed to the CNF:

Seaside Oxeye/Saltmeadow Cordgrass Shrubland (*Borrichia frutescens/Spartina patens*)
Needlerush Herbaceous Vegetation *(Juncus roemerianus*)
Saltmarsh Cordgrass Carolinian Zone Herbaceous Vegetation (*Sparina alternifolia*)
Wild Rice Tidal Herbaceous Vegetation (*Zizania aquatica*)

Table 3.18. Forests in Tidal Stream and Estuaries grouped into the following successional classes, shown in acres.

	Seral Stage				
	Early	Mid	Late	Old Growth	Total
Current Forest Type Condition	0	71	731	0	802
Unclassified (no Forest Type) = 502 acres					

Tidal waters affect salinity and influence the distribution of species in marshes along a salt tolerance gradient. Marshes that are regularly tidally flooded are characterized by discrete, dense patches of black needle rush. Associates that occur at low cover may include sea ox-eye, groundsel-tree, saltmarsh cordgrass, salt grass, and perennial salt marsh aster. Although this community exhibits little floristic variation across its range, it supports a large variety of animal species. Along the mouths of streams and small swamp drainages where water is less saline, marshes are dominated by saltmarsh cordgrass. Other less saline marshes are dominated by salt grass. Marshes fringing tidal freshwater rivers may be dominated by wild rice communities.

While flooding regime and salinity control the distribution of vegetation in marshes, fire plays an important role in regulating plant succession. Historically, marshes burned on a regular basis, being ignited by the adjacent, frequently burned pine uplands (Frost 1995). Fire has been shown to have a number of effects on nutrient release and productivity increase in marsh (De la Cruz and Hackney 1980; Hackney 1982). Fire removes the heavy thatch that builds up in 2 to 5 years, opening up habitat for colonization by new plants. Regular burning allows constant establishment of shade-intolerant herbs, maintaining biological diversity.

Marsh community composition and hydrology have been altered on the CNF through past fire suppression and ditching for mosquito control. Reduction of fire frequency intervals has lead to increases in dominance by single species and, on sites with lower salinity or shallower water, succession to red maple, max myrtle, and pine. Woody succession is most extensive in the marshes along the White Oak River. Although mosquito control ditching has also been extensive along the White Oak River, it has probably had little long-term effect on vegetation distribution. This ditching occurred decades ago and sediments from the uplands have filled most channels.

Maritime Ridges and Dunes: These uplands that fringe salt or brackish water are characterized by plant communities having a component of live oak. There are less than 50 acres on the CNF that could potentially support these types of communities. The following Plant Associations are attributed to the CNF:

Live Oak- Yaupon Shrubland (*Quercus virginia-Ilex vomitoria*)
Mulletbush-Bigleaf Marsh Elder-Wax Myrtle-Yaupon Shrubland (*Baccharis halimifolia-Iva frutescens-Myrica cerifera-Ilex vomitoria*)
Bigleaf Marsh Elder Shrubland (*Iva frutescens ssp. frutescens*)

Some maritime forests have a low tree canopy often stunted and pruned by salt spray and dominated by live oak, Darlington oak, and loblolly pine. Understory vegetation is dominated by red bay, dogwood, yaupon, wax myrtle, and dwarf palmetto. The characteristic maritime shrub types occur in wetland flats and interdune swales and are dominated by dense thickets of wax-myrtle and are sometimes intermixed with red cedar. Others have yaupon and other evergreen shrubs often tied together with seaside greenbrier.

There are few good examples of maritime plant communities on the CNF. Those that do occur appear as scattered remnants in mixed pine stands. Nearly three centuries of human exploitation and disturbance have nearly eliminated these communities. All the live oak in the region was sought out and removed for ship timber during the 18th and 19th centuries (Wood 1981). Fire suppression has also led to less open conditions as shrub have invaded and proliferated on the sites.

Limesink Ponds: These depression ponds occur in limesink complexes and are usually less than a few acres in size. Ponds appear to be products of natural impoundments of old streams (Otte and Whetstone 1979) and some exhibit "sinkhole' or Carolina bay forms (Fussell and Wilson 1980). They are permanently flooded in the center and grade outward to the prevailing hydrology of the surrounding area (Schafale and Weakley 1990) and are usually surrounded by longleaf pine sandhills and savannas. The greatest concentration of limesink ponds on the CNF is in the Patsy Pond Natural Area. The following Plant Associations are attributed to the CNF:

Wright's Witchgrass-Erect-leaved Witch Grass Herbaceous Vegetation (*Dichanthelium wrightianum-Dichanthelium erectifolium)*
Maidencane-Spikerush-Narrow-fruit Horned Beakrush Herbaceous Vegetation (*Panicum hemitomon-Eleocharis equisetoiedes-Rhynchospora inundata*)
Threadleaf Beakrush-Bullrush Herbaceous Vegetation *(Rhynchospora filifolia-Juncus aborvtivus)*

Pond vegetation occurs in a complex of zones, often concentric but sometimes irregular. The deepest parts may be open water or may support aquatic plants such as water lily *(Nymphaea odorata)*, big floatingheart *(Nymphoides aquatica)*, cowlily *(Nuphar lutea)*, and bladderworts *(Utricularia* spp.) The lower margins of ponds are frequently flooded and normally support Threadleaf Beaksedge - Pondshore Rush Plant Associations. Other characteristic species in this zone include coastal beakrush (*Rhynchospora pleiantha)* and three-angle spikerush *(Eleocharis tricostata)*. Mid-margins of limesink ponds are flooded for a shorter period than low margins. The Wright Witchgrass-Erectleaf Witchgrass Plant Association occurs in this zone. Other characteristic species include West-Indies meadow-beauty *(Rhexia cubensis)*, red-top panic grass *(Panicum rigidulum var. combsii),* and white screwstem *(Bartonia verna)*. Most ponds are surrounded by a dense zone of shrubs, often pocosin-like, and dominated by Ti-ti *(Cyrilla racemiflora),* Fetterbush *(Lyonia lucida)*, Inkberry *(Ilex glabra)*, and Myrtle Dahoon *(Ilex myritifolia)*.

Human use in and adjacent to these sensitive areas has resulted in degradation of some sites. The margins of some limesink ponds have been altered by off-road vehicles, leading to soil erosion and vegetation destruction. Fire suppression in uplands has reduced the frequency of burning in these communities. The dense zone of shrubs has become even more dense and enlarged around some ponds due to lack of burning.

Rare Plants: The diverse habitats and plant associations on the CNF currently support 39 rare plant species. Since intensive surveys have been completed on only a portion of the CNF, it is likely that an additional 46 rare plant species could occur on the CNF based on their known habitat preferences. Because of the large number of rare species and documented populations on the CNF and the continued development of other land, in the Atlantic Coastal Flatwoods Section, maintenance and expansion of rare plant species populations and the habitats that support them has been and would continue to be a high priority on the Forest. The status and number of documented populations of rare species that occur or are likely to occur on the CNF are listed below. Endangered Species include plants in danger of extinction throughout all or a significant portion of their range. Threatened species include plants that are likely to become endangered in the foreseeable future throughout all or significant portion of their range. Sensitive species are plants at risk of extinction in a portion of their range. Locally Rare species are those plants that are not Endangered, Threatened, or Sensitive but are uncommon on the CNF and in North Carolina and are considered to be in jeopardy within the State. Refer to Appendices F and H for additional information about the risks to the viability of these species. Rare plants found on the CNF and those likely to occur are in the following categories:

Table 3.19. Categories of rare plants found on the CNF.

			Locally	----------Species Class----------		
	T&E	Sensitive	rare	Vascular	Non-vascular plant	
	species	species	species	plant	Mosses	Liverworts
# of documented species	1	15	23	37	2	0
# of documented populations	5	87	75	167	3	0
# species likely to occur	0	17	29	44	0	2

Environmental Consequences

Wildlife habitat, recreation opportunities, timber harvest sustainability, and the scenic environment on the CNF all depend upon the types and condition of forests, shrublands, and open savanna and their distribution and abundance on the landscape. Activities that change vegetation composition and structure often affect all these resources simultaneously. Effects may be positive, neutral, or negative and they may be short or long term. Knowing how the current vegetation condition is likely to change under the different alternatives would provide a better understanding of impacts to other resources.

Natural disturbance, such as wildfires, hurricanes, and insect outbreaks, and forest management practices, such as road building and timber harvest, can greatly influence vegetation composition and structure. The response of vegetation depends upon the season, intensity, and extent of these disturbances but is also controlled by site factors such as soil drainage, soil fertility, and landform (Frost 1996, Simon, Buncick, Manning 1997). Equally important are the physiological adaptations that many species in the Coastal Plain have developed that allow them to regenerate following disturbance and maintain their presence on the landscape.

Plant Adaptations to Disturbance: Plants on the CNF follow one or several strategies for responding to disturbance. They include: (1) invasion, (2) evasion, (3) avoidance, (4) resistance, or (5) endurance (J.S.Rowe 1983). In general, invaders, evaders, and avoiders rely on seed propagation for survival while resisters and endurers rely on vegetative mechanisms. Such modes of persistence allow many species to be retained on site or to quickly reoccupy sites following disturbance.

Invaders produce abundant wind-desseminated seeds that germinate readily in open areas. They are often weedy and short-lived, shade-intolerant species such as pokeweed *(Phytolacca americana)*, a perennial, fireweed *(Erichtites hieracifolia)*, an annual that regenerates profusely especially in burned areas, and broomsedge *(Andropogon virginicus)*, a perennial that can rapidly invade burned pocosins. Virginia chainfern *(Woodwardia virginica)* also regenerates readily in disturbed pocosins but from windborne spores. Some long-lived species like loblolly pine are invaders on disturbed mineral soils but also follow strategies of resistance when older.

Evaders produce seeds that remain viable for a long period of time and are protected in the soil or in tree crowns. They evade high temperatures of fire and germinate rapidly in openings. Seedbanks of Atlantic white cedar *(Chamaecyparis thyoides)* stored below the soil surface are able to regenerate after disturbance eliminates most all surface vegetation. Some species have hard or refractory seeds that are triggered to germinate by fire-induced temperatures (Uggla, 1958; Vogl, 1974). Pond pines release seeds only after being heated enough to open their serotinous cones. Pond pine, the most common species on the CNF, also has an endurance strategy and can resprout vigorously after above ground stems are killed by fire, wind, or insects.

Avoiders occur in landscape positions that are furthest away from disturbance and prosper where disturbance cycles are long. They include many species that are easily killed by fire such as American beech and all magnolias.

Resisters have above ground parts, such as thick bark on old stems that successfully resist disturbances such as fire. Most trees do not have this ability in juvenile stages. However, the seedling grass stage of

longleaf pine is very fire resistant and trees even at young ages have fire-resistant bark and self prune lower branches that could carry fire into their crowns.

Endurers include the largest group of species on the CNF. They have the ability to resprout from stem bases, rhizomes, root crowns, roots, or other below ground organs. Virtually all the savanna and pocosin herbs and shrubs on the CNF are long-lived and have the underground resources to recover after wind, insects, or fire kills back the shoot (Snyder 1980). Pond pine can form epicormic sprouts throughout their lower and upper bole following disturbance. Some of the most dramatic sprouters are dwarf huckleberry *(Gaylussacia dumosa)* and Honeycups *(Zenobia pulverulenta)* (Abrahamson, 1984: Schafale and Weakley 1990). All the xeric oaks sprout, including turkey oak *(Quercus laevis)*, bluejack oak *(Quercus incana)* and sand post oak *(Quercus margarettae)*. The position of the regenerating bud, which is important in successful sprouting, is influenced by the depth of the humus layer, soil moisture, and the time since the last disturbance. As ecosystems increase in biomass, the rooting systems tend to migrate upwards into thickening duff, into the zone of maximum biological activity and nutrient release (Snyder 1980). Biomass increases when fire is suppressed in systems adapted to short-interval disturbance. When fires do occur, sprouting mechanisms near the soil surface can be destroyed. Wiregrass *(Aristida stricta)* is another endurer that is favored by repeated low-intensity fires. This species normally does not flower unless it is burned (Parrott 1967). It forms a large component in the most flammable fuel type on the CNF, the longleaf pine savanna, and seems to support the idea that plant communities dependent on fire have been selected for increased flammability (Mutch 1970).

Some phenomena can generally be expected in the region: (1) Deep burning long-interval fires may virtually eliminate sprouting species and clear the ground for invading species (occurs following years of fire suppression). (2) In shorter fire cycles with low fuel buildup and fire intensities, species tend to stay rooted in mineral soil where they survive and contribute to early recolonization after fire (all pine savannas and flatwoods on the CNF). (3) Frequent fires favor sprouting shade-intolerant species and those that store seeds (pocosin and pond pine woodlands). (4) An intermediate-length fire interval favors species that are resistant in the adult stage, along with those that store seeds in the canopy (older stands in the pine uplands). (5) Systems with long intervals between disturbance are dominated by the pioneering invaders (few types on the CNF, may include bald cypress).

Natural Community Restoration versus Maintenance of the Current Condition: The proposed alternatives vary considerably in the interpretation of pre-settlement vegetation condition in the Croatan area and how they allocate land and prescribe treatments to reach a desired condition. In Alternatives B, C, and E, management activities would focus on restoration to more natural plant community composition and distribution that reflects the long-term adaptation of species and communities to fire, wind, drought, and insect outbreaks. It is reasoned that pre-settlement plant communities and the animals they support are more resilient to these types of disturbances since they experienced them in the past and are likely to experience them in the future. It is also understood that trying to emulate the natural patch sizes created by wildfires or hurricanes through management, e.g. extensive stand replacement prescribed burning or timber harvest, is not feasible or prudent. The current fragmented landscape also necessitates that some plant communities and sites that support threatened or endangered plants be protected, to the extent possible, from widespread habitat changes that could result in species extirpation.

Alternatives B, C, and E propose activities that shift the current composition of plant communities on the CNF to one more similar to that found before European settlement. This shift in vegetation composition would occur gradually in Alternative B because the frequency of prescribed burning and the acres burned would be less, tree rotation length would be greater, and no clearcutting would be used to restore longleaf pine. Alternative C, on the other hand, would restore all longleaf pine sites as soon as the off-site species occupying the site are mature. Alternative E is similar to Alternative C, but slower in restoration and emphasizes 2-aged over clearcutting regeneration. Prescribed fire would be more frequent, would occur on more acres, and would be used during seasons more similar to when natural fires occur.

Alternatives A and D propose activities that foster the current vegetation composition and structure. There would be limited restoration of natural communities. In Alternative D, prescribed fire would be used as extensively as in Alternative C, but fewer acres would be burned during seasons similar to when natural fires occur.

Affected Landtypes: In Alternatives B, C, C-modified, and E, Management Prescription boundaries follow ecological land unit (Landtype) boundaries generally to the extent practical. The response of plant communities to the proposed activities are thus controlled not only by the current plant community condition but also by the limitations and capabilities of the ecological types and the management prescription. In general, the Hardwood-Cypress Wetland and River Corridors eligible for Wild and Scenic Rivers Management Prescriptions are defined by the boundaries of the Lake and Stream Swamp Landtype. The Hardwood Restoration Prescription follows the natural boundaries of the Stream and River Terraces and Stream and River Slopes Landtypes. Pine Savanna and the RCW HMA follow closely the boundaries of Longleaf Pine Savanna and Flatwoods, Drainage Headlands and Broad Interstream Flats, and some Forested Wetlands. The Bear Habitat Prescription follows Raised Peatland and Forested Wetlands Landtype boundaries. By matching the Landtypes discussed in the effects analysis with maps of Management Prescriptions, a more complete picture of landscape level effects is possible.

Landtypes most affected by likely future activities can be narrowed to primarily 4 types: Pine Savanna, Drainage Headlands and Broad Interstream Flats, Peat Mantled forested wetlands, and Raised Peatlands. The remaining landtypes are least affected because activities are restricted or not likely to occur on those lands.

Table 3.20 provides information to compare effects of likely activities by alternative and landtype. Current vegetation composition is reflected by Forest Type and potential vegetation composition by Landtype

Proposed activities that would occur during the 10-year period of Forest Plan implementation and that could potentially affect plant community can be grouped into three broad categories: ground disturbance, overstory removal, and midstory control. This order of listing reflects the magnitude of potential effects, from high to low, for each type of activity.

<u>*Ground disturbance*</u> occurs: (1) in road, trail, pond and wildlife opening construction, (2) when soils are plowed and bedded during reforestation, (3) along skid trails in logging operations, (4) during roller chopping, and (5) at developed and dispersed recreation sites. These activities can crush or uproot

vegetation and displace or remove soil. There is a complete loss of vegetation on roads, trails, ponds, and developed camping spots: even if maintenance ceases on these spots, plant succession may be slow. If significant soil loss occurs, site potentials may not return to predisturbance conditions for centuries. Wildlife openings, on the other hand, are revegetated quickly. Similarly, bedded sites are revegetated with planted trees and, in the moist Coastal Plain environment, are quickly invaded by the surrounding vegetation. However, species composition in bedded plantations can be altered significantly in the short-term, and some rare species are likely to be removed for long periods of time. Skid trails that do not significantly compact soils may be revegetated quickly from seed from surrounding vegetation or from stored seed, but severely compacted soils may take decades to succeed to the predisturbance vegetation condition. Disturbance at dispersed recreation sites is normally short-term and small in extent unless they are habitually occupied.

Midstory control includes: (1) roller chopping, (2) thinning forest stands from below, (3) prescribed burning, and (4) manual control of midstory competition. Pine straw raking, although not used to control midstory vegetation, is also placed in this category. These activities directly affect the above-ground portions of shrubs and small trees and needle and leaf litter on the soil surface. Forest stands appear more open after these activities, but this change in structure and composition may be only temporary (less than 2-5 years). Shrubs and trees quickly resprout and growth is rapid. Repeated treatments are required to maintain open conditions. Treatments (mechanical, manual, or prescribed burning) have more effect when they are done during the growing season. Removing vegetation above-ground during active growing periods can deplete root carbohydrate reserves, reduce sprouting vigor, and eventually kill shrubs and small trees. This elimination of woody competition can have a positive indirect effect on understory grasses and herbs. The release of available nutrients by prescribed burning (Lewis 1974) can also stimulate regrowth and flowering in these understory plants.

Both pine straw raking and prescribed burning temporarily remove needle and leaf litter that covers the soil surface. Falling leaves and needles beneath a tree canopy cover the exposed soil, and soil erosion is insignificant in the flat topography of the Coastal Plain. Frequent pine straw raking over an entire rotation can remove significant quantities of nutrients, reducing soil productivity (Blevens and others 1994). However, fertilization of raked stands can not only replace nutrients lost in raking, but also increase productivity of needles and wood. Research at the Sandhills Gamelands in North Carolina has shown a 50 percent increase in pinestraw dry weight per year during the second growing season after fertilization. In addition, diameter growth increased 19 percent during the first growing season after fertilization and 49 percent the second growing season in stands as old as 55 years.

Pine straw raking has the potential to uproot herbs and grasses especially if the raking equipment removes material well below the soil surface or if sites are continuously raked without a period of rest. However, recent research on the Croatan concluded that the overall impact on species richness was quite subtle (Kelly 1997). Raking longleaf pine stands from one to three times during a one-year period did not significantly change species richness as compared with pretreatment values. This study suggested that short-term responses to raking may include mechanisms for the recovery of tissues damaged or removed by raking and that removal of heavy litter accumulation may temporarily improve microsite conditions for the establishment of new plants.

Overstory removal includes: (1) clearcutting for timber harvest or creation of developed recreation sites, (2) shelterwood harvest, (3) group selection harvest, (4) creation of wildlife openings or ponds, (5) forest

stand thinning, and (6) clearing rights of way during road and trail construction. These activities directly remove trees and shrubs from a site. They also indirectly affect plants by altering the amount of light reaching the forest floor, the soil moisture regime, and microsite temperature. The size and orientation of the openings are both important factors in determining the degree of environmental change that may occur.

Table 3.20. Acres of plant communities by Landtype and seral stage for each alternative.

	Seral Stage				
LANDTYPE (Forest Type)	Early	Mid	Late	Old Growth	Total
RAISED PEATLANDS					
(Pond Pine)					
Current Condition	25,241	8,101	32,921	0	67,670
Alt. A	0	33,342	32,921	0	67,670
Alt. B	0	33,342	32,921	0	67,670
Alt. C	45,805	21,865	0	0	67,670
Alt. D	45,805	21,865	0	0	67,670
Alt. E	10,200	33,342	24,128		67,670
(Other Pine)					
Current Condition	441	810	747	24	2,023
Alt. A	0	1,251	747	24	2,023
Alt. B	0	1,251	747	24	2,023
Alt. C	1,300	700	0	24	2,023
Alt. D	1,300	700	0	24	2,023
Alt. E	303	1,251	444	24	2,023
(Hardwood)					
	Early	Mid	Late	Old Growth	Total
Current Condition	695	495	3,200	0	4,390
Alt. A	0	1,180	3,200	0	4,390
Alt. B	0	1,180	3,200	0	4,390
Alt. C	3,080	1,310	0	0	4,390
Alt. D	3,080	1,310	0	0	4,390
Alt. E	660	1,190	2,540	0	4,390
not classified = 1146 acres					
PEAT-MANTLED FORESTED WETLANDS					
(Pond Pine)					
Current Condition	1,400	1,182	5,388	9,793	17,766
Alt. A	0	2,582	5,388	9,793	17,766
Alt. B	0	2,582	5,388	9,793	17,766
Alt. C	0	5,259	2,711	9,793	17,766
Alt. D	0	5,259	2,711	9,793	17,766
Alt. E	0	2,582	5,388	9,793	17,766
(Loblolly and Longleaf Pine)					
Current Condition	815	2,341	4,500	75	7,730
Alt. A	0	3,156	4,500	75	7,730
Alt. B	770-1,000	3,156	3,500-3,727	75	7,730
Alt. C	770-1,000	3,329	3,327-3,554	75	7,730
Alt. D	770-1,000	3,329	3,327-3,554	75	7,730
Alt. E	0	3,156	4,500	75	7,730

(Hardwoods)					
Current Condition	335	124	5,076	0	5,535
Alt. A	0	459	5,076	0	5,535
Alt. B	0	459	5,076	0	5,535
Alt. C	0	1,083	4,452	0	5,535
Alt. D	0	1,083	4,452	0	5,535
Alt. E	0	459	5,076	0	5,535
not classified = 811 acres					
XERIC to WET LONGLEAF PINE SAVANNAS AND FLATWOODS----------					
(Longleaf Pine) – total acres					
Current Condition	1,033	2,434	5,743	263	9,475
Alt. A	600	3,468	5,743	263	10,075
Alt. B	1,200	3,468	5,743	263	10,875
Alt. C	4,200	3,468	4,006	2,000	13,675
Alt. D	0	3,468	5,743	263	9,475
Alt. E	2,500	4,568	4,361	1,646	13,075
(Loblolly Pine and Pond Pine)					
Current Condition	1,431	4,604	6,584	0	12,019
Alt. A	300	6,035	5,684	0	12,019
Alt. B	0	6,035	5,384	0	10,819
Alt. C	0	6,330	3,289	0	9,619
Alt. D	1,262-2,000	6,330	4,289-5,027	0	12,619
Alt. E	0	6,035	2,634	0	8,669
(Hardwoods)					
Current Condition	68	38	3,967	0	4,073
Alt. A	0	106	3,967	0	4,073
Alt. B	0	106	3,967	0	4,073
Alt. C	0	192	2,681	0	2,873
Alt. D	0	192	3,881	0	4,073
Alt. E	0	106	3,717		3,823
Not classified = 804 acres					
DRAINAGE HEADLANDS & BROAD INTERSTREAM FLATS----------					
(Loblolly Pine and Pond Pine)					
Current Condition	500	1,637	4,537	0	6,675
Alt. A	300	2,137	4,237	0	6,675
Alt. B	700-1,000	2,137	3,537-3,870	0	6,675
Alt. C	700-1,000	2,393	3,281-3,614	0	6,675
Alt. D	700-1,000	2,393	3,281-3,614	0	6,675
Alt. E	0	2,137	4,237		6,675
(Hardwoods)					
Current Condition	0	55	2,310	0	2,365
Alt. A	0	55	3,210	0	2,365
Alt. B	0	55	2,310	0	2,365
Alt. C	0	121	2,244	0	2,365
Alt. D	0	121	2,244	0	2,365
Alt. E	0	55	2,310	0	2,365
(Longleaf Pine)					
Current Condition	19	60	1,030	0	1,109
Alt. A	0	79	1,030	0	1,109
Alt. B	0	79	1,030	0	1,109
Alt. C	0	121	988	0	1,109
Alt. D	0	121	988	0	1,109
Alt. E	0	79	1,030	0	1,109
Not classified = 263 acres					

LAKE AND STREAM SWAMPS----------					
(Hardwood + Cypress)					
Current Condition	206	60	5,863	0	6,129
Alt. A	0	260	5,863	0	6,129
Alt. B	0	260	3,863	2,000	6,129
Alt. C	0	260	3,863	2,000	6,129
Alt. D	0	260	5,863	0	6,129
Alt. E	0	260	3,863	2,000	6,129
(Pine)					
Current Condition	204	184	1,228	0	1,617
Alt. A	0	388	828	0	1,617
Alt. B	0	388	828	400	1,617
Alt. C	0	388	828	400	1,617
Alt. D	0	388	1,228	0	1,617
Alt. E	0	388	828	400	1,617
Not classified = 124 acres					
STREAM AND RIVER TERRACES & DRAINAGE SLOPES----------					
(Hardwoods)					
Current Condition	0	0	1,730	0	1,730
Alt. A	0	0	1,730	0	1,730
Alt. B	0	0	1,180	550	1,730
Alt. C	1,803	0	1,180	550	3,533
Alt. D	1,803	0	1,730	0	3,533
Alt. E	1,803	0	1,180	550	3,533
(Pines)					
Current Condition	111	479	1,214	0	1,804
Alt. A	0	590	1,214	0	1,804
Alt. B	0	590	1,214	0	1,804
Alt. C	0	590	0	0	0
Alt. D	0	590	0	0	0
Alt. E	0	590	0	0	0
Not classified = 158 acres					
TIDAL STREAMS AND ESTUARIES----------					
Current Condition	0	71	731	0	802
Alt. A	0	71	731	0	802
Alt. B	100	71	631	0	802
Alt. C	802	0	0	0	802
Alt. D	802	0	0	0	802
Alt. E	802	0	0	0	802
Not classified = 502 acres					
MARITIME RIDGES AND DUNES----------					
Current Condition	26	0	23	0	49
Alt. A	0	26	23	0	49
Alt. B	0	26	23	0	49
Alt. C	0	26	23	0	49
Alt. D	0	26	23	0	49
Alt. E	0	26	23	0	49

** Seral Stages: early = 0-10 years, mid = 11-50, late = 50+, old growth = 110+ for longleaf pine, 70+ for pond pine, 200+ for hardwoods. *NOTE* CISC age adjusted to reflect time since wildfire.*

Table 3.20 summarizes direct and indirect effects in Landtypes for each alternative. Effects are depicted as the total acres in different plant community composition and structural classes by the end of the 10-

year Plan implementation period. Plant community structure is described in the same seral stages used in the "Affected Environment" section.

Effects To Rare Plant Species
Protection of threatened and endangered species and maintenance of viable populations of all native species is required under regulations contained in the Endangered Species Act (ESA), the National Forest Management Act (NFMA), and FSM 2670. These laws and policies require: (1) a site specific analysis to determine potential effects to rare species from proposed projects, (2) consultation with the USDI Fish and Wildlife Service whenever a possible adverse effect may occur to proposed, endangered or threatened species and implementation of actions to mitigate these effects, and (3) that proposed actions do not affect the viability of native species and result in a trend in their listing by the USDI Fish and Wildlife Service to threatened or endangered status.

Species rarity on the CNF is due primarily to habitat rarity or loss of open plant community structure. Species such as Loose Watermilfoil *(Myriophyllum laxum)*, West Indies Meadowbeauty *(Rhexia cubensis)* and Dwarf Bladderwort *(Utricularia olivacea)* would grow only in the unique conditions afforded by lime sink ponds. Tennessee bladder wort *(Cystopteris tennesseensis)* and Carolina spleenwort *(Asplenium heteroresiliens)* are confined to calcareous outcrops such as marl. Both of these habitats are extremely rare on the CNF. Other rare species are limited to certain vegetation structure conditions and also have specialized habitat requirements. Fitzgerald's peat-moss *(Sphagnum fitzgeraldii)*, for example, occurs only in moist, deep peat soils with low fertility and ground surfaces that are not shaded significantly by other vegetation. Vegetation structure and its affect on plant shading and micro-environments appear to be the most important factors in controlling the suitability of habitats for rare plants on the CNF. Most rare plant species on the CNF prefer open light conditions found in pine savannas. The suppression of wildfires on these sites over the past half-century has led to shrub and hardwood invasion and a loss of suitable habitat for many species. Some species such as Rough-leaved loosestrife *(Lysimachia asperulifolia)*, Carolina goldenrod *(Solidago pulchra)*, and Carolina asphodel *(Tofieldia glabra)*, once quite common, have become rare and confined to pocosin and savanna ecotones where conditions are more naturally open.

In general, the probability of impacting existing rare species populations increases as the number of ground-disturbing activities increases. This is especially true if these activities occur in rare or unique habitats. Any other activity that increases competition to rare plants, decreases their ability to flower, seed, and regenerate, or otherwise degrades habitat suitability, can have a negative impact. Fire disturbance can periodically reduce competition from woody vegetation, release soil nutrients, stimulate seed production in grasses, and create open habitats for seed germination. Lack of such disturbance can lead to complete loss of habitat suitability for many rare plant species.

Although the ESA, NFMA, and FSM 2760 requirements would not vary among alternatives, each alternative may result in a different level of difficulty in meeting these needs. Alternatives A and D would rely more heavily on future site-specific analysis and mitigation than would alternatives B, C and E, which use land allocation and management prescriptions to maintain suitable habitat and limit potential risks to rare species.

Special management areas that emphasize maintaining natural plant community composition and structure are important in providing habitat for rare plants. Natural Areas identified by the North

Carolina Natural Heritage Program provide protection for rare species and the management emphasis on the CNF to maintain the quality of their habitat. Table 3.21 provides information to compare effects of alternatives on rare plants. It shows the number and size of Natural Areas proposed under each alternative and the number of documented rare plant and unique plant communities they contain.

Table 3.21. Distribution of rare plants within SIAs (natural areas).

	Total Rare elements	Locally rare species	Sensitive species	T&E Species	Unique comm-unities	Total acres
- Raised peatlands – (pocosins) -						
Total Special Interest Areas (SIAs)	22	6	14	2	16	75,230
Alt. A – SIAs	2	1	1	0	6	31,350
Alt. B – SIAs	19	5	12	2	16	40,302
Alt. C – SIAs	19	5	12	2	14	33,668
Alt. D – SIAs	2	1	1	0	6	31,350
Alt. E – SIAs	19	5	12	2	14	33,668
- Peat-mantled forested wetlands						
Total SIAs	4	2	2	0	4	31,840
Alt. A – SIAs	3	2	1	0	2	3,764
Alt. B – SIAs	4	2	2	0	4	8,850
Alt. C – SIAs	3	2	1	0	2	3,764
Alt. D – SIAs	3	2	1	0	2	3,764
Alt. E – SIAs	3	2	1	0	2	3,764
- Pine savannas and flatwoods -						
Total SIAs	58	21	33	4	16	26,970
Alt. A – SIAs	8	4	4	0	4	1,035
Alt. B – SIAs	38	15	20	3	15	6,189
Alt. C – SIAs	34	15	19	3	8	3,980
Alt. D – SIAs	8	4	4	0	4	1,035
Alt. E – SIAs	34	15	19	3	8	3,980
- Mixed pine broad flats						
Total SIAs	13	4	9	0	4	10,150
Alt. A – SIAs	1	1	0	0	2	450
Alt. B – SIAs	5	4	1	0	4	1,155
Alt. C – SIAs	4	3	1	0	4	608
Alt. D – SIAs	1	1	0	0	2	450
Alt. E – SIAs	4	3	1	0	4	608
- Lake and stream swamps -						
Total SIAs	4	2	2	0	2	7,870
Alt. A – SIAs	1	1	0	0	0	912
Alt. B – SIAs	4	2	2	0	1	2,271
Alt. C – SIAs	3	1	2	0	1	1,065
Alt. D – SIAs	1	1	0	0	0	912
Alt. E – SIAs	3	1	2	0	1	1,065
- Hardwood terraces and slopes -						
Total SIAs	5	3	2	0	2	3,740
Alt. A – SIAs	1	1	0	0	1	58
Alt. B – SIAs	2	2	0	0	2	460
Alt. C – SIAs	2	2	0	0	1	143
Alt. D – SIAs	1	1	0	0	1	58
Alt. E – SIAs	2	2	0	0	1	143
- Tidal streams and estuaries (marsh)						
Total Management Areas	0	0	0	0	1	1,300
Alt. A – Natural Areas	0	0	0	0	1	176
Alt. B – Natural Areas	0	0	0	0	1	176
Alt. C – Natural Areas	0	0	0	0	1	176
Alt. D – Natural Areas	0	0	0	0	1	176
Alt. E – Natural Areas	0	0	0	0	1	176
Continued next page…						

- All Landtypes Combined & Lakes						
Total SIAs	106	38	62	6	45	161,000
Alt. A – SIAs	16	10	6	0	16	37,700
Alt. B – SIAs	73	30	37	5	43	59,400
Alt. C – SIAs	69	28	35	5	31	43,400
Alt. D – SIAs	16	10	6	0	16	37,700
Alt. E – SIAs	69	28	35	5	31	43,400

Cumulative Effects: The cumulative effect of current plant community conditions on the CNF have been shaped by past land management activities and the ecological potentials of the land. Future vegetation composition and structure would be determined not only by these conditions and the course of action chosen during the next 10 years but by likely events and activities after the Forest Plan has been implemented. The condition of adjacent private lands, especially those near fragmented CNF ownership, can also influence these trends and our ability to reach desired conditions.

Although the cumulative effects of past, present, and likely future actions are important in appraising potential affects to vegetation, our current choice of action is also critical.

The proposed land management strategies offer different solutions to address issues of biological diversity, forest product and forest health sustainability, and a favorable forest environment for human use and enjoyment. The different types and mixtures of activities proposed to resolve these problems would affect not only the condition of vegetation but also its rate of change now and in the future. The rate at which plant communities change and the type of changes that would occur would affect the suitability of habitats for wildlife, the flow and uniformity of forest outputs

Effects of Alternatives

Alternative A:

Affected Landtypes

Pine Savannas (Includes MIS Species of Longleaf and Wiregrass): Existing savannas would progress to older ages. Conversion of loblolly to longleaf would average about 600 acres over the next ten years. Reliance on clearcutting and bedding would allow a high success rate for longleaf, but is unlikely to produce desired conditions for wiregrass. Therefore, the condition of longleaf/wiregrass community would decline in the short term. Maintenance of the existing system would likely fail over time due to increased shrub competition from lack of adequate prescribed fire in the growing season for midstory control.

Raised Peatlands: Condition would decline with continued growth of dense pocosin vegetation and loss of early seral conditions, due to the low amount of prescribed fire.

Peat Mantled Forest Wetlands: Pond Pine would progress to mid and older age conditions, since no harvesting activity is expected in this landtype. A less aggressive prescribed fire program would likely produce heavy shrub competition and increase risk of stand replacement fire.

Drainage Headlands and Broad Interstream Flats (Mixed Pine): With 300 acres of regeneration expected over the next ten years, most of this community progresses to older ages. Most activity would occur through thinning, which should maintain the community in a relatively healthy state. With low fire frequency and dormant season burning, mid and understory conditions would gradually decline due to high shrub competition.

Rare Plants: With no new natural areas designated, and only 16 of the 106 rare plant and community occurrences protected through natural areas, it is likely that conflicts between project proposals and possible adverse effects on rare plant species would occur frequently.

Transportation System Management

Without a clearly defined OHV system, unauthorized use of the land by OHV's would continue. More than 70 miles of unauthorized travelways have been created and more would be created in the future. Open areas of bare soil occur frequently where overuse occurs and more would likely be created in the future. Constant use of areas does not allow understory communities, particularly rare plants, to recover. Therefore, conditions for plant species would degrade gradually over time as more areas are voided of vegetation.

Cumulative Effects

This alternative continues the current levels of timber harvest, thinning, natural community restoration, rare plant mitigation, and recreation development. These activities would remain constant and much of the forest landscape would remain unmanaged. Forest product availability would fluctuate widely in future decades, but harvest levels would remain the same. Shrub density, especially in pocosins and pond pine woodlands, would continue to increase and hazardous fuel levels would continue to rise. Open pine savanna conditions would be maintained but not expanded and many other sites would become unsuitable for rare plants as shrub and tree encroachment increases. Overall, loblolly pine would become more susceptible to insects and diseases as it develops beyond biological maturity in many areas or remains overcrowded and stressed in unthinned plantations in other areas. The amount and distribution of longleaf pine would increase but only half of the potential sites would be restored during the next century.

Disturbance patch sizes created by management activities, such as clearcuts or small prescribed burns, would remain constant until natural events, such as wildfires, hurricanes, or insect outbreaks necessitate more widespread operations. Large-scale natural disturbances would be more likely in this alternative because of the increased fuel levels and greater acres supporting off-site species. Both conditions could increase the probability of extensive stand replacement wildfires. They would also result in a dramatic increase in the size of disturbance patches and the degree to which vegetation composition and structure changes. Based on past disturbances in similar situations on the CNF such as the Fish Day Fire in 1995, disturbance patch sizes may easily exceed 10,000 acres. Such widespread and rapid change may be catastrophic for some species and would decrease the overall structural diversity of vegetation by creating large areas having nearly homogenous habitat conditions. Furthermore, because of the slower rate of timber harvest during the plan implementation period, many stands of loblolly pine would be retained well beyond their biological maturity and could be highly susceptible to both hurricane damage and insect attacks. These dramatic vegetation shifts and loss of future habitats could lead to elimination of some rare plants already stressed from poor growing conditions during the 10-year plan implementation period and over a 50 year planning horizon (refer to Appendix H for more information about risks to rare plant species). This reduction in habitat suitability on the CNF is even more critical because habitat loss for many rare species on lands adjacent to the CNF is likely to be nearly complete in the not-too-distant future.

Alternative B

Affected Landtypes

Pine Savannas:(Includes MIS Species Longleaf and Wiregrass): Existing savannas would progress to older ages. Conversion of loblolly to longleaf would average about 1,200 acres over the next ten years. Reliance on group selection and prescribed burning could result in a low to moderate success rate for restoring longleaf pine, but is likely to produce desired conditions to retain wiregrass. Therefore, the condition of longleaf/wiregrass community would remain static in the short-term. Maintenance of the existing system would likely fail over time due to increase shrub competition from lack of adequate prescribed fire in the growing season for midstory control.

Raised Peatlands: Condition would decline with continued growth of dense pocosin vegetation and loss of early seral conditions, due to the low amount of prescribed fire.

Peat Mantled Forest Wetlands: Pond Pine would progress to mid and older age conditions, since no harvesting activity is expected in this forest type. A change in vegetation structure and composition would occur on about 770 to 1,000 acres of stands currently dominated by loblolly pine following shelterwood or seedtree harvest. Revegetation of harvest areas would be slow due to less intensive site preparation. The less aggressive prescribed fire program would likely produce heavy shrub competition and increase risk of stand replacement fire

Drainage Headlands and Broad Interstream Flats (Mixed Pine): With 700-1,000 acres of regeneration expected, most of this community progresses to older ages. Most activity would occur through seed tree or shelterwood harvests. This should maintain community structure but there will be slow revegetation of harvest areas due to less intensive site preparation. With low fire frequency and dormant season burning, mid and understory conditions would gradually decline due to high shrub competition.

Rare Plants: The SIAs (natural areas network) would be expanded by 21,700 acres. Nearly 70% of all documented rare plant and plant community occurrences on the CNF would be included in this network of varied landscapes. This would provide protection from ground disturbing activities for more than 4 times the current number of rare plant and plant community element occurrences on the CNF. More acres would be designated in Natural Areas to afford this protection than under Alternatives C and E (refer to Appendix H for more information in about effects to rare plants). It is likely that conflicts between project proposals and possible adverse effects on rare plant species would occur less frequently.

Transportation System Management

With a clearly defined OHV system, unauthorized use of the land by OHVs would decrease. This could allow understory plants, particularly rare plants, to recover. Enforcement of proper use on one OHV area in a landscape with clearly defined natural barriers would be physically possible. Concentrating use away from rare habitats that support threatened and endangered species will reduce conflicts with human use.

Cumulative Effects

This alternative nearly doubles the amount of activity currently occurring on the CNF but takes a 'lighter' hand on the land than alternatives C and D and E. The level of activity in Landtypes that support longleaf pine would be constant for over a century then would fall approximately 30 percent to a

balanced sustainable level. Vegetation composition would gradually shift over the next 100 years on nearly 12,000 acres that are restored to longleaf pine. Vegetation structural change in these areas would be even more gradual with the uneven-aged silvicultural systems being proposed. Activities in loblolly and mixed pine stands would fluctuate for nearly 80 years and then level off. Vegetation composition would not change during this period, and structural changes would be the same as those that occur in longleaf pine areas.

Prescribed burning above current levels in forest stands would reduce hazardous fuels and maintain fair to good quality pine savanna conditions during the 10-year implementation period. Resulting overall forest stand conditions would be easier to maintain in the future, and the probability of stand replacement wildfires would be reduced. However, in pocosins outside of these managed forest areas, little or no prescribed fire activities would occur. Therefore, the risk of extensive wildfire and potential effects to vegetation composition, structure, and rare species viability would be greater in the future. Risk levels would be lower but similar to Alternative A.

Restoration of natural communities, especially longleaf pine, would occur at a much slower rate than in Alternatives C and E both during and after the 10-year plan implementation. The success rate of longleaf pine restoration and regeneration of existing stands is also unknown because the uneven-aged silvicultural systems proposed have never been implemented on the CNF. Natural regeneration of longleaf pine in forest gaps less than a 1/2 acre in size are common on the CNF, but there are few examples, except on the most xeric sites, of stem development beyond sapling or small pole sizes. Growth of this intolerant species is significantly affected by shading and competition from surrounding taller trees. It is expected that restoration using group selection would prolong the development of large-diameter stems in open pine savannas and the period when prescribed fire results in less damage to this species. Most longleaf pine restoration would occur in mature loblolly pine stands. Restoration would increase the need for more frequent burning to control the rapid invasion of restoration openings by loblolly pine seedlings. Failure to maintain burning regimes would significantly reduce the success rate of longleaf pine establishment and extend restoration and regeneration timeframes.

The cumulative effect of relying on uneven-aged silvicultural systems on all acres and in all forest types could lead to fewer open pine savanna conditions in the future and therefore may not fully meet longleaf pine restoration goals. Furthermore, because of the slower rate of timber harvest during the plan implementation period, many stands of loblolly pine would be retained well beyond their biological maturity and could be highly susceptible to both hurricane damage and insect attacks. Both of these factors would significantly reduce habitat quality for certain species such as the RCW and many rare pine savanna plants. This alternative does not provide any other regeneration options if restoration or regeneration goals are not met and would require a Forest Plan revision or amendment to effect this change.

Alternative C/C-modified:

Affected Landtypes

Pine Savannas (Includes MIS Species Longleaf and Wiregrass): Existing savannas would progress to older ages. Conversion of loblolly to longleaf would average about 4,200 acres over the next ten years. Reliance on clearcutting and bedding on wetter sites and shelterwood with reserve trees and prescribed burning on more well-drained sites would allow a high success rate for longleaf restoration. Clearcut

and bedding operations are not likely to produce desired conditions for wiregrass. However, shelterwood harvest and prescribed fire are likely to produce desired conditions for wiregrass. The condition of longleaf/wiregrass communities across the CNF in the short-term therefore depends upon the relative amount of these two restoration methods. Because of the extent of longleaf restoration, the probability of affecting wiregrass in the short-term is highest in this alternative. Maintenance of the existing system is likely to be successful over time due to a decrease in shrub competition because of adequate prescribed fire in the growing season for midstory control.

Raised Peatlands: Condition would improve as prescribed fire is used more extensively to create more open early seral conditions in portions of this landtype.

Peat Mantled Forest Wetlands: Pond Pine would progress to mid and older age conditions, since no harvesting activity is expected in this forest type. A change in vegetation structure and composition would occur on about 770 to 1,000 acres of stands currently dominated by loblolly pine or a mixture of loblolly, pond, and longleaf pine following shelterwood or seedtree harvest but slow regeneration of harvest areas due to less intensive site preparation. With high fire frequency and growing season burning, mid and understory conditions would gradually improve due to reduced shrub competition.

Drainage Headlands and Broad Interstream Flats (Mixed Pine): With 700-1,000 acres of regeneration expected, most of this community progresses to older ages. Most activity would occur through seed tree or shelterwood harvests. This should maintain community structure but there will be slow revegetation of harvest areas due to less intensive site preparation. With high fire frequency and growing season burning, mid and understory conditions would gradually improve due to reduced shrub competition.

Rare Plants: The SIAs (natural areas network) would be expanded by 5,700 acres. Nearly 70% of all documented rare plant and plant community occurrences on the CNF would be included in this network of varied landscapes. This would provide protection from ground disturbing activities for more than 4 times the current number of rare plant and plant community element occurrences on the CNF (refer to Appendix H for more information about effects on rare plants). Fewer acres would need to be designated in Natural Areas to afford this protection than under Alternative B. It is likely that conflicts between project proposals and possible adverse effects on rare plant species would occur less frequently.

Transportation System Management

With a clearly defined OHV system, unauthorized use of the land by OHVs would decrease. This could allow understory plants, particularly rare plants, to recover. However, enforcement of proper use on two, widely separated OHV areas, would be problematic. Moreover, the OHV area proposed in the southern portion of the CNF is primarily in a landscape dominated by interconnected sand ridges with few natural barriers to define authorized routes. This area would likely continue to experience overuse, degradation, and expansion into additional rare habitats that support threatened, endangered, and sensitive plant species and into the greatest concentration of RCW nest trees on the CNF. Future conflicts between human use and sensitive habitats that support rare species will likely increase.

Cumulative Effects

This alternative more than doubles the activity currently occurring on the CNF and is the most aggressive in restoring longleaf pine communities. This alternative also takes an aggressive approach of reintroducing natural fire regimes through prescribed burning. The greatest amount of longleaf pine

restoration would occur during the 10-year plan implementation period. This activity would reduce the current level of overmature loblolly pine stands and allow for future restoration to occur as off-site species reach maturity on longleaf pine sites. Clearcutting is an option that can be used in restoration and therefore the overall change in vegetation structure on the CNF would be more pronounced than in other alternatives both now and in the future. These changes would be less pronounced in 40 years when uneven-aged systems and even-aged seedtree and shelterwood harvests would be used to manage stands currently dominated by longleaf pine or mixed longleaf and other pines. Changes in vegetation composition and structure would be even less dramatic in 60 years, when all longleaf pine sites have been restored and clearcutting is not likely to be used for vegetation management. Activities in mixed pine sites would fluctuate until balanced age classes are created in 80 years. Thereafter, the flow of activities is even.

This alternative proposes prescribed burning well above the current levels in all vegetation types. Burning would reduce hazardous fuels in forest stands, create and maintain good to excellent quality pine savannas, and break up the contiguous fuels buildup in pocosins. Overall vegetation conditions would be easier to maintain in the future and the probability of stand-replacement wildfires would be much lower.

The cumulative effects of activities associated with plant community restoration, timber management, and prescribed burning would lead to biological and social benefits. Biological diversity would be improved and maintained, a sustained flow of high-quality forest products would be possible, a visually appealing landscape would be created, and the intensity and extent of natural disturbances such as wildfire, insects, and diseases would be reduced. When wildfires do occur, they would burn smaller areas, be safer to contain, and may temporarily reduce the need for prescribed burning. The reduced amount and continuity of hazardous fuels would also affect the degree of vegetation composition and structure change. However there will be short-term negative effects to native understory plant species, most notably wiregrass.

Alternative D:

Affected Landtypes

Pine Savannas(Includes MIS Species Longleaf and Wiregrass): Existing savannas would progress to older ages. There would be no conversion of loblolly to longleaf and therefore no short-term affect on wiregrass. However, maintenance of the existing longleaf pine system would likely fail over time due to increase shrub competition from lack of adequate prescribed fire in the growing season for midstory control.

Raised Peatlands: Condition would decline with continued growth of dense pocosin vegetation and loss of early seral conditions, due to the low amount of prescribed fire.

Peat Mantled Forest Wetlands: Pond Pine would progress to mid and older age conditions, since no harvesting activity is expected in this forest type. A less aggressive prescribed fire program would likely produce heavy shrub competition and increase risk of stand replacement fire. A change in vegetation structure and composition would occur on about 770 to 1,000 acres of stands currently dominated by loblolly pine following shelterwood or seedtree harvest and rapid revegetation of harvest areas due to intensive site preparation.

Drainage Headlands and Broad Interstream Flats (Mixed Pine): With 700-1,000 acres of regeneration expected, most of this community progresses to older ages. Most activity would occur through seed tree or shelterwood harvests. This should maintain community structure and there will be rapid revegetation of harvest areas due to more intensive site preparation. With low fire frequency and dormant season burning, mid and understory conditions would gradually decline due to high shrub competition.

Rare Plants

With no new natural areas designated, and only 16 of the 106 rare plant and community occurrences protected through natural areas, it is likely that conflicts between project proposals and possible adverse effects on rare plant species would occur frequently. Refer to Appendix H for more information about effects to rare plants.

Transportation System Management

With a clearly defined OHV system, unauthorized use of the land by OHVs would decrease. This could allow understory plants, particularly rare plants, to recover. However, enforcement of proper use on two, widely separated OHV areas, would be problematic. Moreover, the OHV area proposed in the southern portion of the CNF is primarily in a landscape dominated by interconnected sand ridges with few natural barriers to define authorized routes. This area would continue to experience overuse, degradation, and expansion into additional rare habitats that support threatened, endangered, and sensitive plant species and into the greatest concentration of RCW nest trees on the CNF. Future conflicts between human use and sensitive habitats that support rare species will likely increase, since may of the unauthorized routes would likely be designated for future motorized use.

Cumulative Effects

Like Alternative C, this alternative more than doubles the activity currently occurring on the CNF but is the least aggressive in restoring natural communities. Vegetation composition changes very little during plan implementation or in the future. Although prescribed burning is used on all parts of the landscape, natural fire regimes that include growing season burning are not applied. Less clearcutting would be used than in Alternative C, but seedtree harvests would affect vegetation structure more than in Alternative B. This effect would be steady within 80 years, when the forest age classes are balanced and an even flow of activities would occur. During the first 40 years, however, activities would fluctuate widely, with nearly half of the acres affected during plan implementation occurring during the second (10-20 years) and fourth planning horizon (30-40 years).

The cumulative effects of activities associated with timber management and prescribed burning are similar to Alternative C with some major exceptions. A sustained flow of forest products would be possible, and the intensity and extent of wildfires would be reduced. When wildfires do occur, they would burn smaller areas, be safer to contain, and may temporarily reduce the need for prescribed burning. Biological diversity objectives that include providing open pine savanna habitat for rare species, however, would not be met and the landscape would not be as visually pleasing. Furthermore, the risk of insect and disease losses is reduced only to the degree that thinning would maintain tree vigor. Longleaf pine, which is more resistant to southern pine beetle would occur on 12,000 less acres. Because of the seeding and regeneration vigor of loblolly pine and the use of natural regeneration to reestablish stands, this species would dominate more acres in the future. Most managed timberland adjacent to the CNF is dominated by loblolly pine and is likely to remain so in the future. These factors

would increase the probability of southern pine beetle outbreaks either starting on the CNF or on private land and expanding throughout these extensive monocultures.

Alternative E:

Affected Landtypes

Pine Savannas (Includes MIS Species Longleaf and Wiregrass):
Existing savannas would progress to older ages. Conversion of loblolly to longleaf would average about 3,500 acres. Longleaf pine restoration methods would be tailored to individual sites with the goal of retaining all existing longleaf pine and maintaining or improving existing wiregrass understory condition. About 25% of the restoration would occur from thinning off-site loblolly plantations to favor longleaf pine. About 75% of the restoration would occur from shelterwood harvest, but a small portion would be clearcut. This would result in early successional habitat, but the majority of these areas would have at least 6-10 overstory trees scattered throughout the stand. Clearcutting would only be used on the wettest sites and only where there are insufficient longleaf pine forests to provide RCW recruitment stands in the near future. Flat planting would be encouraged, however bedding may occur on sites where shrub composition is severe.

In pure loblolly pine stands, the emphasis on non-traditional regeneration methods for restoring longleaf pine may result in a low to moderate success rate. It is estimated that about 15-20% of areas needing restoration of longleaf pine to provide future RCW recruitment stands are currently in this condition. However, thinning or shelterwood harvests in stands having some component of longleaf pine is likely to be successful in restoring longleaf pine canopy structure and producing desired conditions for wiregrass. The condition of longleaf/wiregrass community in the short-term is therefore dependent upon the relative amount of mixed loblolly-longleaf stands and pure loblolly pine stands in critical restoration areas. Maintenance of the existing system and the restored longleaf pine system is likely to be successful over time due to a decrease in shrub competition because of adequate prescribed fire in the growing season for midstory control.

Raised Peatlands: Condition would improve as prescribed fire is used more extensively to create more open early seral conditions in portions of this landtype.

Peat Mantled Forest Wetlands: Pond Pine and mixed pine-hardwood stands would progress to mid and older age conditions, since no harvesting activity is expected in this landtype. A more aggressive prescribed fire program would likely reduce heavy shrub competition and decrease risk of stand replacement fire.

Drainage Headlands and Broad Interstream Flats (Mixed Pine): All forest types would progress to mid and older age conditions, since no harvesting is expected in this landtype. A more aggressive prescribed fire program would likely reduce heavy shrub competition and decrease risk of stand replacement fire.

Rare Plants

The Natural Areas network would be expanded by 5,700 acres. Nearly 70% of all documented rare plant and plant community occurrences on the CNF would be included in this network of varied landscapes. This would provide protection from ground disturbing activities for more than 4 times the current number of rare plant and plant community element occurrences on the CNF (refer to Appendix

H for more information about effects to rare plants). Fewer acres would be designated in Natural Areas to afford this protection than under Alternative B. It is likely that conflicts between project proposals and possible adverse effects on rare plant species would occur less frequently.

Transportation System Management

With a clearly defined OHV system, unauthorized use of the land by OHVs would decrease. This could allow understory plants, particularly rare plants, to recover. Enforcement of proper use on one OHV area in a landscape with clearly defined natural barriers would be physically possible. Concentrating use away from rare habitats that support threatened and endangered species would reduce future conflicts with human use.

Cumulative Effects

This alternative significantly increases the activity currently occurring on the CNF, is aggressive in restoring a variety of natural plant communities, and reintroduces natural fire regimes through prescribed burning. Longleaf pine restoration would occur during the 10-year plan implementation period and well into the future as current off-site loblolly pine plantations reach rotation age. This activity would reduce the current and future level of overmature loblolly pine stands. Clearcutting is an option that can be used in restoration but only on about 500-750 acres during each decade. Therefore the overall change in vegetation structure on the CNF would not be pronounced now or in the future. Changes in forest composition and structure would be even less pronounced in 40 years when uneven-aged systems and even-aged seedtree and shelterwood harvests would be used to manage stands currently dominated by longleaf pine or mixed longleaf and other pines. Changes in vegetation composition and structure would be even less dramatic in 60 years, when all longleaf pine sites have been restored and clearcutting is not likely to be used for vegetation management. Activities in mixed pine sites begin after the first 10 years of plan implementation. They fluctuate until balanced age classes are created in 80 years. Thereafter, the flow of activities is even.

This alternative proposes prescribed burning well above the current levels in all vegetation types. Burning would reduce hazardous fuels in forest stands, create and maintain good to excellent quality pine savannas, and break up the contiguous fuels buildup in pocosins. Overall vegetation conditions would be easier to maintain in the future and the probability of stand-replacement wildfires would be much lower.

The cumulative effects of activities associated with plant community restoration, timber management, and prescribed burning would lead to significant biological and social benefits. Biological diversity would be improved and maintained, a flow of high-quality forest products would be possible, a visually appealing landscape would be created, and the intensity and extent of natural disturbances such as wildfire, insects, and diseases would be reduced. When wildfires do occur, they would burn smaller areas, be safer to contain, and may temporarily reduce the need for prescribed burning. The reduced amount and continuity of hazardous fuels would also affect the degree of vegetation composition and structure change.

3.2.2. FOREST HEALTH/INSECTS AND DISEASES

Affected Environment

Forest Health is a condition that permits the forest to renew itself and recover from a wide range of disturbances. It implies the retention of ecological resiliency while meeting current and future needs of people for desired levels of values, uses, products and services.

Prominent forest health concerns on the Croatan National Forests are bark beetle infestations, damage from hurricanes, damage from wildfires, and potential damage from future gypsy moth infestations. Other concerns for southern yellow pine include fusiform rust, annosus root rot, red heart, and brown spot needle blight.

Damage to pine from bark beetle infestations is the common on the Croatan. Bark beetles found on the Croatan are southern pine beetle (*Dendroctonus frontalis*), Ips engraver beetles (*Ips avulsus, grandicollis, and calligraphus)*, and the black turpentine beetle (*Denroctonus terebrans*).

The southern pine beetle is the most destructive of all bark beetles in the south. It attacks most pine species, but prefers loblolly pine and pond pine over longleaf pine. Trees are killed mostly in groups, ranging from a few trees to all trees on hundreds of acres.

Management practices such as maintaining stand vigor by thinning heavily stocked stands, regenerating mature stands, and managing for species less susceptible to southern pine beetle, reduce the risk of outbreaks. Cyclic population outbreaks are controlled by natural enemies, such as diseases, parasites, predators and weather. Integrated pest management may be achieved by any or all of the following control techniques: rapid salvage and utilization of infested trees, piling and burning of infested materials, chemical control in high-value trees, and cut-and-leave during the months of May through October (Insects and Diseases of Trees in the South, 1989). The most common suppression technique used on the Croatan has been to cut and remove (salvage) infested trees.

Until recently, southern pine beetle activity on the Croatan has been at low levels. In the spring of 1997, however, numerous infestations began to appear across the district. In FY-97 over 300 southern pine beetle spots were detected, mapped, and evaluated for treatment. Almost 1,000 acres have been impacted.

Most of the spots detected are in loblolly pine stands, but some activity is occurring in pond pine stands too. Longleaf pine has been impacted only where it occurs in small numbers with loblolly or pond pines. Initial infestations appeared in stands that were heavily damaged by hurricanes Bertha and Fran in the Fall of 1996. Infestations were common in older storm damaged loblolly with broken tops, trees that were blown down, and trees that suffered root damage. Entomologists suggest that the beetle population was on the rise and hurricane damaged stands provided conditions for accelerated development of southern pine beetle populations. Infestations also occurred in loblolly pine plantations where spread was especially rapid in unthinned stands over 15 years of age.

Ips beetles usually attack injured, dying, or recently felled trees and fresh logging debris. Infestations are particularly common in trees weakened by drought, lightning strikes, and wind. Mortality occurs from galleries being constructed in the inner bark and the introduction of blue-stain fungi. These effects

are the same as those of southern pine beetles. Mortality, however, occurs in small groups of trees and does not reach large acreages often associated with the southern pine beetle. Natural controls are parasites, predators, woodpeckers, and weather. Other control techniques include prompt removal and utilization of actively infested trees (Insects and Diseases of Trees in the South, 1989).

Black turpentine beetle attacks all pines native to the south. Attacks occur on trees damaged by lighting, wind, and mechanical activity. Black turpentine beetle attacks are confined mostly to damaged trees, which may be subsequently attacked by other bark beetles. Natural predators and protecting of trees from damage during logging activities keep turpentine beetle populations at low levels (Insects and Diseases of Trees in the South, 1989).

Gypsy moths have been detected in northeastern counties of North Carolina. Defoliation from gypsy moth has been observed in Currituck County, about 120 miles north of the Croatan (Witcosky 1997). Current projections indicate that without the programs to slow their spread, gypsy moths may appear on the Croatan by the year 2005. Special programs might delay their arrival until 2015.

Gypsy moth larvae feed on a large number of host trees and shrubs. Susceptible species on the Croatan are most all the oaks, sweetgum, and black willow. Species that are resistant to defoliation are blackgum, hackberry, most hickory species, red maple, bald cypress, sycamore, yellow poplar, and most pine species. Defoliation from gypsy moths can result in growth loss, crown dieback, and tree mortality. Hardwood trees that are healthy can tolerate several years of defoliation before dieback begins. Hardwoods that are already suffering under some stress, such as drought or crowding, may not tolerate defoliation before dieback begins. Managing for healthy, vigorous stands in a variety of age classes would minimize mortality resulting from gypsy moth defoliation.

Fusiform rust, caused by *Cronartium fusiforme*, occurs in loblolly pine while longleaf pine is fairly resistant. When infestations to the main stem occur in trees less than 5 years old, the spindle shaped galls eventually kill the tree. Fusiform rust is prevalent in loblolly plantations on the Croatan. The best method for control is to remove infected trees during scheduled thinning operations.

Annosus root rot, caused by *Heterobasidion annosum*, occurs in all southern yellow pines but is most common in loblolly pine. This fungus enters the pine stand through freshly cut stumps during thinning, and spreads through root system contacts to healthy trees. Occurrence appears more prevalent on sandy soils, especially where the sand layer is deeper than 12 inches. Annosus root rot has not been a significant problem on the Croatan.

Red heart fungus (*Phellinus pini*) is common in mature and overmature pines. The fungus causes decay in the heartwood of the tree, resulting loss of merchantable volume. Trees with red heart are important to RCW for cavity construction. Red heart is rarely a problem in loblolly pine less than 60 years old (Silvics of North America, Volume 1 Conifers 1990).

Brown-spot needle blight, caused by *Scirrhia acicola*, damages longleaf pine seedlings in the grass stage. Repeated defoliations kill the seedlings. Brown-spot control can be obtained in natural stands by prescribed burning during the grass stage and by using high-quality seedlings during planting operations. Since the Croatan has used mostly artificial regeneration methods with high-quality seedlings and an aggressive burning program, brown spot has not been a significant problem.

Wind damage caused by hurricanes can have significant impacts on the Croatan. Hurricanes touch the area the average of every 2 years, and one in eight is a category III storm, which delivers highly destructive winds. In the past 2 years the Croatan has been in the path of two highly destructive hurricanes. Damage from hurricanes includes uprooting, wounding, bending, and breaking of trees. They also cause damage from standing water and salt spray. Often, insect and disease attacks follow this disturbance and spread to healthy trees. Management practices that help minimize this type of damage are:

- Manage for a mixture of size and age classes to guard against complete loss. Young trees are rarely damaged, because they tend to bend with the wind while old trees tend to break or uproot.
- Stagger thinnings to limit exposure of recently thinned areas.
- Manage for well-spaced, thrifty trees.
- Manage for species that are adapted to hurricane-related damage, such as trees with deep taproots, strong wood characteristics, and trees that have sparse crowns or limber foliage (How to Evaluate and Manage Storm-Damaged Forest Areas).

Wildfires from 1970 to 1994 have damaged over 52,000 acres on the Croatan. Many of these acres are pocosin sites, but some are pond pine, loblolly pine, and longleaf pine forests. Damage from wildfire can be extensive and result in widespread mortality. Prescribed burning, to reduce fuel loads and managing for species adapted to fire, like longleaf pine, can minimize damage to timber and loss of wildlife habitat.

Environmental Consequences

Species composition and age class distribution play an important role in how insects, diseases, and environmental disturbances impact the forest. Some alternatives in this analysis propose to significantly change existing species composition and introduce new age classes over the long-term planning horizon. Changes would be accomplished through a variety of regeneration methods including clearcutting, shelterwood, group selection, and seedtree. Proposed intermediate treatments, such as prescribed burning and thinning, would also play an important role in how disturbances impact the Croatan.

Alternative A: This alternative has the largest proportion of acres managed for loblolly pine using mechanical site preparation and artificial regeneration. Risks for southern pine beetle infestations would be relatively high compared to other alternatives because of the large number of acres with preferred host types, loblolly pine and pond pine. However, risk would be reduced by thinning and by reducing rotations to 60 years for loblolly pine and pond pine.

The number of acres susceptible to gypsy moth infestation would be approximately 24,000 for this alternative. There are no proposals to covert hardwood stands to pine or restore hardwood to pine in this alternative.

Risk of fusiform rust infection would be high in this alternative because of the large number of acres in loblolly pine. Regeneration would rely heavily on planted seedlings where fusiform has historically occurred on the Croatan. Loss would be minimized by planting rust-resistant seedlings and removing infected trees during thinning operations. No serious annosus root rot damage is anticipated.

Red heart fungus is found in mature or over mature pine trees. With relatively short rotations, 60 years for loblolly pine and 80 years for longleaf pine, red heart incidence should be lower for this alternative than other alternatives.

Brown spot impacts to longleaf pine would be minimal in this alternative because regeneration would rely on planted seedlings and prescribed fire would used to control competition in early stages of seedling development. This alternative has the lowest number of acres proposed for longleaf management.

The risk for damage resulting from hurricanes is high for this alternative because it has the highest proportion of loblolly pine acres. Risk for breakage, uprooting, and salt damage is less for longleaf pine than loblolly pine (P.Barry 1993). This difference was evident during the two hurricanes in 1996; most of the damage occurring in loblolly pine and hardwood and less damage in longleaf stands. No activity is proposed in hardwoods.

Risk of damage resulting from wildfires would be higher in this alternative because of the greater susceptibility of loblolly than longleaf pine to fire.

Alternative B: The risk of southern pine beetle damage is high for this alternative because fewer acres of loblolly would be restored to longleaf than in Alternative C. Also, the process of restoration would require a longer period of time using uneven-aged methods of regeneration rather than even-aged methods. Older stands of loblolly pine would be more prevalent in this alternative, increasing the risk of southern pine beetle infestations. The amount of thinning proposed for this alternative is as much or more than for the other alternatives, and this treatment should reduce risk of southern pine beetle outbreaks.

The number of acres susceptible to gypsy moth infestation would be about the same as Alternative A and slightly less than for alternatives C, D, and E.

Fusiform rust incidence would be low for this alternative because no planting of loblolly is proposed. Existing stands of loblolly with fusiform would be treated by removing infected trees during thinnings. Loss to fusiform can be minimized by planting resistant seedlings and removing infected trees during thinning operations. No serious annosus root rot problems are anticipated.

Red heart incidence would be higher for this alternative than for Alternative A because fewer acres of mature trees would be regenerated on an annual basis.

The risk of brown spot to young longleaf is related to the difficulty of burning small groups. Regeneration in this alternative would occur in small groups either by natural regeneration or by planting longleaf pine containerized seedlings. If prescribed fire were used to control competition brown spot would not be a problem. When other methods of release such as mechanical treatments or herbicides are used, the risk of damage to young seedlings increases.

The risk of damage to pine types from hurricanes is less than for Alternative A but higher than for Alternative C, because fewer acres of loblolly pine would be restored to longleaf pine. The risk of

damage to hardwoods is about the same as for Alternative A because treatments to hardwoods are proposed in this alternative.

The risk of damage due to wildfire is less than alternatives A and D and more than C and E. This is because of the amount of longleaf pine restoration is more than A and B and less than what is proposed for C and E.

Alternative C/C-Modified: The risk for southern pine beetle outbreaks is the lowest for this alternative because of the aggressive longleaf pine restoration effort and proposed level of thinning. Longleaf is least susceptible of all southern yellow pines and thinning promotes vigorous trees that are less susceptible to southern pine beetles.

The number of hardwood acres susceptible to gypsy moth infestation would be about the same as Alternative A and B and slightly less than for D and E.

Since longleaf pine is fairly resistant to fusiform rust, this alternative has the lowest risk of damage.

With the long rotations proposed in this alternative, 120 years for longleaf and 80 years for loblolly, red heart incidence could be high, especially as trees approach maturity. The value of harvested trees would be reduced, but suitability of trees of RCW nest excavation would be improved.

Even though this alternative proposes the most longleaf pine management, risk of brown spot would be low because of the proposed level of prescribed burning. This alternative has more acres of burning than the other alternatives.

The risk of damage from hurricanes is the least for this alternative because the number of acres in loblolly pine is reduced and the number of acres managed for longleaf pine is greatest. The number of acres managed for hardwood is not substantially different than alternatives A and B, but it is less than for Alternative D. Risk of loss to wildfire is less for this alternative than the others because of the amount of longleaf pine featured in management.

Alternative D: The risk for southern pine beetle damage is high for this alternative because of long rotations in RCW clusters and the large number of acres featured for loblolly pine management. The number of acres managed for longleaf pine, which is a less preferred host, is higher than for Alternative A but less than Alternatives B,C, and E. The level of thinning proposed for this alternative would moderate southern pine beetle risks by promoting vigorous growth in pine stands. The level of thinning would be about the same as for Alternative C and A, but less than for Alternative B.

This alternative has the highest number of acres featured for hardwood management. Species such as the oaks, sweetgum, and willow would be susceptible to gypsy moth defoliation. Trees that are older and stressed from other damage, such as hurricanes, could die from one defoliation and certainly from repeated defoliations. No management is proposed for existing hardwoods in this alternative. Lack of management opportunities to provide age-class distribution and development of young hardwood stands that could withstand repeated defoliations.

Fusiform rust would be common in this alternative because a large number of acres are managed for loblolly pine. Fusiform would be managed by planting resistant seedlings and removing infected trees during thinning operations.

Red heart would be a problem in this alternative with loblolly pine, especially as trees near the 80-year rotation age. Red heart is generally not a problem in loblolly pine under 60 years old. However, a loss in volume of trees harvested over age 60 can be expected. Red heart in longleaf would occur, but at a later age, and it would improve the trees for RCW nest excavation.

This alternative proposed about 8,000 acres of longleaf management, brown spot would be managed by using high-quality seedlings during planting and by burning. The risk of damage from hurricanes is high because this alternative has the most acres managed for hardwoods. This alternative also proposes a number of acres of loblolly pine second only to Alternative A.

Risk of loss to wildfire is high for this alternative because of the large number of acres managed for loblolly pine.

Alternative E: The risk for southern pine beetle outbreaks is low for this alternative because of longleaf pine restoration effort and proposed level of thinning. Longleaf is least susceptible of all southern yellow pines and thinning promotes vigorous trees that are less susceptible to southern pine beetles.

The number of hardwood acres susceptible to gypsy moth infestation would be about the same as Alternative A and B and slightly less than for C and D.

Since longleaf pine is fairly resistant to fusiform rust, this alternative a relatively low risk of damage.

With the long rotations proposed in this alternative, 120 years for longleaf, red heart incidence could be high, especially as trees approach maturity. The value of harvested trees would be reduced, but suitability of trees of RCW nest excavation would be improved.

Even though this alternative proposes longleaf pine management, risk of brown spot would be low because of the anticipated amount of prescribed burning.

The risk of damage from hurricanes is moderate for this alternative because the amount of loblolly pine is reduced and longleaf pine is increased. The amount managed for hardwood is not significantly different than alternatives A and B, but it is less than for Alternative D. Risk of loss to wildfire is less for this alternative than the others because of the amount of longleaf pine featured in management.

3.2.3. WILDLIFE AND RARE ANIMALS

Affected Environment

Life Forms:
The Croatan National Forest supports a wide array and diversity of wildlife species and habitats. The Forest provides habitat for 262 resident vertebrate species (known or likely to occur), in the following classes:

Class	Number of Species
Mammals	46
Birds	122
Reptiles and Amphibians	94

Birds: The Forest provides habitat for 122 species of permanent resident birds. Fourteen species of birds have state or federal status as legal game species. The most commonly hunted bird species include eastern wild turkeys, northern bobwhite quail, mourning doves, and wood ducks. Lesser-hunted species include the American woodcock, and clapper, Virginia, and king rails. Thirty-six species of birds require either forest interior conditions, large-diameter trees, or extensive forested tracts. Thirty-five species use aquatic habitats for foraging or nesting. Twenty-nine species require snags, cavities, or both.

The Partners-In-Flight Program considers nineteen species of birds "high-priority" species. Three of the five species considered by the Partners-In-Flight program as being "high priority" Neotropical migrants for the mid-Atlantic Coastal Plain, occur on the Forest (Wayne's black-throated green warbler, Swainson's warbler, and prothonotary warbler).

The Forest has a moderate but rapidly expanding wild turkey population. Conversely, the northern bobwhite quail population on the CNF has been on a steady decline. This decline is occurring throughout the Southeast.

Three federally listed bird species are known or likely to occur on the CNF: RCW, bald eagle, and peregrine falcon. The red-cockaded woodpecker (RCW) is known to occur on the CNF. Sixty-one active RCW clusters and 17 inactive RCW clusters currently exist on the CNF. The number of active RCW clusters on the Forest has been expanding for the last 5-10 years. The peregrine falcon occurs on the Forest only as a winter and spring migrant; it is not a resident breeding species. The bald eagle, a resident breeding bird on the CNF, occurs on the CNF at one nest site. However, suitable nesting and roosting habitat does occur along riverine and estuarine areas. Six species are known or likely to occur on the CNF that have recognized viability concerns: Bachman's sparrow, anhinga, loggerhead shrike, black rail, purple gallinule, and white ibis.

Mammals: The Forest is home to 46 species of mammals; 19 of these have state status as legal game species or fur bearing animals (commonly hunted or trapped). White-tailed deer and eastern black bears are the most popularly hunted big-game animals. Small game animals commonly hunted include eastern gray squirrels, red foxes, gray foxes, raccoons, cottontail rabbits, and opossum. Commonly trapped animals include raccoons, mink, river otters, coyotes, gray foxes, red foxes, bobcats, beaver, muskrats, and nutria. Other animals include 5 species of mice, 10 species of bats, 5 species of shrews and moles, and 3 species of voles. Two species of mammals are considered locally or regionally rare: the southern fox squirrel and Rafinesque's big-eared bat. The Forest is in the historical range of the eastern cougar and red wolf, but both of these species were extirpated from North Carolina by the turn of the century. An experimental population of red wolf has been established in several counties in the Pamlico-Albemarle Peninsula. The Forest constitutes potentially suitable red wolf habitat, but given the degree of urban and commercial development occurring in counties surrounding the Forest, the Forest may not provide a large enough block of habitat to support a population of wolves. The CNF represents one of several remaining large and intact black bear habitat core areas in the North Carolina Coastal Plain. The black bear population on the CNF is considered moderate to high, and stable.

Amphibians and Reptiles: Of the 94 species of reptiles and amphibians known or likely to occur on the CNF, 17 are frogs, 5 are toads, 17 are salamanders, 33 are snakes, 12 are turtles, and 10 are lizards. The American alligator is the only federally listed reptile or amphibian species known to occur on the CNF. Five other species of reptiles or amphibians with recognized viability concerns are known or likely to occur on the CNF. These include diamondback terrapin, mimic glass lizard, Carolina gopher frog, eastern diamondback rattlesnake, and Carolina salt-marsh snake.

Habitat: Prior and Present Condition

Wildlife habitat conditions present on the CNF today are a result of past actions, as well as the presence or absence of natural forces. Historical records indicate the landscape of the North Carolina Coastal Plain prior to European impact was shaped by natural disturbances. The landscape pattern was largely determined by the frequency, severity, and intensity of natural and Native American-ignited fires and the cyclic effects of major storm systems.

The frequency and severity of disturbances shaped the type and distribution of wildlife habitat conditions which supported the diversity and abundance of wildlife species. Frequent wildfire regimes maintained more open understory conditions in upland longleaf pine stands, confining hardwood-dominated forest types to transitional hardwood slopes and more mesic to hydric bottomland sites. Hardwood-dominated forest types most likely were more uncommon than they are today, while upland pine forest types were much more widespread and dominant across the landscape.

Natural storms, and periodic, intense and severe wildfires ensured that wildlife species and populations were those adapted to relatively frequent disturbances. Gaps and edge-effects were a natural part of the landscape. Early-successional habitats ebbed and flowed across the landscape, causing rises and falls in species diversity and abundance, as well as the distribution of species. While a variety of successional stages were present across the landscape, habitat conditions were most likely dominated by older-aged forest conditions, and species adapted to more mature forest and late successional conditions.

However, wildlife habitat conditions and the mix of successional stages changed significantly after European settlement. Land clearing and conversion to farmland and settlements and extensive logging changed the forest landscape from predominately older-aged forest conditions, with some early to mid-successional stages, to predominately early to mid-successional conditions. With this change in the mix of habitats came a change from wildlife communities adapted to somewhat older-aged forest conditions, with scattered gaps and interspersion of edge habitats, to wildlife communities adapted to predominately early seral or more open habitat conditions.

Two habitat types, longleaf pine forests and pocosins, had been severely altered in the past. In the last 150 years, most of the stands on the CNF have been logged at least once. During this time period, the absence of periodic fire caused a significant reduction in acres of mixed-pine and longleaf pine forests. Extensive logging of bottomland hardwood and bald cypress swamps, which occurred by the end of the 19th century, almost eliminated older-aged bald cypress dominated types on the CNF. The same process eliminated Atlantic white-cedar stands. Homogeneous stands of loblolly pine, as well as mixed loblolly pine-hardwood stands, became common across the Forest compared to what occurred naturally. In the last 50 years, a substantial percentage of historical longleaf pine types on the Forest have been converted to loblolly pine.

Pocosin habitats, which were once much more common throughout the North Carolina Coastal Plain, have also been altered on the CNF. Small pocosin patches have been modified by ditching and draining, road construction, conversion to off-site pine plantations, and absence of fire. The remaining large patches of pocosin habitat are critical in maintaining the coastal black bear population. The long-term future of the eastern black bear in the North Carolina Coastal Plain depends on the protection of existing large blocks of pocosin habitat, such as that found on the CNF.

Habitat conditions across much of the CNF now tend to favor wildlife species associated with mid to late successional stages. Prior to the recent southern pine beetle outbreak, early seral wildlife habitats have been somewhat limited in quantity and distribution across the Forest, with 0-6 year old habitats comprising less than one percent of the Forest. Early successional habitat (0-10 years) constitutes about 2.1 percent of terrestrial habitats on the Forest. Early successional wildlife habitat is not evenly distributed among habitat types. By far the greatest percentage of this early successional habitat is found within the pond pine and pocosin habitat groups (81 percent of the 0-10 habitat on the Forest). The preponderance of this successional stage arises from the effects of natural and man-ignited fires that have occurred in the last 5-10 years on the Forest. Early successional habitat constitutes about 3.3 percent of the oak-gum-cypress habitat group, 3.9 percent of the mixed pine-hardwood group, zero acres in the southern mixed mesic group, and approximately 10 percent in the longleaf pine/pine savanna group.

Early successional habitat is provided through permanently maintained grass/forb wildlife openings, powerline rights-of-way, mowed road rights-of-way, agricultural fields, recently burned pond pine and pocosin wetlands (natural and human-ignited), and timber regeneration areas. As a cooperative effort with the North Carolina Wildlife Resources Commission, the Forest maintains approximately 255 acres of permanent wildlife openings. These openings range in size from 0.05 to 13.0 acres. Maintained wildlife openings are managed to provide both food and cover for early successional wildlife species. These openings consist of both annual and perennial plantings. The potential exists for improving the quality and quantity of grass/forb habitat by managing approximately 100 miles of powerline rights-of-way. Currently, a large percentage of these rights-of-way are experiencing moderate to heavy damage by high clearance off-road vehicles.

While limited in total acreage, a system of mature bottomland hardwood/cypress forested wetlands exists. Approximately 6,100 acres of bottomland hardwood/swamp forest are present on the Forest. Bottomland hardwood stands are considered unsuitable for timber production in the existing CNF Plan (1986). This system of older-aged hardwood wetlands provide habitat linkages and wildlife travel corridors linking interior portions of the Forest to major riverine systems, such as the Neuse, Trent, and White Oak Rivers. This habitat linkage is critical in maintaining the viability of the coastal black bear population in the North Carolina Coastal Plain. This community type plays a critical role in maintaining the habitat for neotropical migratory birds that are associated with interior bottomland hardwood wetland forest systems. Two hurricanes that struck the CNF in 1996 modified the structure and composition of some bottomland hardwood stands. Multiple canopy gaps were created throughout the bottomland hardwood type.

Mid- to late-successional habitats occupy approximately 63 percent of the Forest, about 10 percent is considered late successional. About 91 percent of hardwood and mixed pine/hardwood habitats, and 57 percent of pine habitats provide mid- to late-successional conditions.

Hardmast-producing habitat types (hardwood or mixed pine-hardwood) are somewhat limited in distribution and abundance across the Forest. They occupy about 17,700 acres (10.7 percent of the Forest). Mast-producing trees occur in predominantly pure stands and in mixtures with other species. Hardwood forest types are classified in the existing CNF Plan as unsuitable for timber production.

The Forest provides one of the largest intact pocosins in the North Carolina Coastal Plain. Approximately 95,000 acres of bay-swamp and pond pine pocosin habitat are present on the Forest. The largest block of pocosin habitat occurs in the interior portion of the Forest in the vicinity of Catfish Lake and Great Lake. This block comprises approximately 57,000 contiguous acres, and provides the core of the highest quality black bear habitat on the Forest. This area has the lowest road density of any area on the Forest. The second largest pocosin block is east of highway 70 southeast of the town of Havelock, N.C. This block of pocosin habitat also has low road density.

Snags and cavity trees are plentiful across the Forest. Hurricanes Bertha and Fran increased the availability of snags. An outbreak of southern pine beetle during 1997 has also substantially increased the distribution and availability of standing snags. However, given the rapid rate of decay of dead wood in the Southeast, suitable cavity habitat for secondary cavity dwellers may become somewhat limited in the near future.

The availability of large dead logs varies across the Forest, with higher availability in bottomland hardwood and hardwood stands and lower availability in upland xeric pine stands. Hurricanes Bertha and Fran increased the availability of large logs in hardwood-dominated stands, and in some upland pine stands. However, rapid rates of decay and frequent burning rotations speed turnover in the availability of large downed logs and subsequent microhabitat in upland pine stands.

Occurrence of live hardwood den trees varies across the Forest, with more in bottomland hardwood and upland hardwood forest types, and less in upland pine types. This habitat component is critical in upland-pine dominated stands for species, like the southern fox squirrel, which depends upon live hardwood den trees greater then 15 inches in diameter. Where hardwood stringers exist in close proximity to upland pine types, den trees may be adequate. Live hardwood den trees greater than 25 inches in diameter are limited across the Forest, limiting potential denning sites for eastern black bears and preferred roosting sites for the Rafinesque's big-eared bat.

Approximately 802 acres of marsh habitat exist on the Forest, with the majority along the White Oak River. The quality of this habitat is somewhat poor due to the exclusion of fire over the past 25 years. The absence of periodic fire has resulted in a predominance of invading hardwood species.

With the exception of the large patches of pocosin habitat, the CNF is considered roaded or accessible by vehicles in terms of wildlife habitats. These access-ways consist of local unimproved and improved county roads, improved State roads, improved Federal Highways, as well as forest service developed and maintained roads. Road conditions, and public-use rates, vary across the Forest. Open-road densities vary from a high of 4.2 miles of open road per 1,000 acres to a low of 0.7 miles per 1,000 acres. The current level of roads has resulted in a fragmented forest landscape. This fragmentation occurs as a result of higher rates of interspersion of edge habitats, and the infusion of moderate to high public-use rates. The Forest is dissected by several major highways, in addition to frequent CNF closed and open

system roads. U.S. Highway 70, which extends east and west through the Forest, provides access to Moorehead City, and to the North Carolina coast. At present, a bypass is being considered around Havelock, NC. Portions of this bypass would traverse the Forest. Other existing public roads are also under consideration for being upgraded to improve or expand public access.

Wildlife Recreation

The CNF represents one of the largest blocks of publicly owned land in the North Carolina Coastal Plain. Public hunting use rates are considered moderate to high. Preferred game species include deer, bear, spring turkey, small game, and migratory waterfowl. People from all areas of the State utilize the Forest for hunting. The Croatan National Forest, under a cooperative agreement with the North Carolina Wildlife Resources Commission, is managed under the North Carolina Game Lands Program, and is open to all legally recognized public hunting uses. The amount of private land surrounding the CNF leased to private hunting clubs has progressively increased over the last 10 years.

Deer hunting includes the use of dogs to drive deer and still-hunting (i.e. archery, muzzleloader, rifle, and shotgun hunting). The deer-hunting season lasts approximately 2 1/2 months. The use of dogs to hunt deer has been a long-standing tradition on the Forest. However, changes in landownership patterns, and a surge in the popularity of still-hunting, has created a marked increase in the interest and demand for still-hunting opportunities on the CNF. An increase in development of private land adjacent to the Forest has accentuated conflicts between traditional deer hunters who use dogs, and private landowners in some areas.

As a cooperative effort with the North Carolina Wildlife Resources Commission and Ducks Unlimited, the CNF manages the 800 acre Catfish Lake Waterfowl Impoundment to provide opportunities for public migratory waterfowl hunting and wetland wildlife viewing. Public waterfowl hunting is considered high, with demand exceeding the availability of hunting area. Water levels in the Catfish Lake Impoundment are drawn down each year. Waterfowl food plants are provided by annual grain planting and moist-soils waterfowl food plant production.

Public waterfowl hunting opportunities are also provided along the shorelines of the Neuse and White Oak Rivers. Wintering waterfowl numbers are sometimes high along both rivers. Commonly hunted waterfowl include mallards, black ducks, sea ducks, ruddy ducks, buffleheads, lesser scaup, ring-necked ducks, redheads, and canvasbacks.

The North Carolina Wildlife Resources Commission manages about 40 acres of public dove hunting fields on the Forest. Public hunting use is considered high. The Forest manages approximately 55 acres of agricultural fields under a special-use agreement. These fields provide early-successional habitat for many game and non-game species, while concurrently expanding opportunities for public dove hunting. However, there is some concern that the presence of these agricultural fields in interior portions of the CNF could constitute a source of nest parasitism by brown-headed cowbirds upon resident neotropical migratory birds. Additionally, the current special-use agreement and wildlife management plan for the area are not providing the desired quality of habitat for oldfield-dependent wildlife species, such as northern bobwhite quail, cottontail rabbits, common yellowthroats, yellow-breasted chats, loggerhead shrikes, and white-eyed vireos.

Bear hunting use is high on the Forest. Bear hunters use dogs to drive bears from the dense vegetation. Approximately 50,000 acres of the Forest is designated as a black bear sanctuary where bear hunting is not permitted. The sanctuary provides a core area for sow black bears to avoid contact with humans. The annual black bear harvest has remained somewhat stable over the last several years.

A somewhat rapid increase in the eastern wild turkey population over the last 5 years on the CNF has resulted in a high level of public interest in spring turkey hunting. The Forest provides one of the few areas of public ownership where the general public can hunt turkeys in the North Carolina Coastal Plain. Most of the Forest has recently been opened to spring turkey hunting. The majority of the highest quality turkey habitat occurs in stands dominated by hardwood-hardmast producers. On the CNF such stands are in upland and bottomland hardwoods. Other game species hunted on the Forest include rails, woodcock, squirrels, rabbits, quail, raccoons, and trapping of furbearer animals.

No facilities currently exist on the CNF to enhance opportunities for physically disabled hunting. At least one area has been designated on the Forest for limited entry use by individuals who meet the North Carolina Wildlife Resources Commission's "Disabled Sportsmen" program criteria.

The demand for public opportunities to view wildlife is considered high. Coastal population growth has brought a substantial increase in the number of people who value opportunities to view wildlife on public lands. Highway 70 carries high numbers of people through the CNF to the North Carolina Coast. However, only one developed wildlife viewing facility currently exists on the Forest. It is located in the Cedar Point area along the southwestern portion of the Forest along the White Oak River. This facility is accessible by people with physical disabilities. No viewing facilities in the Catfish Lake Impoundment are accessible to people with disabilities (hunting or wildlife viewing). With much of the Forest being somewhat accessible by motorized vehicle, substantial opportunities exist for expanding the number of terrestrial and wetland wildlife viewing facilities.

Counties surrounding the CNF are experiencing significant population growth and development, which are expected to increase in the next 10 years. Private land ownership adjacent to the Forest, which has historically been utilized for agricultural and forest-products production, is rapidly being converted to residential and commercial developments. Several major highway improvement projects, which bisect the Forest, are planned or proposed in the next 10 years. As the human population expands in the surrounding three to five counties, public recreational use of national forest land is expected to increase. This increase in public use could impact wildlife habitats and populations.

Environmental Consequences

Changes in wildlife habitat suitability occur at several scales and at differing intensities depending on the home range size and habitat requirements of individual species. The planning alternatives vary generally by programmatic goals and management prescriptions. Therefore, effects analyses for wildlife are broad, forestwide, and programmatic by design. At project scales, analyses would consider species with low mobility and restricted home ranges, such as constructing a parking lot, clearing a wildlife opening, clearing or paving a special-use communication facility, or plowing a fire control line.

Probable management activities that could potentially affect wildlife communities can be grouped into three broad categories: (1) changes in the type, quantity, quality and spatial arrangement of suitable

habitat; (2) direct mortality, reduced survival, or increased susceptibility to mortality; and, (3) increased disturbance.

Changes in the type, quantity, quality and spatial arrangement of suitable habitat: Habitat changes from vegetation treatments affect wildlife. Restoration, regeneration, and forest health goals vary by planned alternative. The activities to achieve those goals include overstory, midstory and ground cover removals, road reconstruction and maintenance, prescribed fire, site preparation, planting and other similar activities.

Prescribed burning is an important management tool for maintaining or improving wildlife habitat suitability. Growing-season burns would reduce midstory vegetation and increase herbaceous ground vegetation. Reductions in the midstory would favor species such as northern bobwhite quail, Bachman's sparrow, eastern wild turkey, eastern bluebird, and southern fox squirrel, but reduce habitat suitability for species such as hooded warbler, gray catbird, white-tailed deer, wood thrush, and red-eyed vireo. Relatively frequent and intense prescribed burns would most likely reduce the overstory and midstory hardwood component, resulting in reductions in hardmast production capabilities in upland pine-dominated stands. Habitat suitability would most likely be reduced for species such as white-tailed deer, eastern gray squirrel, eastern black bear, southern fox squirrel, and eastern wild turkey. Snag availability would fluctuate, as existing snags are either consumed by fire or fall down, but new snags are created from the impacts of localized intense fire or natural processes.

Relatively frequent prescribed burning regimes may reduce the number of logs on the forest floor, reducing the availability of microhabitats for species such as pine woods treefrogs, pine woods snakes, and eastern diamondback rattlesnakes. Prescribed fire in pocosins would improve habitat suitability for black bears and white-tailed deer by improving the availability of succulent green browse, forage, and softmast. The exclusion of fire from pocosins can change habitat suitability. Excluding fire from pocosins allows for the establishment of fire intolerant woody tree and shrub species, such as red maple, and a progressive shift from shrubs to deciduous trees. This change would cause a decline in habitat quality for black bear, deer and others.

Lengthening timber rotations in upland pine stands would increase the number of large diameter snags and cavity tree and improve habitat suitability for secondary cavity nesters such as pileated woodpeckers, brown-headed nuthatches, great-crested flycatchers, and red-headed woodpeckers. Thinning of young pine stands stimulates growth of the remaining forest stand, while increasing the amount of sunlight that reaches the forest floor. Herbaceous understory vegetation would be stimulated, potentially improving habitat suitability for species such as white-tailed deer, eastern wild turkeys, Bachman's sparrows, and reptiles and amphibians.

Restoring longleaf pine increases the distribution and abundance of early-successional habitats, improving habitat suitability for species such as common yellowthroats, yellow-breasted chats, white-eyed vireos, prairie warblers, northern bobwhite quail, white-tailed deer, eastern cottontail rabbits, and Bachman's sparrow. The long-term effects would be a net increase in suitable habitat for species that rely more upon mature open upland longleaf pine forest-types, such as pine warblers, brown-headed nuthatches, Bachman's sparrows, and southern fox squirrels. When mixed pine hardwood stands are converted, a net reduction in habitat suitability results due to the reduction of hardwoods for eastern gray squirrels, eastern wild turkeys, white-tailed deer, blue-gray gnatcatchers, yellow-throated warblers,

black-throated green warblers, wood thrushes, hooded warblers, northern parula warblers, and hairy woodpeckers.

Changes in vegetative type or successional stage can increase competition between species, as habitat conditions become more conducive to some species and less for others. The absence of fire or silvicultural treatments from longleaf pine stands reduces habitat suitability for RCW, southern fox squirrels, Bachman's sparrows, and northern bobwhite quail when the midstory component becomes densely stocked with hardwood species. Habitat conditions become more favorable for eastern gray squirrels, which can out-compete the southern fox squirrels in areas with dense midstories. Substantial increases in the distribution and abundance of early-successional habitats in interior forested stands can affect bird species requiring interior and mature forests, but benefit early successional, edge dependent bird species. Maintaining too much of a hardwood component in longleaf pine stands tends to increase the competition between RCW clans and southern flying squirrels.

To delineate habitats, 3 databases were examined. The ecological classification system classifies land units according to plant communities, soil, moisture and other environmental variables (Refer to the Plan, Appendix A). CISC is a timber inventory of stand conditions that classifies land units by forest type, age, condition, and density. Hammel (1992) created habitat groupings and correlated the habitat groupings with CISC land units.

The ecological classification and CISC were combined; the results are displayed in Table 3.20. It provides a useful measure of habitat, current conditions, and likely future conditions by seral stage for each alternative. Table 3.22 displays a combination of the ecological classification with Hammel groups. The tables provide similar information about habitats and changes by alternative. For anaylsis purposes, we used Table 3.20 for information about habitat changes by alternative.

Table 3.22. Current condition: landtypes and broad wildlife habitat groupings on the CNF.(See definition of Groups below)

	Stage 1 Early	**Stage 2 Mid**	**Stage 3 Late**	**Stage 4 Old Growth**	**Total**
Landtype: Tidal Streams and Estuaries (Marsh)					
X Marshes	0	71	731	0	802
Landtype: Lake and Stream Swamps (Oak-Gum-Cypress)					
II. OGCY	206	60	5863	0	6129
III. MPHW	204	184	1228	0	1617
Landtype: Stream and River Terraces/Drainage Slopes (Oak-Beech-Hickory)					
IV. SMMH	0	0	1,730	0	1,730
III. MPHW	111	479	1,214	0	1,804
Landtype: Drainage Headlands and Broad Interstream Flats (Pine Flatwoods)					
V. LPSM	500	1637	4537	0	6675
III. MPHW	0	55	2310	0	2365
VI. LLSL	19	60	1030	0	1109
Landtype: Peat-Mantled Forested Wetlands (Pond Pine Woodlands)					
VIII. PPPO	1400	1182	5388	9793	17766
VI. LLSL	815	2341	4500	75	7730
VII. BSPO	335	124	5076	0	5535
Landtype: Raised Peatlands (Pocosins)					
VIII. PPPO	25241	8101	32921	0	67670
V. LPSH	441	810	747	24	2023
VII. BSPO	695	495	3200	0	4390

Landtype: Xeric to Wet Longleaf Pine Savannas and Flatwoods (Pine Savannas)					
I. PSAV/ LLSO/SHLL	1033	2434	5783	263	9475
V. LPSH	1431	4604	6584	0	12619
III. MPHW	68	38	3967	0	4073
Landtype: Maritime Ridges and Dunes (Maritime Forest)					
IX. LOMA	26	0	23	0	49

Group I: Pine Savanna (PSAV, LLSO, SHLL)
Vegetation Types: PSAV (Pine Savanna), LLSO (Longleaf Pine-Shrub Oak), and SHLL (Sandhills Longleaf Pine). These forests consist of widely scattered trees in which longleaf pine comprises the majority of the stocking. Scrub oaks and other hardwoods make up less than 25 percent of the stocking.

Group II: Oak-Gum-Cypress (OGCY)
Consists of bottomland or swamp forests, which may include swamp tupelo, water tupelo, blackgum, sweetgum, oaks, black willow, pond cypress, Carolina ash, or bald cypress singly or as a plurality of stocking.

Group III: Mixed Pine Hardwood (MPHW)
In these forests, hardwoods (usually oaks) and pine each constitute at least 25 percent of the stocking. Mixed pine-hardwood stands can occur on sites ranging from wet mesic to upland. Depending upon position on the landscape, the mixture of species can include sweetgum, American beech, white oak, willow oak, water oak, live oak, bluejack oak, southern red oak, turkey oak, shortleaf pine, longleaf pine, maple, laurel oak, overcup oak, water hickory, loblolly pine, and pignut hickory.

Group IV: Southern Mixed Mesic Hardwoods (SMMH)
These forests occur along stream banks of bluffs where American beech or southern magnolia, singly or in combination, constitutes a plurality of the stocking. On some bluff sites, a variety of oaks and hickories may be present.

Group V: Loblolly Pine-Shortleaf Pine (LPSH)
This type can occur in a range of conditions, from wet to mesic sites (drainage headlands/interstream flats), and pocosins (off-site species on raised peatlands) to upland-mesic-dry sites (as off-site species on xeric to wet longleaf pine savannas and flatwoods). The type occurs in a variety of topographic conditions across the Southeast.

Group VI: Longleaf Pine-Slash Pine (LLSL)
This type can occur on wet to mesic sites (drainage headlands and interstream flats), and pond pine woodland sites (off-site on peat-mantled forested wetlands). Sites supporting it are moist, and are flat. Longleaf pine makes up the majority of the stocking, but a variety of tree and shrubs can be present.

Group VII: Bay Swamp-Pocosin (BSPO)
These are forests on boggy, poorly drained organic soils in which various species of broadleaf evergreen make up the stocking. Primary species include blackgum, swamp tupelo, red bay, sweet bay, gallberry, inkberry, pond pine and titi.

Group VIII: Pond Pine Pocosin (PPPO)
This type occurs on boggy, poorly drained soils, consisting of pond pine, titi, fetterbush, inkberry, blueberry, swamp bay, gallberry, and possibly Atlantic white cedar, pond pine dominant in the stocking.

Group IX - Live Oak Maritime (LOMA)
Live oak comprises at least 50 percent of the stocking, but yaupon and wax myrtle major associates stands often are influenced by salt spray and maritime breezes.

Group X: Marshes (MRSH)
Vegetation includes saltmarsh meadow cordgrass, black needlerush, wild rice, wax myrtle, and other tidal herbaceous vegetation.

Direct Mortality, Reduced Survival, or Increased Susceptibility to Mortality: Management activities, such as prescribed burning, road construction, pond construction, timber harvesting, construction of wildlife openings, trail construction, construction of recreational facilities, and maintenance of wildlife openings, could result in direct mortality to individual species. Operation of motorized equipment, logging, road construction, fireline construction, and the use of off-road vehicles, can kill individual animals. Less mobile species are more susceptible than mobile species. Individuals also can be killed by misapplication of pesticides and other chemical agents. Inadvertent felling of cavity trees can kill cavity-nesting species. Individuals, as well as groups of species, can be killed by prescribed fires as well as wildfires. Individuals can be killed during construction and routine maintenance of waterfowl impoundment dikes, as well as during annual flooding of sub-impoundments.

Increased Disturbance: Construction of recreation facilities including parking lots, campgrounds, and buildings, reduces the acres of habitat suitable for wildlife through direct conversion, as well as by increasing the distribution and level of human disturbance. Disturbance to wildlife can be expected from moderate to high-use recreation facilities (campgrounds, picnic sites, boat launches, interpretive centers, development of parking lots), special uses, roads open to public motorized vehicles, and recreation trails (mountain biking, horseback riding, hiking, etc.).

Development of access roads, agricultural openings, and power transmission lines, also can intersperse early seral vegetation into interior forested tracts, increasing the likelihood of competition by nest parasites or nest predators upon interior species. For species that are considered area sensitive, partitioning may make the habitat unsuitable.

Access roads and OHV access can be barriers to immobile species, thus fragmenting populations and habitats. Paving of previously unimproved roads also can create barriers to wildlife movement and dispersal. For very immobile species, such as terrestrial snails, reptiles or amphibians, the impacts can result in isolation of local populations.

Development of new public recreation facilities, roads, trails, special uses, and OHV areas would increase the levels of human-induced disturbances to black bears, wild turkeys, and other wildlife species considered sensitive to disturbance. Wildlife would attempt to change home-range use patterns to avoid major disturbances. Such shifts in habitat utilization may force animals to use inferior quality habitat. Such shifts in home range utilization may be temporal, seasonal, or permanent, depending on

the longevity, intensity, and type of disturbance. These responses also can make popularly hunted game species, such as turkeys, deer, and black bears, more vulnerable to mortality.

Any changes in the current level or type of use of existing facilities may also adversely disturb wildlife populations. Widening of an existing public highway can cause shifts in the home ranges of species, as well as make species more vulnerable to hunting and highway mortality. Designation of a closed road as a moderate- to high-use horseback-riding trail can induce changes in the response of local wildlife populations.

A study conducted by Wright and Speake (1975), found that turkeys on the Land Between the Lakes Recreation Area did not frequent a heavily used off-road vehicle area. Foot travel also had an adverse effect on the use of the area by turkeys. Turkeys were not known to inhabit an area closer than 1.0 km to campgrounds in the summer. Guynn and Reed (1990) found that turkeys on the Coweeta Hydrologic Laboratory in western North Carolina responded to the use of dogs for bear hunting by temporarily abandoning portions of their established home ranges and relocating to unhunted areas during the 2-month bear hunting season. Everett et.al (1978) reported that adult male turkeys moved 1.1 to 1.4 km to unhunted areas during short hunts where dogs were used to hunt white-tailed deer.

Disturbance can result in nest abandonment by ground and tree-nesting birds, such as northern bobwhite quail, wild turkeys, bald eagles, peregrine falcons, and waterfowl. During the spring, females may re-nest, but with smaller clutch sizes, or they may not re-nest at all. For species with low population levels or high mortality rates, decreased reproduction can affect the overall population level.

Brody and Pelton (1988) studied the effects of roads on black bear movements in western North Carolina. They reported that bears exhibited a clear preference for crossing roads of light traffic rather than those with heavier traffic. Bears may shift their home ranges in response to road densities when road densities reach certain thresholds.

Human-induced disturbances also can reduce the quality of recreational hunting experiences. Since spring turkey hunters locate turkeys by hearing their gobbling, high noise levels reduce the quality of the hunt considerably. Most spring turkey hunters would avoid areas with high noise levels.

Management indicator species are used to estimate effects of planning alternatives. Table 3.23 displays the terrestrial wildlife MIS selected for the CNF. Refer to Appendix G for further details about selection of MIS.

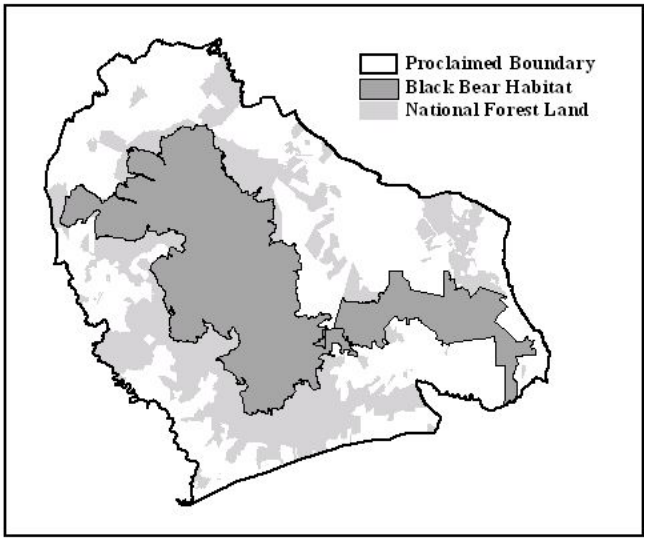
Table 3.23 displays the Management Indicator Species, the ecological landtypes, and the specific habitat components or conditions necessary for that particular species. The bolded text represents the favored habitat for each species.

Management Indicator Species	Ecological Landtypes	Habitat Components
Red-Cockaded Woodpecker	**Pine Savanna**	Mature open pine woodlands; dependant on live cavity trees; federally listed.
Eastern black bear	**Pocosin** Oak Gum Cypress Oak-Beech Hickory Pond-Pine woodlands	Disturbance sensitive; hardmast; game species.
Wild Turkey	Maritime Forest Oak Gum Cypress **Oak-Beech Hickory**	Mid-to-late successional stage (> 40 yr.); hardmast; grass/forb habitat; game species.

Habitats and Landtypes Least Affected: Habitats in several landtypes would not likely change in planning alternatives: Tidal Streams and Estuaries, Lake and Stream Swamps, and Maritime Ridges and Dunes. Low impact and infrequent management practices would not substantially alter these habitats. Species, such as neotropical migratory birds, would not likely be influenced by human caused disturbance in these landtypes and populations should increase. Any changes in populations, however, would not be caused by any direct activities on the CNF (refer to Appendix G). Examples of species benefiting from relatively undisturbed bottomland hardwood-cypress wetland habitat are: prothonotary warblers, black-throated green warblers, pileated woodpeckers, Swainson's warblers, great-crested flycatchers, Rafinesque's big-eared bats, and barred owls.

Catfish Lake Waterfowl Impoundment: The waterfowl impoundment, managed jointly with NC Wildlife Resources Commission, would continue operations at the same level under every alternative; operational plans are updated periodically. Typical species whose populations would be sustained through management of this impoundment are: mallard, black, redhead, and canvasback ducks, monitored by the NC Wildlife Resources Commission. Forest Service biologists cooperate with habitat monitoring.

Core Bear Habitat: A core area for bear habitat was identified. The spatial extent is shown on the inset below. The habitat area accounts for the needs of large tracts of land with low disturbance from motorized vehicles, and travel corridors west and east of the CNF (see figure below). About 83,000 acres of the CNF are needed for bear habitat, which is more than 50 percent of the CNF.



Management prescriptions that may detract from bear habitat include developed areas, OHV areas, urban/interfaces, and water-based recreation. The allocations of these prescriptions were examined for all alternatives by overlaying the core bear habitat area over the land allocations. Less than 5 percent of core bear habitat would be affected by these prescriptions for any alternative. The OHV accounts for most of the 5 percent in Alternatives C through E. In Alternative B, no prescriptions would detract

from the core bear habitat area. While an OHV area allocation adversely affects bear habitat, the extent of OHV use would be contained and narrowed to less than 5 percent of the habitat in any alternative. Short term effects would likely cause slightly increasing trends in populations to flatten out, but in the long term, bears would likely re-adjust home ranges and trends would begin to increase (see Forest Plan, Chapter 5, Population Trends).

The allocations of RCW (Pine Savanna) prescriptions were considered to have a neutral effect on core bear habitat. Less than 5 percent of RCW prescriptions were allocated for any alternative in core bear habitat.

Turkey Habitat: The best habitat for turkey occurs on stream and river terrace landtypes. The terraces are upland hardwoods that provide the hard mast components. When loblolly pine occupies these sites, hardwood restoration would restore key turkey habitat. The amount of this landtype is somewhat rare on the CNF. Existing habitat is about 1,700 acres, and with restoration, can be increased to about 3,600 acres. In planning alternatives, the rarity of this habitat was acknowledged and would not vary substantially among the alternatives.

Bottomland hardwoods provide turkey habitat. These areas are protected with the hardwood cypress wetland prescription in Alternatives B through E. The outer edges of the hardwood wetland areas, where hardwood sites may grade into upland pine sites, could generate differences in effects among alternatives. As hardwoods overtake pine sites, it enhances turkey habitat. Restoring longleaf pine would detract from turkey habitat, which vary by alternative as examined in the following discussion of alternatives.

Alternative A:

RCW The short-term habitat trend is nearly static for this alternative with only 600 additional longleaf savanna habitat (Table 3.20). Without prescribed burning, and especially growing season burns, habitat would begin declining after the next 10 years. A slight increase in populations, about 2 percent, (Table 2.1) are predicted due to artificial cavity installation over the next 10 years. The long-term habitat goal 37,875 acres with population trend increasing to 126-139 clusters. There are high risks of not attaining these goals with the low amount of habitat preparation over the next ten years.

Black Bear Habitat trends would be static to declining over the next 10 years without an active prescribed fire program in pocosin ecosystems. In the absence of continued periodic prescribed burning, habitat capability for black bears and deer in pocosin habitats would decline. Wildfires experienced in the last 10 years in pocosin areas improved soft mast production and improved the palatability of succulent green browse of ericaceous shrubs. The beneficial effects of these burns for improving wildlife habitat quality would be somewhat short-lived without continued burning. Without controls on OHV and unauthorized trail use, habitat quality would degrade due to motorized disturbance. Long-term population trends would likely be static to decreasing.

Wild Turkey Habitat conditions would remain stable in the next 10 years, and likely increase in the long term. This alternative would maintain the existing distribution and abundance of loblolly and mixed loblolly pine-hardwood stands, due to lower levels of conversion of off-site species to longleaf pine. The continued reliance on cool dormant-season burning would have less adverse impacts on hardmast

producing hardwoods. Existing grass/forbs would be maintained, but without additional grassy areas, populations would not likely increase, but instead would likely remain static over the next 10 years. This predicted trend considers the continued maintenance of hardwoods for hardmast, maintenance of existing amount of distribution of grass forb, and fewer controls on unauthorized access routes. Short and long term population trends would continue to slowly increase.

Cumulative Effects Due to lower levels of early successional habitat provided (Table 3.20) over the next 10 years and the long term (Table 3.20), the cumulative effect on habitat for wildlife species such as yellow-breasted chats, common yellowthroats, white-tailed deer, prairie warblers, and northern bobwhite quail would decline and be somewhat limited in distribution and abundance. This contrasts with conditions that favor species associated with mid- to late-successional forest habitats, such as yellow-throated warblers, northern parula warblers, blue-gray gnatcatchers, Acadian flycatchers, and brown-headed nuthatches, which are likely in increase over the long term.

Alternative B

RCW The habitat trend declines in this short term for this alternative due to the low level of prescribed burning. With 12,000 acres of burning, the fire return interval would lengthen more than 5 years to treat the entire RCW habitat management area. Therefore, habitat quality would degrade until midstory and shrub layers could be reduced. A slight increase in populations, about 2 percent, (Table 2.1) are predicted due to artificial cavity installation and growing season burning of approximately 1000 acres per year over the next 10 years. There are high risks that long term populations would never be met due to the uncertainty of uneven aged management for longleaf restoration. It is possible that habitat goals of 46,656 acres in the RCW HMA may not be ready for the populations to increase up to 169 clusters.

Black Bear Habitat would begin declining in quality over the next 10 years without an active prescribed fire program in poscosin ecosytems. In the absence of continued periodic prescribed burning, habitat capability for black bears in pocosin habitats would decline. Positive gains in bear habitat are made by reducing disturbance through Wilderness prescriptions, natural area designation, tighter controls of OHV and road use, and larger, relatively undisturbed hardwood /cypress wetland corridors for movements. Therefore, long-term population trends would likely be stable, to slightly decreasing.

Wild Turkey Positive gains in habitat conditions are due to the low level of access, keeping hardmast trees from dormant season burning, and maintaining the existing distribution and abundance of mixed pine and mixed pine-hardwood stands in the short term. However, existing grass/forbs would likely decrease due to obliteration of roads and trails and lack of maintenance. Therefore, the overall habitat trend would remain static and populations would likely continue to increase over the next ten years and then level off.

Cumulative Effects This alternative would yield only minor increases in the quantity and distribution of early seral vegetation over the next 10 years. Early seral habitat would be developed primarily using somewhat small "gaps or groups," which would not adequately meet the habitat needs for wildlife species dependent upon early successional plant communities. The cumulative effects on habitat for wildlife species such as yellow-breasted chats, common yellowthroats, white-tailed deer, prairie warblers, and northern bobwhite quail would decline. The use of uneven-aged timber management, and extended timber rotations for longleaf pine and loblolly pine/shortleaf pine, are expected in the long-

term to favor species associated with later successional forest habitat conditions. Species associated with loblolly pine or mixed loblolly pine-hardwood forest types would benefit. In the long term, benefits to early successional-dependent wildlife species are expected to be minor and of short duration. The cumulative effect on habitat capability for species such as yellow-throated warblers, northern parula warblers, blue-gray gnatcatchers, Acadian flycatchers, and brown-headed nuthatches is expected to increase in the long term.

Alternative C; C-modified:

RCW Habitat conditions would improve in the short and long term. Positive gains in habitat quality are made through higher levels of prescribed burning and growing season burns. Short term habitat loss may occur due to the high level of clearcutting, which would lose all large nesting potential trees on those sites. Also, the high level of bedding, which may cause the temporary loss of wiregrasses, which are the preferred fuels needed to carry prescribed burning. However, longleaf canopy restoration would be successful in the long term, providing about 46,656 acres of habitat thus providing the habitat needed to reach the long-term population objectives of 151-169 clusters. About a 5 percent population growth rate in the short term could be expected.

Black Bear Habitat quality increases due to prescribed burning in pocosins, tighter controls on access and OHV areas, a network of large hardwood/cypress wetlands for bear migration. Some loss of hardmast sources occur due to the high level longleaf restoration and burning, however, the positive gains in habitat quality outweigh any losses. Bear populations would likely increase in the short and long terms.

Wild Turkey Positive gains in habitat occur by stimulation of grasses/forbs in open longleaf pine stands and through road closures. Tighter controls on OHV access and road closure enhance turkey habitat. Over the next ten years, populations are likely to increase and begin to level off. However, in the longer term, the restoration of upland hardwoods converted from loblolly pine is likely to increase populations in 25 to 40 years.

Cumulative Effects In the short term, there would be a substantial increase in the distribution and abundance of vegetation age 0 to 10 years, with a commensurate increase in habitat capability for early seral-dependent wildlife species. This shift would primarily occur as a result of restoration efforts aimed at converting off-site species (both hardwoods, loblolly pine, and mixed pine-hardwood) to longleaf pine.

In the long-term, the cumulative effect would be a progressive shift in habitat conditions across the Forest, emphasizing habitat conditions for wildlife species, such as brown-headed nuthatches, yellow-throated warblers, Bachman's sparrows, red-cockaded woodpeckers, southern fox squirrels that are associated with older-aged forests. The most pronounced shift in the long-term would be an increase in habitat for species associated with mid- to late-successional stage longleaf pine forest types. Early successional habitat would still be provided in later planning periods, but at a lesser degree and scale then in the short-term.

Alternative D:

RCW Slight improvements in habitat over the next years are due to cavity augmentation and growing season burns. Therefore, populations may grow at about 3 percent in the short term. In the long term, risks are high that population objectives would not be met. No longleaf restoration goals in the alternative would provide future habitat, therefore, habitat goals of 43,424 acres are not likely to be met. It is likely that population levels would level off after 10 years and remain static rather than reaching levels of 136-151 clusters.

Black Bear Habitat enhancements are due to prescribed burning in pocosins , the maintenance and potential increase in hardmast sources. These gains are offset by the high level of access provided with this alternative. OHV and other motorized use would be widespread throughout the forest, causing high disturbance levels and fragmentation effects. Bear population trends would likely remain static over the next 10 years, but would likely decline in the longer term.

Wild Turkey Positive gains in habitat accrue by keeping and increasing hardmast sources, and providing early successional conditions in mixed pine/hardwood stands. However, losses of habitat are due to the relatively unrestricted motorized and non motorized access. Wildlife openings would continue to receive the necessary level and intensity of maintenance, with additional openings constructed. An increase in the distribution and availability of permanent wildlife openings would benefit species such as white-tailed deer, eastern wild turkeys, northern bobwhite quail, cottontail rabbits, and early successional neotropical birds. However, there is a projected offsetting loss of permanent grass and forb habitat as a result of increased public recreational use of existing linear wildlife openings (closed, seeded roads. Therefore, populations would continue to increase in the short term and level off after approximately ten years.

Cumulative Effects Early-successional habitat would predominately be in the form of large even-aged blocks, and existing forest types would be relevant. Habitat capability for early-successional wildlife species would only be slightly below that of Alternative C. Cumulatively, early-successional habitat would remain stable throughout subsequent planning periods.

Alternative E:

RCW Habitat conditions would improve in the short and long terms. Positive gains in habitat quality are made through higher levels of prescribed burning and growing season burns. This alternative attempts to deal with the short-term habitat losses in Alternative C. The loss of all potential nesting trees in Alternative C would be offset by keeping 6-10 trees per acre where 2 aged regeneration methods are appropriate for longleaf restoration. To offset the losses of wiregrass that may occur in Alternative C, guidance is provided to use alternative site preparation methods for planting. By maintaining some large loblolly trees during restoration efforts, the short-term populations should increase at 5 percent or more. However, some risks of not achieving full longleaf restoration objectives are assumed by keeping a seed source of loblolly pine, which may out compete the longleaf. With high level of prescribed burning, these risks are diminished and long-term population objectives should be achieved in this alternative. Trends in habitat should increase to about 64,000 acres with population increases to 137-169.

Black Bear Habitat quality increases due to prescribed burning in pocosins, tighter controls on access and OHV areas, a network of large hardwood/cypress wetlands for bear migration. Some loss of hardmast sources occur due to the high level longleaf restoration and burning, however, the positive gains in habitat quality outweigh any losses. Bear populations would likely increase in the short and long terms.

Wild Turkey This species is likely to be more sensitive to short term habitat loss of hardwood sources than black bear. Positive gains in habitat occur by stimulation of grasses/forbs in open longleaf pine stands and through road closures. Tighter controls on OHV access and road closure enhance turkey habitat. Over the next ten years, populations are likely to continue to increase and then level off after 10 years. However, in the longer term, the restoration of upland hardwoods converted from loblolly pine is likely to increase populations in 25 to 40 years.

Cumulative Effects In the short term, there would be an increase in the distribution and abundance of vegetation age 0 to 10 years, but at fairly low levels. Habitat capability for early seral-dependent wildlife species would increase slightly. This shift would primarily occur as a result of restoration efforts aimed at converting off-site species (both hardwoods, loblolly pine, and mixed pine-hardwood) to longleaf pine.

In the long-term, the cumulative effect would be a progressive shift in habitat conditions across the Forest, emphasizing habitat conditions for wildlife species, such as brown-headed nuthatches, yellow-throated warblers, Bachman's sparrows, red-cockaded woodpeckers, southern fox squirrels that are associated with older-aged forests. The most pronounced shift would be an increase in habitat for species associated with mid- to late-successional stage longleaf pine forest types. Early successional habitat would be provided at higher levels than in the short term. Therefore, all successional stages would be sustained through time in this alternative.

Cumulative Effect of Proposed Havelock Bypass for All Alternatives A proposed bypass around the town of Havelock would affect CNF land in the near future. Environmental assessment has been prepared by the US Dept of Transportation Federal Highway Administration and the NC Dept. of Transportation. The USDA Forest Service is listed as a cooperating agency in the assessment. (Refer to US 70, Havelock Bypass, Federal Aid Project No STP-NHF-F-56-4(34), State Project No. 8.T170701, T.I.P. No, R-1015 (hereafter EA). Analyses in the assessment are incorporated by reference and summarized below.

Table 3.24 shows the amount of CNF affected by Corridor C (preferred in referenced EA) and by prescription and percent of each prescription in this FEIS. The actual footprint of the road would take up about one-third the total amount listed for any plan alternative, since the roadbed and shoulders would be about 325 feet wide within the 1000-foot corridor. However, for purposes of this analyses, we use the corridor width because the actual location of the roadbed has not be determined.

RCW HMA, Bear, and mixed pine forests consistently have prescription areas greater than 1 percent affected among the alternatives. (Note: In Alternative E, mixed pine forests were rolled into RCW HMA). The acreages of affected prescriptions would not create high risks in reaching forestwide desired conditions for any planning alternative. However, the bypass would affect lands adjacent to the road

footprint, creating a fragmentation effect due to the amount of direct habitat affected. These effects are examined in terms of MIS below.

RCW The bypass directly affects foraging habitat for RCW, but would not adversely affect the populations of this species (EA, Appendix B). However, approximately 1070 acres of CNF land to the east of bypass would be fragmented and difficult to prepare or maintain RCW habitat. An additional 2 to 3 percent of potential RCW HMA would cumulatively be affected above the amounts cited in Table 3.24.

The desired population objectives in Table 2.1 accounted for the effects of the bypass, by establishing slightly lower population levels. Therefore, the bypass would not impose any greater risks to meeting population objectives or projected trends for any planning alternative.

The difficulty in managing the longleaf systems fragmented to the east of the bypass could affect trends for longleaf and wiregrass. Since methods other than prescribed fire may be required to maintain the longleaf/wiregrass system, the habitat quality is likely to decline. Due to the high cost of habitat maintenance, some losses of this system would be likely. Thus, using the percentages described above, alternatives predicting declines in longleaf/wiregrass would decline further, and any increases in trends would be somewhat dampened.

Bear Reference Table 3.24 and the EA, USFS Section 2, Wildlife Analysis. A higher level of direct mortality would occur as bears attempt to cross the bypass. The project would fragment part of a bear sanctuary and create conditions that would force bears to adjust home ranges and travel corridors.

Planning alternatives have goals to provide habitat linkages to adjacent landscapes. The bypass imposes risks to achieving these goals in the short term. However, black bear are fairly adaptable, and, the provision of bridges and other structures would likely mitigate the effects of the bypass on bear passage. Population trends in the planning alternatives may decrease slightly in the short term. Another concern would be the prospects of any additional or future highway projects affecting the populations in the bear sanctuaries.

Turkey Bottomland hardwoods and mixed pine habitats used by turkey would be affected by the bypass. Young turkey would experience difficulty in using habitat on both sides of the bypass because of difficulty in crossing the roadway. Current occupancy would probably decline, however, these are localized effects. The forestwide trend for turkey would decrease only slightly for any of the planning alternatives.

Other species The EA discloses effects to Rafinesque's Big Eared Bat and Solidago Verna. These effects require mitigation at the site specific, project level.

Table 3.24 Acres of Management Prescription by Alternative affected by Havelock Bypass proposal.

Prescription	Alternative Acres and (percents)				
	A	B	C/C-modified	D	E
MA 1	246(1%)				
MA 2	285(4.9%)				
MA 3	303(4.3%)				
MA 5	181(0.3%)				
Hardwood wetlands		52(0.9%	52(0.6%)	52(0.5%)	52(0.6%)
Mixed Pine Forest		116(2.9%)	191(4.3%)	117(1.3%)	
RCW HMA		544(1.4%)	500(1.1%)	608(1.4%)	776(1.2%)
Pocosin/Pond Pine (RCW)		239(1.7%)	85(0.6%)	51(0.4%)	
Special Interest Area		64(0.1%)			
Bear			92(0.2%)	92(0.2%)	92(0.2%)
WUI			95(1.8%)	95(1.8%)	95(1.8%)
Total	1015	1015	1015	1015	1015

Cumulative Effects of Alternatives on Rare Terrestrial Species: Analysis of the risks of viability of rare species is documented in Appendix H. Risks are reduced in Alternative E for the following species: Bachman's sparrow, Henlow's sparrow, Anhinga, bald eagle, and eastern diamondback rattlesnake. Refer to Appendix H for more information about risks to rare species.

Of great concern in the argo skipper. Due to the lack of habitat and no means to increase the habitat through restoration, no management alternatives can be developed within the authorities of the agency to ensure viability of this species.

3.2.4. FISHERIES

Affected Environment

All waters of the Croatan National Forest are in the Coastal Plain physiographic province. The streams are characteristic of many others in this physiographic province in that their gradients are very low, they have varying degrees of acidity, and they are colored by peat and other organic materials the water drains. The natural lakes on the Forest are large and shallow. Because of their acidity, aquatic species diversity is limited to an assemblage of acid tolerant fish species such as redfin pickerel, fliers, and bullhead catfish.

The CNF is bounded on the north by the Trent River, on the east by the Neuse River, on the west by the White Oak River, and to the south by Bogue Sound and the Atlantic Ocean. Great Lake (approximately 2,000 acres) and Catfish Lake (approximately 800 acres) are near the center of the Forest at a higher elevation than surrounding terrain. Consequently, streams originate from the lakes or surrounding lands and reach their largest size upon confluence with the Neuse, Trent, and Whiteoak Rivers and Bogue Sound.

Ecologically, waters on the Croatan can be grouped into some 11 aquatic ecological types based primarily on acidity and on where a particular stream reach, pond, or lake falls in the spectrum from freshwater to saltwater. Size and degree of tidal influence are other factors that cause some waters to be biologically different from others. The 11 aquatic ecological types identified in a "first approximation" include the following:

1. Saltwater Sound. Examples include Bogue, Pamlico, and Albemarle Sounds all of which are estuarine in nature (a biologically productive mixing zone of fresh and saltwaters).

2. Large Tidal Rivers. The lower Whiteoak and Neuse rivers, and the Newport and Trent Rivers are examples of this ecological type. The rivers are influenced by wind tides and saltwater intrusion. Chloride concentrations are often several thousand parts per million, and the fish assemblage is usually dominated by marine species in the lowermost reaches. Some freshwater fish species co-occur with the marine species except in the most saline reaches of these rivers.

3. Tidally Influenced Sections of Large Creeks. This category of waters includes the lower reaches of large creeks such as Brice and Hunter Creeks. Directional streamflow, depth, and salinity are influenced by wind tides of their receiving rivers. These stream reaches usually contain some saltwater fish species in addition to freshwater species such as largemouth bass, chain pickerel, and bluegill. The saltwater fish species usually include striped mullet, American eels, and summer flounder.

4. Non-tidal Midreaches of Large Streams. Two examples of this aquatic ecological type are Brice Creek in the vicinity of the public boating access, and the White Oak River near Belgrade. These ecological types are important in that they contain the most diverse assemblages of freshwater fish on the Croatan National Forest. These stream reaches contain a more diverse and abundant array of habitats than smaller stream reaches and consequently meet the habitat requirements of more species. The sizes of these stream reaches also allow more recreation opportunities such as canoe or boat fishing as opposed to wading or bank fishing only.

5. *Acidic Upper Reaches of Large Streams.* Brice Creek from its origin at Catfish Lake downstream to a point where acidity as measured by pH is 5.5 or less typifies this ecological type. The fish community is dominated by a relatively small number of acid-tolerant species such as redfin pickerel and brown bullhead, and fishing opportunities are more restricted than in less acid, larger stream habitats.

6. *Nonacidic Upper Reaches of Large Streams.* At present, our data are not adequate to identify stream segments that are characteristic of this ecological type. It can be anticipated that this ecological type would not be well represented on the Croatan National Forest. Where it does occur, fish species diversity should be considerably greater than in similar, more acidic streams.

7. Large Acidic Natural Lakes. In North Carolina, this ecological type is unique to the Coastal Plain and is represented by Great and Catfish Lakes.

8. Acidic Ponds. A pond may be a natural or manmade body of water. Typically, size is less than five acres. Ponds in this ecological category have a pH less than 5.5.

9. Nonacidic Ponds. Ponds with a pH equal to or greater than 5.5. An example is Cedar Swamp Pond. Although rare on the Croatan, this type pond has the capacity to be intensively managed for several species of sport fish.

10. Estuarine Branches. Short drainages into saline, lower reaches of rivers such as the White Oak, Newport, Neuse, and Trent, or into estuarine portions of ocean sounds.

11. Estuarine Creeks. Small streams that are largely contained within salt-marsh ecosystems. Salinity is typically high and the biota are dominated by marine species. These habitats are often important nursery areas for many species of saltwater fish and shellfish.

Although there have been no recent angler surveys on the Croatan, fishing use is estimated to be very low relative to other areas with comparable miles of stream and acres of lakes. Angler interest is high, but the acidic nature of many Croatan waters severely limits opportunity. From a more positive perspective, many of the Croatan waters are nearly pristine, and allow anglers to fish in high quality natural environments in relative seclusion. These opportunities are particularly well represented on larger creeks such as Brice, Hunter, Holston, and Hadnot Creeks and the upper- and mid-reaches of the Whiteoak River.

Fisheries management activities that might occur include: the construction and intensive management of ponds and small lakes that are accessible to bank fishing anglers of all abilities; development of "canoe ways" and bank fishing trails to allow more bank fishing opportunities, and interagency cooperative projects aimed at improving populations of marine and anadromous fish species such as striped bass.

Environmental Consequences

Forest management activities that have the potential to affect fisheries habitat quality include: (1) any ground disturbing activities that could result in erosion and stream sedimentation, (2) application of pesticides, (3) application of fertilizer or other nutrients, and (4) riparian area tree harvest or land disturbance. None of these activities is part of any proposed alternatives. The flat terrain and riparian area protection measures that would be included under all alternatives greatly reduce the potential for off-site effects in aquatic systems. A more real threat may be activities that would result in increased fishing pressure in areas that have limited capacity and activities that result in the transport of significant quantities of nutrients to receiving waters.

As was pointed out earlier, the protection of bottomland hardwoods for fisheries and wildlife purposes combined with the relatively flat terrain of all upland areas on the Croatan greatly reduces the potential for land management activities or recreation activities that affect surface hydrology or negatively affect aquatic resources.

Alternative A: This alternative would continue the present level of forest and fisheries management activities. Emphasis would be on limited fisheries habitat improvement activities and limited surveys of distribution and relative abundance of different fish species. Fishing opportunities would remain very limited, and little action would be aimed at increasing bank fishing opportunities through construction of ponds, small lakes, and bank fishing trails. Existing riparian area protection guidelines, combined with a terrain that is not easily erodible, minimizes the consequences of land disturbing activities, timber

harvest, silvicultural practices, or prescribed fire as these activities relate to aquatic environments. No direct or indirect effects on aquatic resources are anticipated under this alternative.

Alternative B: Emphasis in this alternative would be on better aquatic resource inventories and monitoring and the increase of fishing opportunities by construction of bank fishing trails, canoe launches, and ponds and small lakes. None of these activities is expected to negatively influence other resources. The potential harvest in all waters other than newly constructed ponds and small lakes may be reduced if angling pressure cannot be maintained at acceptable levels. No other direct or indirect effects are anticipated.

Alternative C, C-Modified,D, and E: Each of these alternatives involves additional recreation development, more intensive timber harvest and silvicultural practices, and more effort to increase fishing opportunities. No direct effects are anticipated under any of the alternatives. Increased accessability to existing aquatic resources may indirectly limit the ability of a given water source to support acceptable levels of angler harvest. Construction of canoe trails, bank fishing trails, and small lakes and ponds would measurably improve fishing opportunities on the Croatan.

Cumulative Effects of Alternatives on Rare Aquatic Species: Analysis of the risks to viability of rare species is documented in Appendix H. The Croatan crayfish is a species of concern, however, none on the alternatives would impose substantial risks of this species persisting on the CNF.

3.3: Cultural And Economic Environment

3.3.1. RECREATION

Affected Environment

Much of the recreation on the CNF occurs on significant bodies of water within a few miles of the Atlantic Ocean; and most of these waters have a tidal influence. These tidelands waters are among the most important aspects of recreation on the CNF.

The CNF climate and demographics sustain a year-round recreation program. The CNF has much milder winters than the mountains in western North Carolina, and winter camping, hiking, and fishing, are quite popular. Summers are considerably hotter than in the mountains, but because of the nearby ocean beaches, the CNF receives considerable summer use from families with schoolchildren. Spring comes earlier and fall lasts longer than in the mountains. Many retired and semi-retired people, and families without children vacation in the area during those periods. The retirement community is rapidly expanding in the area, and demand for year-round recreational opportunities is expanding.

The Recreation Opportunity Spectrum (ROS) provides planners a way to divide outdoor recreation settings, activities, and experience opportunities into several categories: Primitive, Semi-primitive Non-motorized, Semi-primitive Motorized, Roaded Natural, Rural, and Urban. Opportunities range from a very high chance of solitude, self-reliance, challenge, and risk, to a highly social interactive experience. All of these categories are represented on the CNF except urban and primitive. ROS settings are partially determined by the location and development level of roads, trails, and developed recreation areas. ROS settings are also influenced by the density of non-natural visual impacts, such as roads,

houses, clearcuts, towers, and military flight paths. Approximately one-fourth of the Croatan is in the Semi-primitive Non-motorized and Semi-primitive Motorized settings. Most of this area is Wilderness and Roadless Areas. The rest of the CNF is in Roaded Natural and Rural settings. A more complete description of the ROS system is found in Appendix G of the Croatan National Forest Plan document.

Table 3.25. ROS class, acres, and percent of total acres.

ROS Class	ROS Acres	Percent of Total Acres
SPNM	35,785	22
SPM	9,247	6
RN	101,188	62
R	16,141	10

Over the planning period, possible changes that would influence ROS settings for lands on the CNF include: 1) variations in road and trail density – either building new roads and trails or closing existing ones; 2) continuing private development in the urban/rural interface at the edge of the forest and on private in-holdings; 3) increasing the size and/or development level of recreation sites on the forest; 4) variations in location, intensity, and methods of timber harvest; 5) intensity and frequency of prescribed fire applications; and 5) changes in the intensity of military over-flights and on-the-ground training.

Recreation use is measured in terms of recreation visits to the forest. In 2000, the Forest Service began a systematic survey of recreation use and user preferences to obtain the more accurate information. This information will be undated periodically. The Coastal area of North Carolina is expected to show a 23 % population increase by 2020. Participation rates by the public in outdoor recreation activities are also expected to increase slightly over the period. The most popular recreation uses for public lands in Coastal North Carolina are driving for pleasure, picnicking and day use activities, and viewing nature and wildlife. Hiking is by far the most popular trail activity. Recreation surveys show the greatest growth areas for recreation in Coastal North Carolina over the next 25 years will be viewing nature, visiting historic sites, and swimming in streams, lakes, and the ocean. Participation rates in some other popular activities such as horseback riding, fishing, developed and dispersed camping, and mountain biking are expected to increase at rates similar to overall population growth.

Existing CNF capacity for developed camping is expected to meet demands for the planning period. The development of additional hiking trails is expected to enable demand to be met for this popular activity. New dispersed and day use facilities proposed in this plan will come close to meeting demand for those activities. New trail opportunities for mountain biking and horseback riding are planned to be developed during the planning period, but probably will not meet expected demand due to physical limitations for new trail construction on the CNF. The Forest Service will not be able to meet demand for off-highway vehicle (OHV) recreation. The Forest Service will work cooperatively with other governmental and private interests to assist them in helping to meet demand for these other trail activities.

Currently, interpretive information is provided at five areas on the CNF – at four developed recreation sites and also the district office. The most in-depth interpretive sequence can be found along the Tidelands Trail within the Cedar Point Recreation Area. Themes of these interpretive topics include area history, local ecosystems, and the effects of natural change on the local environment.

Environmental Consequences

Most of the effects from fire and timber regeneration on recreation are tied to the impact to the scenery and the expectation visitors have of what they'll see on the CNF. A discussion of these impacts is in the Scenery Management section of this Chapter. A brief description of effects on scenery follows.

Effects Common to all Alternatives

Many of the harvest areas for the next decade would be concentrated near recreation facilities like Cedar Point, Pine Cliff, and Brice Creek. Some are near Millis Road, Haywood Landing, and the Long Point Road. While timber harvesting is occurring, there is the possibility of disruption along entrance roads into recreation sites, additional dust and noise, and potential safety problems. Logging debris left within view of recreation sites can mar the natural scenery that visitors expect. Visitors might avoid recreation sites where timber regeneration is occurring, or the quality of experience may be degraded.

The large burning program on the CNF would affect the recreating experience, but it is difficult to correlate on the ground burning with recreation developments. Except for the hardwood corridors, and some of the pocosins, it is probable that most of the forest would be burned at some time. There are short- and long- term effects from burning. Short-term effects include patches of blackened forest and scorched tree crowns, hazy skies, and smoke concentrated in some areas. Longer-term effects include slow healing or permanent plowlines that are visible from recreation areas, and plowlines along access roads.

Benefits from timber regeneration and burning would include open understory views of the forest, enhancement of scenes like those in longleaf pine savannas, and less vegetative debris left in view. Burning also reduces ticks, chiggers, and brush that hide snakes.

Alternative A: This alternative would continue the program and variety of recreation settings and experiences that now exist on the CNF. Existing use exceeds, by about 15 percent, what was anticipated when the current plan was written. Overuse of undeveloped sites would continue, causing resource changes, and demand for more rustic and primitive facilities would not be accommodated. Construction of more highly developed facilities at Cedar Point would be completed, which would help ease current demand. Demand for new trail systems for mountain bikers and horseback riders would be only partially accommodated on existing trails and closed roads. OHV routes (about 36 miles) would remain the same, as would use of unauthorized trails and roads by OHV riders. Since user-created, unauthorized trails and roads are distributed widely throughout the Forest, OHV riders perceive most of the natural forest as open. The cumulative effect is that recreation use would continue to increase over the decades, even though capacity remains the same. Long-term effects would be greater numbers of people concentrated in recreation sites and on the trails, with some use spilling over into the general forest. Thus, the ROS social setting would change to reflect increased numbers of people in contact with one another at highly used and popular facilities. There would most probably be resource damage through overuse of sites. Visitors who are seeking more solitude would recreate in relatively unused areas like the Wildernesses.

Alternative B: Emphasis in this alternative is on non-motorized recreation opportunities and more rustic recreation developments. Little new construction would occur unless opportunities for partnerships and funding were available. Rural and Roaded Natural ROS areas would increase in PAOT capacity by about 10 percent, while Semi-primitive Motorized capacity increases by about 20 percent. This increase

would partially address the demand for more rustic facilities. Semi-primitive Non-Motorized use is expected to increase by 31 percent, so more people would use the rustic recreation sites, and increased numbers of people would be in contact with one another. This crowding could lead to resource damage and lower quality visitor experiences. As in Alternative A, demand for new trail systems for mountain biking and horseback riding would only be partially accommodated on existing trails and closed roads, increasing PAOT capacity by 7 percent. The only OHV routes that would be designated would be loops and routes that avoid sensitive wildlife and plant habitats. OHV trail miles would decrease to approximately 8 - 10 miles; the remainder of roads, trails, and all other areas of forest would be closed to OHV use. Overuse of some trails is highly likely because of decreased miles available.

Interpretive locations would almost double, utilizing existing recreation sites and trailheads. Increased interpretation would enhance visitors' experiences and share information on resource management, ecosystems, and history of the area. Better-informed visitors are good partners in helping to manage the CNF.

The cumulative effect of use is projected to increase by 18 percent over the next three decades, while PAOT capacity remains the same. This would be accommodated through increased use during the week. Long-term effects would be higher numbers of people using recreation sites and on trails, with some use spilling over into the general forest. Thus, the ROS social setting would change to reflect increased numbers of people in contact with one another at highly used and popular facilities. For instance, a Roaded Natural setting may become a Rural setting due to increased encounters. There would probably be resource damage through overuse. Visitors who are seeking more solitude would recreate in more lightly used areas like the Wildernesses. OHV users in particular would see a change. Over time, resource damage and use of unauthorized trails would subside if enforcement measures are effective.

Alternatives C, C-modified, and E: Recreation opportunities and new development would support nature and heritage-based tourism. Development would occur at both the more developed (Rural and Roaded Natural) and the more rustic (Semi-Primitive) ends of the ROS spectrum. Developed sites (Rural) would increase by 15 percent, and rustic development at water-based locations (Roaded Natural and Semi-Primitive Motorized) would increase by approximately 40 percent. Thus, demands for more rustic recreation sites with water access would be met, rounding out the more highly developed opportunities. Opportunities for hunting and wildlife viewing would be increased through additional development of trails and viewing platforms at Catfish Lake Impoundment. Designated trail systems for mountain biking and horseback riding would be constructed using existing roads and new trails, increasing trail PAOT capacity by 27 percent. Thus current demand for these trails would be met with a well-defined trail system. Interpretive sites would triple from existing to about 17 sites. Access to an extensive water-based trail system through the CNF and nearby areas would be available. This will require partnerships with local entities to enhance this opportunity for saltwater and inland access to this system. In addition to interpretation at recreation sites, a New Bern-Morehead City auto tour is proposed, interpreting historic and cultural features. Increased interpretation opportunities would enhance visitors' experiences and share information on resource management, ecosystems, and history of the area. Better-informed visitors are good partners in forest management.

Cumulatively, these alternatives would meet the demands for more rustic ROS experiences over time. By emphasizing development of existing SPM areas, user demands would be accommodated, while

reducing the risk of resource damage. Rural and Roaded Natural ROS opportunities would also increase, so that by the end of the third decade use of facilities would not exceed capacity and visitors' expectations would be met. Trail systems would be well defined and would allow phasing out and closing of unauthorized trails that are damaging natural resources. Thus, disturbances to rare species and habitats from recreational activities would decrease.

Alternatives C/C-modified and E differ in their approach to OHV management. Alterative C/C-modified would attempt to provide a loop system in the area from Nine Foot Road to Millis Road. Some roads in the Black Swamp area would continue as OHV trails. About 20-30 miles would help meet demand for OHV activity, and most unauthorized routes are phased out. Alternative E would provide a well-designed OHV system in the Black Swamp area and close out the remainder of forest to OHV use. About 8-10 miles would be provided. Riders would experience a demanding course requiring a high skill level. The social setting would be Rural, conducive to outings and high levels of interactions. Foregone are benefits of remote access to OHVs.

Alternative D: Recreation development would encourage a full range of recreational activities and provide easy access to the forest. As in Alternative C, development at both the more highly developed (Rural and Roaded Natural) and the more rustic (Semi-Primitive) ends of the ROS spectrum would occur. More developed sites (Rural) would increase by 30 percent, and rustic development at water based locations (Roaded Natural and Semi-primitive Motorized) would increase by approximately 40 percent. Thus, the demands for more rustic recreation sites with water access would be met, and more highly developed opportunities would be satisfied. Greater emphasis would be on attracting out-of-region tourists. Opportunities for hunting and wildlife viewing would be increased through additional development of trails and viewing platforms at Catfish Lake Impoundment. About 20-30 miles of OHV trails would be available, with the possibility of a new system if demand warrants. A new system of trails may result in less confusion and unauthorized OHV use. Interpretive sites would triple from existing to about 18 sites. In addition to interpretation located at existing recreation sites, a New Bern-Morehead City auto tour is proposed, interpreting historic and cultural features. Increased interpretation opportunities enhance visitors' experiences and provide an opportunity to share information on resource management and the ecosystems and history of the area. Better-informed visitors are good partners in CNF management.

Because access to the CNF would be easier (more open roads), use would probably increase and visitors would utilize more areas of the Forest. While this alternative provides the greatest range of recreation opportunities for visitors to the forest, there may be a greater chance for conflicts between forest users' demands and the ability to provide high-quality habitat for wildlife and some plant species. Among users there may be conflicts, and those who desire more solitude may find it difficult.

The cumulative effects of this alternative over time are very similar to Alternative C. This alternative would meet the demand for all the ROS experiences on the CNF. By emphasizing development of existing Semi-primitive Motorized areas, user demand would be accommodated with a low risk of resource damage. Rural and Roaded Natural ROS opportunities would also increase, so by the end of the third decade facilities would not be over-used and visitors' expectations would be met. Trail systems would be well defined, and use of unauthorized trails that are damaging natural resources would be stopped. Thus, disturbance to rare species and habitats would decline.

3.3.2. RIVER CORRIDORS ELIGIBLE FOR WILD AND SCENIC RIVER STATUS

Affected Environment

Wild and Scenic Rivers (W&SR) are segments of watercourses that contain a mixture of natural, cultural, scenic and recreational values that are outstanding for their particular geographic area. Through designation to Wild and Scenic River System, their outstanding values are retained and enhanced on national forest land. Two rivers, White Oak and Brice Creek (which includes portions of East and West Prong Creeks) are eligible for WSR status. Since the rivers' corridors are primarily in private ownerships, further study of their suitable classifications would be conducted jointly with State of North Carolina, who would lead the effort. The rivers characteristics are described as follows.

The White Oak River is free flowing and has outstanding scenic, botanic, wildlife, historic, and cultural values. Plant communities provide scenery in four distinct ecotypes -- saltwater marsh, hardwood swamp, upland hardwood forest, and pine forest. The river changes from a fast-flowing, narrow, meandering, creek in an upland hardwood forest to a broad, sluggish, coastal blackwater river lined with tidal cordgrass marsh. It is rich in wildlife providing important habitat for the American alligator and a number of wading birds and waterfowl. It also provides habitat for seven threatened or endangered wildlife species listed on Federal or State registers. The river has a high probability for historical and archeological sites. There are 70 known sites (13 on NF lands), 36 (seven on CNF lands) of which may qualify for listing on the National Register of Historic Places. Further study of its suitability and potential classification is deferred to the State of North Carolina because the CNF comprises less than 20% of the land in the river corridor, all on the east back of the river.

Brice Creek has four different segments along the 27.4 mile corridor, including West Prong, East Prong, their junction with Brice Creek, and continuing down to the confluence with the Trent River. The creeks are free flowing and have outstanding scenic, botanic, wildlife, and historic, and cultural values. Areas directly adjacent the streams consist of lake and stream swamps, where the vegetation is cypress and closed canopy hardwoods, and the water is colored by tannins. Animals include double breasted cormorant, Neuse river waterdog, and American alligator. Along Brice Creek are many stands of dry mesic hardwood and pine with only small remnants of mixed pine-hardwood, mainly loblolly, sweetgum and oaks. Animals include RCW and many other bird species. Some areas have drainage slopes, where oak and hickory dominate. The diamondback rattlesnake, black bear, wild turkey and many bird species are present. West Prong Creek is in low pocosin on very deep peatlands, which support stunted pond pines and dense, short evergreen shrubs. Rare animals include American alligator, eastern cougar, Bachman's sparrow, Croatan crayfish, and RCW. The habitat supports black bears and many bird species. In addition to lake and stream swamps and mesic hardwood-pine, East Prong Creek goes through stream and river terraces. Here, trees include predominantly beech, poplar, hickory, and oak. The habitat supports black bears, wild turkeys, and many birds. Brice Creek has high probability for historical and archeological sites. There are 17 sites that may qualify for listing on the National Register of Historic Places.

Environmental Consequences

Alternative A: The White Oak River portions of the CNF would be managed to maintain the outstanding values that made it eligible for designation. The CNF lands would be managed under the River Corridors Eligible for Wild and Scenic River Status management prescription. Brice Creek would be

managed under the Hardwoods Cypress Wetlands prescription. The standards for scenery, access, and development in these prescriptions are similar to standards in the River Corridors Eligible for Wild and Scenic River Status prescription; however, it would not be studied further for Wild and Scenic Status. Long-term cumulative effects to both the White Oak and Brice Creek would be the same as the existing condition.

***Alternatives B, C, C-modified, and E*:** The White Oak River and Brice Creek (The CNF portion) would be studied for Wild and Scenic River suitability jointly with the State of North Carolina, who would lead the effort. The CNF lands would be managed under the River Corridors Eligible for Wild and Scenic River Status management prescription. River corridors would be managed to protect their values. As a result, scenery would be better protected and there would be fewer developments and less vegetation management than in Alternative D, which does not recommend further study. Frequently, WSR status may increase public interest and awareness of river resources. Effects of these rivers in WSR status are the societal benefits, and the prestige of having a National Wild and Scenic River in the area which is likely to increase tourism. Recognizing these rivers as wild and scenic would help keep them in their present natural state and would help emphasize their scenic quality.

The positive cumulative effects of potential WSR status continue through time. As populations and the pressures for development increase, the value of managing these areas in their relatively natural condition would increase. Management as WSR could be difficult when catastrophic events occur. Timber harvesting, road building, and other activities necessary to clean up after such events would have to be done in a more restrictive way, adding to the costs of projects.

Alternative D: White Oak and Brice Creek would not be recommended for further study of suitability as WSR. Both White Oak and Brice Creek would be managed under hardwood and cypress wetlands prescription for the CNF portions. The standards for scenery, access, and development for this prescription are similar to standards in the River Corridors Eligible for Wild and Scenic River Status prescription. The main difference would be that maintaining a free flowing condition is not required.

Cumulative effects include pressures to develop both White Oak River and Brice Creek for other uses may increase over time. These uses could impact their values to the point where they would no longer be eligible for Wild and Scenic River status. Values at risk include water quality, natural vegetation, and wildlife and fisheries habitat, as well as the social value of scenic quality. Recreation use would continue and probably increase to a more developed, less natural ROS setting, and heritage resources would be protected through existing laws.

3.3.3. SCENERY MANAGEMENT

Affected Environment

All national forest landscapes have value as scenery, but some have more value than others. The Scenery Management System (SMS) helps to inventory and classify the importance, or value of landscapes as they relate to people and the ecosystem.

The first scenery mapping and inventory that was done for the 1986 Croatan Uwharrie National Forest Management Plan used the Visual Management System (VMS). The Scenery Management System, (SMS) released in 1996, evolved from and replaces the VMS. The SMS differs from the VMS in that it

borrows from and is integrated with the basic concepts and terminology of ecosystem management. SMS provides for improved integration of aesthetics with other biological, physical and social/cultural resources in the planning process. Attractive scenery ties directly with water and vegetation types on the CNF. Class A, the most attractive scenery, includes rivers, lakes and sounds, marshes and tidal influence areas, swamp forests, low pocosin, longleaf pine savannas with wire grass understory, and hardwood slopes. It also includes potential restoration areas for longleaf pine savannas.

Scenic classes are one component of the SMS. They measure the relative importance of landscapes, and during project planning, help compare the value of scenery with the value of other resources. Scenic classes are determined by combining the three classes of scenic attractiveness with distance zones and concern levels. Scenic classes 1 and 2 have high public value and are used in this document to identify areas that need special mitigation measures if vegetation management activities are implemented. The SMS is explained in more detail in Appendix F of the CNF Plan.

On the CNF, scenic classes 1 and 2 are the foreground (up to 1/2 mile from a road) along most of the major roads, along trails and in recreation sites. There are 25,266 acres in scenic class 1 and 47,109 acres in scenic class 2. Class 1 areas occur along the roads leading to recreation sites like Cedar Point, Pine Cliff, and Brice Creek, while class 2 areas concentrate along U.S. Highway 58 with smaller concentrations along Mill Branch Road, Millis Road, Haywood Landing, Holston Creek Road, and the Long Point Road area. Although these acres are within scenic classes 1 and 2, not all of them are visible from sensitive viewing locations, like roads, trails, streams, or recreation sites. A field review is needed to determine the sensitivity of each location.

The large burning program on the CNF has an effect on the scenic quality. It is difficult to correlate where burning is going to occur in relation to the scenic class 1 and 2 areas. Except for the hardwood corridors and some of the pocosins, it is probable that all the high scenic areas would be burned at some time.

The existing condition of the landscape is measured as scenic integrity, which is the degree of alteration from a natural-appearing condition. The suitable harvest acres in scenic class 1 and 2 fall primarily into a High scenic integrity level, meaning the landscape appears unaltered, and human-caused activities are not readily evident. A small number of acres fall into a Moderate or slightly altered level, and a very few acres are in Low, moderately altered, and Very Low, heavily altered. See Appendix F of the CNF Plan for a more detailed discussion of scenic integrity.

A variety of techniques can be used to maintain the scenic quality of the class 1 and 2 areas. These may include smaller harvest unit sizes, feathering the edges of unit boundaries, minimizing the size of openings onto major roads, scheduling longer harvest rotations so adjacent units have more time to revegetate, and thorough clean-up of logging debris in close foreground viewing situations. Burning techniques include minimizing the size of plowlines, and keeping them out of view from travelways or trails, using natural features such as creeks as wet firelines, allowing a mosaic burn pattern that leaves some green vegetation within the unit, and removal of large unburned debris in close foreground viewing situations.

Environmental Consequences

High scenic quality depends on landscapes appearing natural with little evidence of management activities. Visitors have expectations of what they would see in the forest and these expectations usually include attractive and natural appearing scenery. What visitors see affects their experiences and enjoyment of recreation activities and the forest in general. If scenic quality is lost through removal of large areas of timber, or if areas of logging slash and roads are left in view, visitors' experiences are also diminished. Activities that might affect scenic quality include timber regeneration, road construction, special uses like transformer lines and corridors, and fire plowlines and burned areas. Effects to scenic quality can be mitigated depending on how activities are carried out. For instance, timber harvesting can create vistas, and fire can open up the understory to create more expansive views into the forest, and reduce unattractive logging debris. Timber harvesting and fire are most likely to have the greatest effect on scenery and would be the activities discussed and evaluated in each alternative.

Scenic Integrity Objectives (SIOs) are the standards by which scenery will be managed in each prescription. SIOs vary by prescription and hence by Alternative. Alternative C-modified is the same as Alternative C for SIO acres and environmental consequences. The table below displays the full array of SIOs by Alternative (Alternative A is managed using the Visual Management System).

Table 3.26. SIOs by Alternative.

SIO	Alt.B	Alt.C/C-modified	Alt.D	Alt. E
Very High	65,000	33,000	34,000	33,000
High	54,000	70,000	68,000	70,000
Moderate	28,000	14,000	23,000	14,000
Low	15,000	44,000	36,000	44,000

Alternative A: Direction for this alternative uses the existing Visual Management System (VMS). The areas of Retention and Partial Retention Quality Objectives from the VMS coincide with areas of high scenic quality (scenic classes 1 and 2) in this planning effort. Over the 10-year planning period, approximately 1,200 acres would be regenerated, and about 50 percent of those acres would be in Retention and Partial Retention areas. This alternative regenerates the smallest number of acres of all the alternatives. Depending on the size, location and timing of the clearcut units within the retention and partial retention areas, there would be little impact on the scenic quality.

About 15,000 acres would be burned per year. Although it is difficult to correlate how many of these acres would occur in scenic class 1 and 2 areas, it is known that none of this would occur in pocosin areas, and very little during the growing season. Because the pocosins can benefit in appearance from burning, and longleaf pine areas benefit from growing season burns, enhancing scenery through burning in this alternative.

Regeneration acres would remain approximately the same each 10-year period. The cumulative effect over time is the appearance of the viewing corridors would be of younger age classes and may appear managed and not as natural-appearing. After 130 years, approximately 15,000 acres would be in the high scenic quality longleaf pine savannas. This is twice as much as Alternative D, and 25 percent less than in Alternatives B, C, C-Modified, and E.

No burning would be done in the pocosins, increasing over time the likelihood of wildfire. Impacts to the scenery would include large burned over areas and extensive soil disturbance from use of large equipment to fight the fire.

Alternative B: Approximately 1,046 acres would be harvested during the 10-year planning period. One half of these acres are in the scenic class 1 and 2 areas. The harvest method would be group selection in ¼ acre to 1 acre size openings. Because of their small size, these units would have very little impact on the scenic quality of the area. Longleaf pine savannas, which are some of the most attractive scenery, would double in acreage from existing condition. Because of these two situations, this alternative best retains the scenic quality of the CNF.

This alternative burns the least amount per year, about 12,000. Growing-season burns are 1,000 acres or five times Alternative A, but still only 1/10th of alternatives C and D. The growing-season burns would enhance the longleaf pine areas, thus enhance scenic quality in these types. Since the pocosins are not burned, they would remain visually unattractive and impenetrable. Because of the lower amount burned, this treatment would have little effect on scenic quality.

Conversion to longleaf pine acres would remain constant over the decades, and remains the same for mixed pine acres except for one decade. Cumulative effects, after 130 years, approximately 20,700 acres would be in the high scenic quality longleaf pine savannas, a three-fold increase from the existing, and assuming the restoration is successful. This, along with Alternatives C and E, has the highest number of longleaf pine savanna acres and would add to the overall scenic quality of the CNF.

Alternative C/C-modified: Approximately 6,200 acres would be harvested during the 10-year planning period in this alternative. Half of these acres are in the scenic class 1 and 2 areas. Approximately 2/3 of the acres in scenic classes 1 and 2 would be clearcut. The other 1/3 would be heavily thinned leaving all the longleaf pine, which creates a more attractive setting for the future. An additional approximately 1,800 acres would be thinned to restore mixed pine and hardwoods. There would be very little short-term affect from this thinning, but scenic quality would be enhanced in the long term.

Overall this alternative would have the most impact on scenic quality because of the number of clearcut acres, almost 275 acres per year for 10 years in the scenic class 1 and 2 areas. That amount of clearcutting doesn't leave very much time for one area to begin revegetation before another area is cut. Since many of these areas are near recreation sites and along major roads, recreation visitors and others who desire natural appearing scenery likely would be disappointed with their recreating experience. During this first decade, therefore, visits might decrease, and visitor complaints about the scenery might increase.

Over 25,000 acres would be burned each year in this alternative. Approximately 9,000 acres would be in pocosins, and growing-season burns would double from Alternative B to 2,000 acres. Although the total amount burned is high, the opportunity to enhance the scenery, through burning longleaf pine savannas and clearing debris, is the greatest in this alternative. Short-term impacts, however, would include blackened areas, scorched tree crowns, and smoky skies.

During the second decade, clearcutting would decrease to about 1/10th the previous decade. Clearcut acreage would pick back up in the 5th and 6th decades, and then end by the 8th decade. Heavy thinning would decrease to about 100 acres per year. Almost all the scenic class 1 and 2 acres suitable for

harvest would be harvested within the first few decades. The cumulative effect of the heavy regeneration of the first decade would take about two decades to recover, but when it does, the areas would be enhanced because of their conversion to longleaf pine savannas. After 130 years, there would be almost 20,700 acres of longleaf pine savannas, which like Alternative B, would enhance the scenic quality of the CNF.

This alternative has the most positive effect over time from fire. Longleaf pine savannas would be enhanced, the pocosins would be more visually attractive, and a diversity of understory vegetation would be present. The cumulative negative effects would include many permanent fire plowlines visible from main roads and from the air.

Alternative D: Approximately 4,000 acres would be harvested during the 10-year planning period in this alternative. About 1/2 of these acres are in scenic class 1 and 2 areas. Timber removal would leave seed trees, and there would be very little clearcutting. The effect to the scenery is about the same for the two methods. An additional approximately 1,800 acres would be thinned to restore mixed pine and hardwoods. There would be very little short-term effect from this thinning and scenic quality would be enhanced in the long term.

Next to Alternative C, this alternative would have the most impact to the scenery. Cutting almost 200 acres per year for 10 years in high-scenic-quality areas would leave little time for one unit to revegetate before another is harvested. The impact would include many young stands of pine timber, rather than older, more natural appearing mixed vegetation types. As in Alternative C, there might be a decrease in visits and an increase in complaints from visitors because their expectations of high quality, natural appearing scenery are not met.

Over 27,000 acres would be burned each year in this alternative. Approximately 9,000 acres are in pocosins, and growing-season burns are 1,000 acres. Although the total number is high, the opportunity to enhance the scenery is high in this alternative. Growing-season burns are 1/2 of Alternative C, so positive effects to longleaf pine are somewhat less. Short-term impacts would still include blackened areas, scorched tree crowns, and smoky skies.

Over the decades, the number of harvest acres fluctuates between 2,500 and 4,000. In the 8th decade, this acreage levels off to about 3,800 acres per decade. Because of these consistently high numbers of harvest acres, the cumulative effect on high-quality scenery would continue to decline over time. As in Alternative C, almost all the scenic class 1 and 2 acres would be harvested in the first few decades. In addition, longleaf pine is not emphasized, so at the end of 130 years, there would only be 8,600 acres on the forest. Longleaf acreage would be about 1/3 of Alternatives B and C, and 1/2 of Alternative A. Thus, this alternative has the highest negative long-term impacts to the scenery.

This alternative has a positive cumulative effect over time from fire. The limited number of longleaf pine savannas would be enhanced, the pocosins would be more visually attractive, and a diversity of understory vegetation would be present. The long-term negative effect would be many permanent fire plowlines visible from main roads and from the air.

Alternative E: Approximately 2,500 acres would be harvested during the 10-year planning period in this alternative. Half of these acres are in the scenic class 1 and 2 areas. Approximately 2/3 of the acres

harvested in scenic classes 1 and 2 would emphasize two-aged regeneration over clearcut. The other 1/3 would be heavily thinned leaving all the longleaf pine. The treatment methods would create a more attractive setting for the future compared to Alternative C.

Overall this alternative would have the moderate impact on scenic quality because of the amount of regeneration, almost 140 acres per year for 10 years in the scenic class 1 and 2 areas. Two-aged regeneration would leave large trees, so the impact on scenery would likely be a visually pleasing scene after the activity is finished. Since many of these areas are near recreation sites and along major roads, recreation visitors and others who desire natural appearing scenery likely would be impacted during the activity of two-aged regeneration. Adverse scenic impacts from clearcutting would occur, but would be substantially reduced from Alternative C. The interspersion of two-aged and thinning with clearcutting would allow quick recovery of scenic values in class 1 and 2 areas.

Effects of burning are similar to Alternative C. Over 25,000 acres would be burned each year in this alternative. Approximately 9,000 acres would be in pocosins, and growing-season burns would double from Alternative B to 2,000 acres. Although the total number of acres burned is high, the opportunity to enhance the scenery, through burning longleaf pine savannas and clearing debris, is the greatest in this alternative. Short-term impacts would still include blackened areas, scorched tree crowns, and smoky skies. Cumulative impact of permanent fire plowlines would negatively affect scenery from high use roads and the air.

3.3.4. WILDERNESS AND ROADLESS AREAS

Affected Environment

Wilderness

The 1984 North Carolina Wilderness Act established four Wildernesses totaling 31,221 acres on the CNF. They are Catfish Lake South (8,530 acres), Pocosin (11,709 acres), Pond Pine (1,685 acres), and Sheep Ridge (9,297 acres). All four Wildernesses are entirely in pocosin. Pocosin vegetation is typically dense, almost impenetrable. Pocosins are rich and diverse in both plants and animals. Dominant trees include pond pines, with some loblolly, and bays. The presence of abundant and diverse insectivorous plants is a unique feature of pocosin vegetation.

All four Wildernesses had a low level of prior disturbance when designated in 1984. Disturbances include old fire plowlines, bedded plantations, and closed roads. Wildfire has burned through some of the Wildernesses and affected the vegetation. These disturbances are being allowed to revegetate naturally. No logging has been done in the four Wildernesses since the National Forest was established in 1933.

No trails exist in any of the Wildernesses. Access is by cross-country travel through dense vegetation on boggy soils. Even with these difficult travel conditions, about 500-600 people are estimated to use each Wilderness annually, which is primarily used for big game hunting around the Wilderness boundary. People boating on Catfish Lake or Great Lake may use the shorelines in Catfish Lake South and Sheep Ridge Wildernesses.

Existing Wilderness character is described by five elements: natural integrity, apparent naturalness, remoteness, solitude, and primitive recreation.

Natural Integrity - The pocosins in the Wildernesses are among the least disturbed on the CNF and probably in North Carolina. Natural fire is an important factor in the physiognomy and species composition of pocosins, as well as contributing to nutrient cycling. More lightning-caused fires are allowed to play a more natural role in Wilderness. Prescribed natural fire is not addressed in the current plan. Management ignited prescribed fire is permitted in Wilderness, but because of the high risk factors has not been used.

Apparent Naturalness - All four Wildernesses generally appear natural and undisturbed to most visitors, but there is some visual evidence of prior disturbances. Some old fire plowlines are still noticeable on the landscape even after several decades of wilderness management. Revegetation is slow because the organic growing medium first must be restored. Trees growing in rows in the old plantations may still be discernible to some viewers at close range. There are no areas of concentrated recreation use, such as campsites, and associated site impacts.

Remoteness - Pocosins are among the last remote regions of eastern North Carolina. Remoteness is partly attributed to the dense vegetation and tangled underbrush, which make it difficult to penetrate a pocosin for more than a few steps. The few people who attempt to traverse the Wildernesses probably experience a high sense of remoteness, except for the sight and sound of low-flying military aircraft, and motorboats on Great Lake and Catfish Lake. Although the dense vegetation ensures opportunities to feel remote within the Wilderness boundaries, all four areas are easily accessed by state or national forest roads. Portions of the boundary of each area are closely paralleled by roads, and in one case, a railroad. Even though they are easily accessed by roads, all but Pond Pine meet the Recreation Opportunity Spectrum criteria for semi-primitive non-motorized. See the following table.

Table 3.27. SPNM boundary acres.

Wilderness	Total acres	Approximate SPNM acres	% Meets SPNM	Miles of Boundary	% Boundary Adjacent Road
Catfish Lake South	8,530	5,631	66	18	40
Pocosin	11,709	8,020	68	24	29
Pond Pine	1,685	0	0	8	41
Sheep Ridge	9,297	4,906	53	18	42

Solitude - The four Wildernesses provide moderate to high opportunities to experience solitude, except for aircraft overflights. Flight track diagrams for Cherry Point and Bogue military facilities were correlated to National Forest boundaries. Based on this comparison mapping it is probable that flight paths between Cherry Point and Bogue pass over Pocosin Wilderness. These flights are reported to be at altitudes of 1,500 to 3,000 feet above ground level. The areas are largely natural appearing, with little to no evidence of human use. Since few people visit the Wildernesses at the same time and few people are traveling cross-country, the likelihood of encountering other users is low.

Primitive Recreation - The Wildernesses provide moderate to good opportunities for a primitive recreation experience. Opportunities include a number of natural hazards and challenging features: dense, impenetrable vegetation; no terrain features to orient by; mucky quick-sand-like soils; high temperatures and humidity for much of the year; and biting insects, poisonous snakes and possibly alligators. Traversing a pocosin requires a high level of orienteering skills and provides the wilderness visitor with many opportunities to experience solitude, remoteness, closeness to nature, adventure, risk, challenge and self-reliance. Hunting, which occurs in part in the Wildernesses and roadless areas, is the

largest single recreational use of the forest. Although hunting is increasing, other uses of the Wildernesses are experiencing no upward trend.

Roadless Areas
The CNF has seven inventoried roadless areas totaling 20,771 acres. These roadless areas are almost entirely within pocosin ecosystems, and are adjacent to the four existing Wildernesses, although some of them are separated by roads or a railroad. Four are proposed as boundary adjustments to existing Wildernesses. About 90 percent of the roadless areas are currently managed to retain roadless characteristics. Appendix C of this EIS includes the suitability analysis and recommendations for wilderness designation of these areas.

Natural integrity -the roadless areas are similar to the Wildernesses. They are adjacent to Wildernesses, which are comprised of intact pocosins.

Apparent naturalness - The roadless areas generally appear natural and undisturbed to most visitors, although all of the areas have had some level of disturbance, with most of it from road systems and activities associated with the roads surrounding them. Catfish Lake North has timber harvest units with plantations as young as 5 years old along Little Road and Catfish Lake Rd. There are also many firelines in the eastern third of the area. Catfish Lake South Additions A and B are undisturbed. Sheep Ridge Addition has old timber harvest units along the southern edge, wildlife fields on the east boundary, and extensive plow lines in the northern half. These were created in the l994 Fish Day Fire, which burned the entire area. Pond Pine Addition B, and Pocosin Addition are relatively undisturbed.

Remoteness, solitude, and primitive recreation opportunities are similar to those characteristics in the existing Wildernesses.

Two roadless areas, Masontown Pocosin and Union Point Pocosin, were evaluated and excluded from wilderness consideration. They did not meet the criteria for solitude, but are available for a vehicle-restricted, primitive recreational experience.

Environmental Consequences

Probable activities for the Wildernesses and roadless areas include recommending designation of some or all of the roadless areas as Wilderness, increasing trail access for hiking and horseback riding into the Wildernesses, closing roads that currently access the Wildernesses and roadless areas, and restricting the engine size for boats on lakes adjacent to the Wildernesses. Fire can play a large role in wilderness and management activities may include prescribed burning to reduce fuel build-up, allowing natural fire to burn in Wilderness, and altering the vegetation in the wildland urban interfaces.

Alternative A: Existing Wildernesses would remain the same, and the amount of use and type of use would change and increase at a rate similar to the past few years. The roadless areas inventoried for this planning process would be managed under current Management Area 5 standards. These include, in part, providing opportunities for semiprimitive non-motorized experiences, and high scenic quality. Standards in MA 5 would maintain about 90 percent of the areas with minimum roading and little development. Some vegetation management utilizing timber harvesting could occur in portions of Catfish Lake North, Catfish Lake South Addition A, Sheep Ridge Addition, and Pond Pine Addition B. The lands suitable for timber growing in these areas are along the perimeters and near roads. Prescribed

fire for fuel reduction or vegetation management in the roadless areas would be less restricted than if they were Wilderness, but very little burning is occurring in these areas under current direction. Wilderness boundaries would not be adjusted, so boundary management would remain difficult. There would still be opportunities for solitude and little evidence of human activities in the Wildernesses and roadless areas.

Cumulatively, there would be little long-term impact to the Wildernesses. They are protected from mechanical intrusion except for wildland fire suppression. Since fire is not often used in pocosins under current direction, over time, fuels could build up, increasing the chance of wildfire. Since little increase in hiking use is anticipated, wilderness qualities of remoteness, solitude, and primitive recreation would remain the same.

Table 3.27a. Management Prescription allocations by roadless area by alternative.

Catfish Lake North		**Alternatives**			
	B	**C**	**C-mod**	**D**	**E**
Prescriptions					
Wilderness	11294				
Hardwood Cypress Wetlands		61	61	801	61
River Corridors Eligible for Wild and Scenic River Status		740	740		740
RCW HMA		1077	1077	1077	1077
Wildland Urban Interface		1401	1401	1401	1401
Bear		7789	7789	7789	7789
Developed Areas		2	2	2	2
Small Pocosin Patches		224	224	224	224
Catfish Lake South B					
Wilderness	233	233	233	233	233
Catfish Lake South A					
Wilderness	172	172	172	172	172
Pocosin Addition					
Wilderness	286	286	286	286	286
Sheep Ridge Addition					
Wilderness	5716	0	0	0	0
RCW	77	77	77	77	77
Bear	0	5716	5716	5716	5716
Developed	3	3	3	3	3
Small pocosin	10	10	10	10	10
Pond Pine B					
Wilderness	2980		2980		
Wetlands		587		587	587
Lakes		3		3	3
RCW		273		273	273
Bear		2076		2076	2076
Small pocosin		41		41	41

Alternative B: This alternative would recommend adding the most acres into wilderness. All of the inventoried roadless areas would be recommended, for a total of 20,771 additional acres. Wilderness acres would be approximately one third of the total district in this alternative. Existing Wildernesses would continue to be managed as they are currently, with the addition of a boat engine size limitation on Great Lake. Approximately 50 miles of roads would be closed, about one third of those located within or adjacent to existing Wildernesses and roadless areas. These actions are consistent with and encourage the semiprimitive non-motorized qualities of Wilderness. Thus, the long-term value in designating all the roadless areas as Wilderness would be to preserve the areas for semiprimitive non-motorized and unconfined recreation, research, education, and habitat and ecosystem preservation. While these values would be enhanced, other activities that require easy access and use of motorized equipment, like fire fighting and search and rescue, would be made more difficult.

Over time, the cumulative effect of this alternative does the most to enhance and retain wilderness integrity and qualities of apparent naturalness, solitude, remoteness, and primitive recreation. All the roadless areas would be protected through designation as Wilderness. The use of fire would only be allowed to help suppress wildfire so few disturbances from fire plowlines would be evident. Over the long-term, the pocosin vegetation could be altered because of fuel build-up and lack of wildfire in the areas.

Effects Common to Alternatives C, D, and E: These alternatives would recommend studying for designation as Wilderness an additional 691 acres, including Catfish Lake South Additions A and B, and Pocosin Addition. These areas adjust boundaries of existing Wildernesses to reflect changes in ownership since the 1984 legislation. The boundary adjustments allow more flexibility to manage for Wilderness character.

The other roadless areas would be managed primarily under the black bear prescription, which would maintain most of the areas with minimal roading and development. Some vegetation management utilizing timber harvesting could occur in portions of Catfish Lake North, Sheep Ridge Addition, and Pond Pine Addition B roadless areas. The affected area would be less than in Alternative A.

Boat engine size would be limited on Great Lake. This action is consistent with and encourages the semiprimitive non-motorized qualities of Wilderness.

Approximately 2,450 acres of Catfish Lake and Sheep Ridge Wildernesses are in wildland urban interface areas. These areas may require vegetative treatment to reduce the fire hazard to adjacent private land. A site-specific NEPA decision would be made to address the methods of treatment and areas proposed for treatment. Prescribed burning and wildland fire use for resource benefit would be permitted in Wildernesses, and use of mechanized equipment in wildland fire suppression would be allowed on the entire forest. As is shown by previous fire plowlines in the pocosin, it takes many years for ground disturbances to heal. These disturbances decrease the apparent naturalness of the Wildernesses. Although these disturbances compromise the wilderness quality, they are only noticed from the air, or when someone comes upon them while hiking, since the pocosins are so dense and flat.

Prescribed fire has the potential to have the most cumulative effect on the Wildernesses. Wildland fires might be allowed in Wilderness, increasing the possibility of more fire plowline disturbances. Wildland Urban Interfaces overlap with Wildernesses, and their management could alter the vegetation along the

boundaries, and change the natural appearance of the Wildernesses. Over time, decrease in fuel loading and understory along the pocosin edges would encourage and allow easier access to the Wildernesses and roadless areas. An increase in hiking and hunting would probably occur. It is unlikely that enough use would occur to change the feeling of solitude inherent in the Wildernesses. The roadless areas would experience increased pressure over time to add roads and trails for access. As populations increase, the Wildernesses and roadless areas would be the few undeveloped and "wild" areas on the CNF and surrounding private land.

Alternative C: In addition to the effects common to Alternatives C and D, approximately 30 miles of roads would be closed. About one half of the closed roads would be in or adjacent to existing Wildernesses and roadless areas. This action is consistent with and encourages semiprimitive non-motorized qualities.

Alternative C Modified*:* In addition to the areas added in Alternative C, Pond Pine Addition B would also be recommended for Wilderness designation. The value of this 2,980 acre addition is as a linkage to other Wildernesses. It would enlarge the Pond Pine Wilderness to the east and provide a biological linkage around Great Lake to the Sheep Ridge Wilderness to the north and Pocosin Wilderness to the south. The area is relatively undisturbed and so meets the wilderness criteria at a higher level than some of the other roadless areas. There are no additional cumulative effects from those listed in Alternatives C, D, and E above.

Alternative D: In addition to the effects common to Alternatives C, D, and E approximately 12 miles of roads would be closed; most of those roads would be adjacent to existing Wildernesses and roadless areas. This alternative has the least number of closed road miles, and does the least to encourage semiprimitive non-motorized qualities.

3.3.5. FOREST PRODUCTS

Affected Environment

Pine is the most common forest cover type on the Croatan, with almost 80 percent of the Forest occupied by longleaf, loblolly or pond pine. Hardwood and mixed hardwood-pine cover about 16 percent of the Forest. The other 4 percent is nonforest, such as lakes, rivers, marsh, and developed areas.

Pond pine occupies about 56 percent of the forest land on the Croatan. However, most of it is on sites with deep organic soils not capable of growing merchantable trees. These sites were considered unsuitable for timber production in the 1986 plan. Hardwood and mixed hardwood-pine occupy sites ranging from poorly drained river and stream margins to well drained upland sites. All hardwood and mixed hardwood-pine types also were designated as unsuitable for timber production. Table 3.28 below displays the current distribution of acres by forest type for the Forest.

About 17 percent of the total acres are suitable for timber production. Most are now occupied by loblolly pine. Longleaf and pond pine make up only 14 percent and 18 percent of the suitable acres respectively. Table 3.29 displays acres by forest type that are considered suitable for timber production in the 1986 Land and Resource Management Plan.

Even-aged management and artificial regeneration by planting were introduced on the CNF in the early 1960s. Species planted were longleaf pine and loblolly pine. Currently there are 2,704 acres of longleaf plantations and 9,897 acres of loblolly plantations on the Forest. As artificial regeneration techniques were developed and refined, plantations were established by machine planting bare-root seedlings on fertilized and bedded sites. This method provided good survival and rapid seedling growth, resulting in a very successful regeneration program for the Forest.

Table 3.28. Acres of forest type on the CNF.

Forest Type	**Acres**
Non-Forest	7,509
No Inventory	1,341
Loblolly Pine-Hardwood	81
Longleaf Pine	12,886
Slash Pine	2
Loblolly Pine	24,321
Shortleaf Pine	20
Pond Pine	90,068
Bottomland Hardwood-Yellow Pine	57,111
White Oak-Black Oak-Yellow Pine	122
Swamp Chestnut Oak-Cherrybark Oak	2,581
Sweet Gum-Nuttall Oak-Willow	8,505
Atlantic White Cedar	35
Bald cypress-Water Tupelo	61
Sweet Bay-Swamp Tupelo-Red Maple	7,989
Total Acres	162,142

Source: Continuous Inventory of Stand Conditions (CISC database)

Table 3.29. Current acres suitable for timber production, 1986

Forest Type	**Acres Suitable for Timber Production**
Loblolly Pine	18,620
Pond Pine	2,670
Longleaf Pine	3,695
TOTAL	24,985 Acres

Source: CISC database.

The Forest Plan completed in 1986 relied on clearcutting as the primary regeneration method. About 1989, Interim Guidelines for RCW management were introduced and the level of regeneration activities fell from almost 300 acres per year to less than 100 acres per year. The amount thinned almost doubled during this same period. In the early 1990s, first thinnings in young plantations were recognized as a priority treatment needed to maintain growth and development of the new stands. Without thinning, young plantations become crowded and stressed resulting in increased susceptibility to attacks by insects and diseases. Southern pine beetle infestations in the summer of 1997 were most common in unthinned plantations and caused extensive damage.

Table 3.30 summarizes management activities and displays the amounts harvested by method, thinned, and planted since 1988.

Table 3.30. Annual number of acres clearcut, thinned, and planted since 1988.

Year	Acres Clearcut	Acres Thinned	Acres Planted
1988	299	56	329
1989	262	225	300
1990	174	222	199
1991	40	197	199
1992	203	433	183
1993	57	535	178
1994	0	194	153
1995	23	622	99
1996	0	0	112
1997	58	424	0

Age classes of timber stands on the Croatan are clumped around 60-80 year range with about 79 percent of the total forested acres falling into this category. Most of these acres, about 70 percent, are pond pine on organic soils and are not capable of producing trees of commercial size without extensive drainage structures. These sites are not considered suitable for timber production. Age class distribution of acres currently classified as suitable for timber production are more evenly distributed, but a large proportion is in the 11-30 year range (30 percent) and the 60-80 year age class (39 percent). Table 3.31 below displays the age class distribution for total acres by forest type, and Table 3.32 displays age class distribution for acres suitable for timber production only.

Table 3.31. Current Age Class Distribution by Forest Type and Total Acres for the CNF.

Age-Class	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101+	Total *
LLP	515	338	810	1,526	164	442	2,731	2,862	1,114	1,014	1,371	12,888
LOBP	1,421	3,265	5,275	836	518	1,655	5,437	4,258	1,291	231	65	24,252
PP	507	56	207	9	0	2,100	8,726	74,949	536	35	2,943	90,068
MP/ HWD	0	0	0	0	0	993	2,700	2,017	69	80	54	5,913
HWD	0	0	0	0	55	1,666	7,366	8,717	546	0	725	19,705
AWC	0	35	0	0	0	0	0	0	0	0	0	35
CP/ TUP	0	11	0	34	0	0	0	0	0	0	16	61
Percent	1.6	2.4	4.1	1.6	0.5	4.5	17.6	61.0	2.3	1.0	3.3	152,922

**This acreage does not include recent land acquisitions.*

Table 3.32. Current Age Class Distribution by Forest Type on Suitable Acres Only

Age-Class	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101+	Total *
LLP	486	336	288	185	28	226	1,008	902	267	68	0	3,694
LOBP	1,297	3,111	4,776	536	401	1,412	3,995	2,805	714	91	33	18,620
PP	0	0	36	0	0	533	1,405	377	0	0	0	2,351
MP/ HWD	0	0	0	0	0	0	0	255	0	0	0	255
HWD	0	0	0	0	0	0	19	0	0	0	0	19
AWC	0	35	0	0	0	0	0	0	0	0	0	35
CP/ TUP	0	11	0	0	0	0	0	0	0	0	0	11
Percent	6.5	12.9	19.1	2.7	1.6	8.6	20.9	19.7	3.3	1	4.02	24,985

LLP=Longleaf Pine HWD=Hardwood LOBP=Loblolly Pine AWC=Atlantic White Cedar PP=Pond Pine
CP/TUP=Cypress/Tupelo MP/HWD=Mixed Pine Hardwood

The allowable sale quantity established in the 1986 Plan for the Croatan was 709 thousand cubic feet (39 million board feet) or an annual average of 71 thousand cubic feet (3.9 million board feet). Records indicate that since the plan was implemented in 1986, annual volume harvested has ranged from a high of about 4.9 million board feet in 1987 to a low of 1.1 million board feet in 1990. Lower harvest levels reflect plan amendments to include RCW Interim guidelines.

Table 3.33. Volume sold by year and percent roundwood in the CNF timber program since 1986.

Year	Volume Mcf	Percent Roundwood
1986	636	28%
1987	891	34%
1988	436	32%
1989	418	50%
1990	200	48%
1991	691	41%
1992	400	46%
1993	345	46%
1994	291	12%
1995	582	66%
1996	564	67%
1997	891	65%

The high volume in 1997 is a result of salvage sales from southern pine beetle activity and hurricanes Fran and Bertha in 1996. In 1995, 96, and 97 the percentage of roundwood was more than 60 percent of the total sale volume. This high percentage reflects efforts to thin young plantations in 1995 and 1996 and southern pine beetle salvage activity in plantations.

Current Timber Management Activities

Regeneration methods on the CNF have primarily been even-age (clearcutting) as established in the Land Management Plan for the Croatan/Uwharrie National Forests. Since the current plan was approved in 1986, the primary reforestation method has been machine planting approximately 550 one-year old seedlings per acre after site preparation including shearing, windrowing, bedding, and fertilizing. This method has proven to be highly successful for seedling survival of longleaf and loblolly pines.

The Final EIS for the Management of the Red Cockaded Woodpecker (RCW) emphasizes longer rotations for southern yellow pines and emphasizes longleaf pine as a desired forest type for RCW habitat. With longer rotations it becomes more cost efficient to utilize natural regeneration methods. Natural regeneration by shelterwood or seedtree regeneration methods is a feasible option for the CNF.

Clearcutting and artificial regeneration would continue to be important for longleaf restoration, especially when converting loblolly and pond pine to longleaf pine where longleaf seed sources are limited. Intensive site preparation would continue to be important for establishing seedlings in poorly drained soils and for longleaf restoration projects. Prescribed fire would be the most widely used tool, and possibly the only tool needed, in natural regeneration of all the southern yellow pine species, especially longleaf.

Reforestation activities have declined from 300 acres in 1989 to 99 acres in 1995. The reason for this decline is to satisfy habitat requirements for RCW as required in the RCW interim-guidelines. With the final EIS for management of RCW and this plan revision, the amount of regeneration needed to meet all management objectives would be clearly defined.

Probable Timber Management Activities

Timber management activities may include prescribed fire, use of herbicides, mechanical treatments using heavy equipment, harvesting for restoration or regeneration, and harvesting as an intermediate treatment to improve health and vigor of young stands. Appropriate treatments would be determined by site-specific analysis to determine the best methods and treatments to achieve desired future conditions established in the CNF Plan. Descriptions of regeneration methods are documentd in CNF Plan Revision, Volume II, Appendix E.

Environmental Consequences

Effects of treatments on timber supply were modeled using Spectrum software, maintained by USFS in Fort Collins, CO. The analysis assumptions are documented in this FEIS, Appendix B. Results of analysis are shown in Table 3.34.

Table 3.34. Estimated timber-related effects and outputs, by alternative.

	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Suitable for timber Production (Ac)	24,985	10,890	26,774	21,546	25,723
Allowable Sale Quantity MCF/Year (Planning Period: MCF)	1st: 497 2nd: 1625 3rd: 1625 4th: 1625 5th: 1625	1st: 260 2nd: 319 3rd: 319 4th: 353 5th: 363	1st: 2,093 2nd: 1355 3rd: 1355 4th: 1355 5th: 1355	1st: 1484 2nd: 1486 3rd: 1489 4th: 1489 5th: 1489	1st: 876 2nd: 1427 3rd: 1427 4th: 1427 5th: 1427
Long Term Sustained Yield Capacity (MCF/Year)	1,625	442	1,247	1,573	1,303
Maximum Present-Net Value (MM $)**	$23.2	$4.4	$29.3	$26.2	$20.9
Method of Regeneration over 10 Years (Ac/Yr) Average					
Longleaf Rest.	60	0	400	23	250
Clearcut	53	---	273*	440	100
Seedtree/Shelterwood	62	---	200	---	0
Two Age	5	---	150	---	150
Group Selec.	---	104	---	---	0
Average Total Harvest Over 10 Years (Ac/Yr)	120	104	623	440	250
Hardwood Restoration (Ac/Yr)	0	0	23	0	23
Thinning (Acres/Yr)	268	400	314	500	320
Pine Straw Production (Tons/Yr)	0	0	220	453	220

** All longleaf restoration. ** PNV is for timber related benefits and costs only. Values are cumulative over 16 decades.*

***Alternative A*:** This alternative would use even-aged management with rotations for loblolly pine at 80 years and longleaf pine at 100 years, and would have the third largest number of acres suitable for timber production at 24,985. As a result of these rotation ages and amount suitable for timber production, the cumulative effect is a long term sustained yield of 1,625 thousand cubic feet per year, a projected annual yield for the first decade of 497 thousand cubic feet, and 1,625 thousand cubic feet for decades 2 - 5 (Table 3.34). The relatively low harvest level in the first period is primarily due to the high proportion of acres in stands less than 60 years old.

Loblolly regeneration is favored over longleaf restoration. The current forest composition (Table 3.29) would shift to slightly more longleaf; but loblolly would dominate the suitable land base.

This alternative would regenerate about 120 acres per year and with the exception of Alternatives B and E, includes the fewest acres of clearcutting. Approximately half of the regeneration acres would be

longleaf restoration attained by clearcutting the existing stands and planting longleaf pine. The remaining 60 acres of regeneration would use the seedtree regeneration method for mixed loblolly and pond pines. This is about four tenths of one percent of the total acres suitable for timber production in this alternative. Sites clearcut for longleaf pine restoration would be mechanically prepared and planted to longleaf pine. Sites regenerated by the seedtree method would be prepared by prescribed burning, and regeneration would be by natural methods using seed trees and seed from adjacent stands.

Using artificial regeneration following clearcutting, seedlings are established with a predetermined distribution and amount per acre. Seedling quality is high and the seedlings are from known sources with a history of good survival, growth, and development. Rapid early growth can be expected in artificial regeneration, allowing seedling growth to surpass competition and reach a merchantable size early in the life of the stand.

Natural regeneration relies on existing trees for seed and a well-prepared seedbed of exposed soil for success. With loblolly and pond pine, good seed production years are relatively frequent and can result in large numbers of seedlings being established. This intense early competition may create slower growth of seedlings and overall stand development. With longer rotations, such as 80 years or more, benefits from rapid early growth in artificial regeneration are limited to early thinning opportunities. At age 80 or older there would be little noticeable difference in stem size or numbers between stands artificially and naturally regenerated.

With natural regeneration it may be necessary for a precommercial thinning treatment to remove trees and reduce competition. This would provide the remaining trees with the increased growing space, water, and nutrients needed to maintain healthy and vigorous growth. Reducing competitive stress decreases susceptibility to insect and disease attacks. Precommercial thinning could be accomplished on these sites by a variety of methods including heavy equipment, prescribed fire, or herbicides. The need and method for this treatment would be determined on the basis of a site-specific analysis. This treatment is rarely needed with artificial regeneration.

In this alternative longleaf pine restoration would account for about 60 acres of regeneration per year for the first planning period. Among the alternatives proposing longleaf restoration, this alternative ranks third, with a total of 1,088 acres over a 40-year period. Proposed restoration acreages are 32 acres per year for the second planning period, 10 acres per year for the third planning period, and 7 acres per year for the fourth planning period.

Thinning would take place on about 268 acres per year for the first period; third highest of all the alternatives. Thinning is important to maintain healthy conditions by providing the needed growing space for individual trees to continue vigorous growth. Thinning also reduces the risks of insect and disease attacks.

There is no current pine straw production and no hardwood restoration on the CNF.

***Alternative B*:** This alternative proposes uneven-aged management using the group selection regeneration method. It has the amount suitable for timber production at 10,890, the lowest long term sustained yield capacity at 442 thousand cubic feet per year, and the lowest projected annual yield for

the first decade at 260 thousand cubic feet per year, 319 for the second decade, 319 for the third decade, 353 for the fourth decade, and 363 for the fifth decade.

Alternative B proposes to regenerate about 104 acres per year during the first decade in small groups ranging from 1/2 acre to 3 acres in size. This is less than one tenth of one percent of the total acres suitable for timber production. Sites occupied by these groups would be prepared for natural regeneration by prescribed burning and by herbicide application where burning is not practicable. No longleaf restoration is proposed in this alternative.

The reliance on uneven aged management and low burning favors loblolly regeneration. The long-term forest composition (Table 3.29) would remain about the same mix over the long term.

Natural regeneration from existing seed sources would be the primary source for seedling establishment in group openings. In some cases planted seedlings may be necessary to supplement natural regeneration in the absence of good seed trees. Seedlings in group openings are slower to grow and develop than seedlings grown in larger openings. This is especially true in smaller openings where shading from adjacent trees may impact the entire opening. Where overstocking of seedlings occurs, it may be necessary to precommercial thin the openings to provide additional growing space for selected trees.

With this regeneration method prescribed fire introduced to the entire stand could result in seedling mortality within the groups, depending on seedling size. For successful regeneration within the groups it may be necessary to provide for longer intervals between burns in conjunction with scheduled harvest entries at 20 years or more.

Commercial thinning opportunities would be possible in this alternative, especially in existing young pine stands. No pine straw production or hardwood restoration is proposed in this alternative.

Alternative C/C-modified: This alternative proposes even-aged management with varying rotations depending on species and whether the stand is inside or outside the RCW Habitat Management Area (HMA). The rotation is 120 years for longleaf pine inside the HMA, and 80 years outside the HMA. For loblolly and pond pine the rotation is 80 years inside the HMA, and 60 years outside the HMA. The RCW HMA makes up approximately 70 percent of the acres suitable for timber production in this alternative. Alternative C has the highest number of acres suitable for timber production, about 26,774 acres.

The cumulative effect is a long-term sustained yield capacity at 1,274 thousand cubic feet per year, the highest allowable sale quantity for the first decade at 2,093 thousand cubic feet per year, and 1,355 for decades 2 through 5. The harvest volume in the first planning period is higher than subsequent decades due to the aggressive longleaf restoration effort.

The forest composition (Table 3.29) would begin shifting in the short term with about 4,000 more acres of longleaf and that much less in loblolly. Over the long term, longleaf would dominate forest composition on suitable land.

The alternative proposes to regenerate about 623 acres per year during the first period. This is about 2.3 percent of the acres suitable for timber production, and about four tenths of one percent of the total district acres. About 200 acres of mixed pine would be regenerated per year using the seedtree and shelterwood regeneration methods. Longleaf restoration accounts for about 400 acres per year for the first decade. Restoration would be accomplished through clearcutting and mechanical site preparation for artificial regeneration on sites without adequate longleaf pine seed sources. A portion of these acres, less than half, would be bedded to ensure survival of seedlings on poorly drained sites. Restoration would also be accomplished on mixed pine sites using natural methods when there is an adequate longleaf seed source by thinning out loblolly species and retaining longleaf.

In areas where natural seed sources are inadequate, longleaf restoration would require artificial regeneration to ensure an adequate number of seedlings become established. Survival and growth of planted longleaf seedlings has proven successful, especially when containerized seedlings are planted in full sunlight. Without artificial regeneration on these sites, longleaf restoration would not be successful and the site would more than likely be regenerated to loblolly pine or pond pine by seed from adjacent stands.

In mixed pine stands with adequate longleaf pine seed trees, natural regeneration may be possible after the loblolly pine and/or pond pine component is removed. As with all natural methods, success can be highly variable and dependent on a combination of adequate seed production years and site preparation timing. Supplemental planting may be necessary in the case of inadequate stocking (less than an average of 300 seedlings per acre). Growth and development of seedlings should be acceptable if competition is managed through prescribed fire or other methods.

Thinning is proposed on about 300 acres per year during the first period. This total would eliminate a backlog of needed thinning in mostly loblolly pine plantations and is needed to maintain growth and reduce risks of insect and disease problems. In this alternative, these stands are important for future RCW habitat in terms of foraging and nesting sites.

Pine straw production in this alternative is about 200 acres per year for the first period. Production is about 220 tons per year or about 1.1 tons per acre. Alternative D is almost twice this amount. Hardwood restoration occurs in this alternative.

***Alternative D*:** This alternative proposes even-aged management with varying rotations similar to Alternative C. For loblolly pine and pond pine inside the RCW Habitat Management Area the rotation age is 80 years, outside the HMA it is 60 years. For longleaf pine it is 120 years inside the HMA, and 100 years outside. This alternative has the third largest number of acres suitable for timber production at 21,546. The harvest level is 1,484 thousand cubic feet per year for the first planning period, 1,486 for the second, and 1,489 for decades 3 through 5; the second highest of all alternatives. The cumulative effect of long-term sustained yield is 1,573 thousand cubic feet per year.

Alternative D restores less than 25 acres per year to longleaf pine during the first decade and is the lowest of all alternatives except Alternative B, which restores no acres to longleaf. Over a 70-year period, the cumulative effect would restore a total of 810 acres of longleaf. Therefore, the forest composition (Table 3.29) would remain nearly stable, with loblolly pine dominating the suitable land base.

This alternative is second among the alternatives in regeneration at about 463 acres per year during the first period. This is about 2 percent of the total acres suitable for timber production in this alternative and about 0.3 percent, of the total district acres. In this alternative, regeneration would be accomplished using clearcut as the regeneration method, mechanical site preparation, and planting. Most of the planting would be loblolly pine during the first period.

Planting loblolly pine after clearcutting is very successful on the Croatan. Seedling survival and growth has been acceptable on most sites. On poorly drained sites, site preparation may require bedding to get adequate growth and development of the planted seedlings. With artificial regeneration, number and distribution of seedlings is easily achieved and improved seedlings with a history of good performance can be used. With this method, rapid growth rates can be expected and a commercial thinning would be needed between age 15 and 20 to maintain vigorous growth.

Thinning for Alternative D is estimated at about 500 acres per year.

Pinestraw production is at 453 tons/year during the first period. Production would occur on about 400 acres per year.

No hardwood restoration is proposed for this alternative.

Alternative E: This alternative proposes two-aged management as the dominant method of regeneration. Clearcutting would be used only where longleaf cannot be restored using the two-aged method. The program would concentrate on longleaf restoration within the RCW HMA.

The cumulative effect is a long-term sustained yield capacity at 1,427 thousand cubic feet per year, the allowable sale quantity for the first decade at 876 thousand cubic feet per year, and 1,427 for decades 2 through 5. The harvest volume in the first planning would be sustainable over the planning horizon.

The alternative proposes to regenerate about 250 acres per year during the first period. This is about 1.0 percent of the acres suitable for timber production, and about one tenth of one percent of the total district acres. Focused on longleaf restoration within the RCW HMA, restoration would be accomplished through two-aged and clearcutting methods. Restoration would also be accomplished on mixed pine sites using natural methods when there is an adequate longleaf seed source by thinning out loblolly species and retaining longleaf.

Forest composition (Table 3.29) shifts gradually toward a longleaf dominated system. In the long term, longleaf would occupy more than two-thirds of forest composition on suitable lands.

In areas where natural seed sources are inadequate, longleaf restoration would require artificial regeneration to ensure an adequate number of seedlings become established. Survival and growth of planted longleaf seedlings has proven successful, especially when containerized seedlings are planted in full sunlight. Without artificial regeneration on these sites, longleaf restoration would not be successful and the site would more than likely be regenerated to loblolly pine or pond pine by seed from adjacent stands.

Bedding would be used only on sites too wet to assure success. Reducing bedding, combined with the change from clearcutting to two-aged methods, increases the risk of failure of longleaf restoration. Projections of outputs and conditions for this alternative can be accomplished only with careful, well-designed project-level restoration plans, which include diligent follow-up treatments of planting and prescribed fire.

In mixed pine stands with adequate longleaf pine seed trees, natural regeneration may be possible after the loblolly pine and/or pond pine component is removed. As with all natural methods, success can be highly variable and dependent on a combination of adequate seed production years and site preparation timing. Supplemental planting may be necessary in the case of inadequate stocking (less than an average of 300 seedlings per acre). Growth and development of seedlings should be acceptable if competition is managed through prescribed fire or other methods.

Thinning is proposed on about 320 acres per year during the first period. This total would eliminate a backlog of needed thinning in mostly loblolly pine plantations and is needed to maintain growth and reduce risks of insect and disease problems. In this alternative, these stands are important for future RCW habitat in terms of foraging and nesting sites.

3.4. Human Resources

3.4.1. SOCIOLOGICAL

Affected Environment

The administrative and legislative forces that led to the creation of the Croatan National Forest began with the New Deal Programs initiated during the Great Depression. Some of these programs were designed to remove submarginal land from crop production and convert it to timber production. Because of many years of agricultural abuse and abandonment, there were many such acres in the "Tidewater" Region of North Carolina.

Local citizens in eastern North Carolina, where the Croatan National Forest is located, were aggressive in their pursuit of designation of part of the region as a national forest. Under the provisions of the Clarke-McNary Act of 1924, the Forest Service was given the authority to acquire land needed for timber production as well as for the protection of the flow of navigable streams. In 1933, a purchase unit was defined within which forest land could be purchased in the eastern North Carolina counties of Carteret, Craven, and Jones.

Activity began in 1934 with the purchase of land and the designation of a unit of the Civilian Conservation Corps to develop it. The CNF was created by proclamation of President Franklin D. Roosevelt on July 29, 1936. On September 30, 1996, the CNF consisted of 159,586 acres in the three counties -- Carteret, 56,623 acres; Craven, 62,974 acres; and Jones, 39,989 acres.

3.4.1.1. Population - General

The population of the three-county region is growing at a rate much greater than that of the State of North Carolina and almost twice the rate of the United States (Table 3.35). Jones County, with no towns

of over 900 people, actually lost population between 1970 and 1990. It is the most rural county in the three-county region with a population density of only 19.9 persons per square mile, the third lowest of all North Carolina counties.

Carteret County is the fastest growing. The area is particularly attractive to those seeking water-based recreation and beachfront home sites. The towns of Morehead City, Beaufort, and Newport have attracted both retirees and younger immigrants seeking living and working opportunities. Between 1970 and 1990, the population increased by 66.3 percent, more than twice the rate for the State. Population density is 98.9 persons per square mile, which is below the State average of 136.1 persons per square mile.

Craven County is the most urban with two cities, Havelock (20,268) and New Bern (17,363), and a population density of 117.3 persons per square mile. New Bern is one of the oldest cities in North Carolina and, until the end of the Revolutionary War, served as the capital of North Carolina. Havelock owes much of its growth to the presence of the U.S. Naval Aviation Depot at Cherry Point.

Table 3.35. Population and percentage change in population of the counties surrounding the Croatan National Forest, the State of North Carolina, and the United States, 1970, 1980, and 1990.

County	**1970 No.**	**1980 No.**	**1990 No.**	**Change (%) (1970-1990)**
Carteret	31,603	41,092	52,556	66.3
Craven	62,554	71,043	81,613	30.5
Jones	9,779	9,705	9,414	(3.7)
Total	103,936	121,840	143,583	38.1
North Carolina	5,084,411	5,881,766	6,628,637	30.4
United States	204,800,000	226,545,805	248,709,873	21.4

Sources: U.S. Department of Commerce, Bureau of the Census, Census of Population and Housing, 1970 and 1980, Washington, D.C. U.S. Department of Commerce, Economics and Statistics Administration, Bureau of the Census, 1990 CPH-1-35, 1990 Census of Population and Housing, Summary Population and Housing Characteristics, North Carolina, Washington, D.C.

3.4.1.2. Population - Age Distribution

The population in the three counties also is getting older. In 1970, 35.5 percent of the population was below the age of 18. By 1990, the total number had fallen from 36,883 to 36,353 or by 1.4 percent, which was 25.3 percent of the population. During the same time, the population over 65 more than doubled. In 1970, the over 65 population was 7,398 (7.1 percent) and in 1990, it was 18,009 (12.5 percent). Median age increased by almost 8 years between 1970 and 1990.

3.4.1.3. Population - Diversity

The percentage of White members of the population has remained almost constant. The proportion of people classified as White was 76.6 percent in the 1970 census, and 77.9 percent in 1990. In 1970, 22.9 percent of the population was classified as Black-American and only 0.5 percent was classified as Native-American and Others. By 1990, those classified as Black-American were 20.3 percent of the population while the Native-American and other groups had risen to 1.8 percent.

The Native-American population in the region quadrupled between 1970 and 1990. In 1970, there were only 144 Native-Americans, most of whom were in Craven County. By 1990, the number had increased to 596, almost half of whom are now in Carteret County.

The greatest increases have been in groups classed as "other". In 1970, there were only 390 persons classed as 'Others'. By 1990, this group had increased by over 400 percent to 2,017. Most of these new residents are Asian.

3.4.1.4. Income Per Capita

The average income per resident in the three counties has been increasing at a rate slightly higher than that for all of North Carolina (Table 3.36). Incomes increased an average of 418.1 percent between 1970 and 1990, while the average for the state was 406.3 percent (Table 3.36). Per capita income in the three counties has always been below the average for the State. In 1970, the average for the three counties was 86.8 percent of the State average (Table 3.37). By 1980, the average was 90.0 percent of the State's, but it fell back to 88.8 percent in 1990.

Table 3.36. Per Capita Income in the Counties Surrounding the Croatan National Forest and the State of North Carolina, 1970, 1980, and 1990.

County	1970 $	1980 $	1990 $	Change (%) (1970-1990)
Carteret	2,771	7,644	14,238	413.8
Craven	3,004	7,524	14,217	373.3
Jones	2,648	6,428	15,190	473.6
Average	2,808	7,199	14,548	418.1
North Carolina	3,236	7,999	16,383	406.3

Sources: Statistical Abstract of North Carolina Counties 1991. State Data Center, Management and Information Services, Office of State Budget and Management, Raleigh, North Carolina. County Development Information, 1993. Center for Improving Mountain Living, Western Carolina University, Cullowhee, North Carolina 28723.

3.4.1.5. Civilian Labor Force - General

The Civilian Labor Force in the region has been increasing at a rate greater than that for North Carolina (Table 3.38). In 1970, the regional labor force totaled 35,620. It increased by 78.8 percent to 63,680 in 1990. During the same period, the Labor Force for the State increased by 54.9 percent from 2,195,000 to 3,401,000.

Table 3.37. Per capita income in the counties surrounding the CNF as a percentage of the average per capita income for the State of North Carolina, 1970, 1980, and 1990.

County	**1970** **%**	**1980** **%**	**1990** %	**Change (%)** **(1970-1990)**
Carteret	85.6	95.6	86.9	1.3
Craven	92.8	94.1	86.8	(6.0)
Jones	81.8	80.4	92.7	10.9
Average	86.8	90.0	88.8	2.0
North Carolina	100.0	100.0	100.0	0.0

Sources: Statistical Abstract of North Carolina Counties 1991. State Data Center, Management and Information Services, Office of State Budget and Management, Raleigh, North Carolina.
County Development Information, 1993. Center for Improving Mountain Living, Western Carolina University, Cullowhee, North Carolina 28723.

Table 3.38. Civilian labor force and percentage change in civilian labor force in the counties surrounding the CNF and the State of North Carolina, 1970, 1980, and 1990.

County	1970 No.	1980 No.	1990 No.	Change (%) (1970-1990)
Carteret	12,230	16,490	25,600	109.3
Craven	20,230	28,200	33,660	66.4
Jones	3,160	3,920	4,420	39.9
Average	35,620	48,610	63,680	78.8
North Carolina	2,195,000	2,855,000	3,401,000	54.9

Sources: Profile, North Carolina Counties, Sixth Edition 1981. Office of State Budget and Management, Research and Planning Services, 116 West Jones Street, Raleigh, NC 27611.
Civilian Labor Force Estimates for North Carolina, 1980-1993. Employment Security Commission of North Carolina, Labor Market Information Division, P.O. Box 25903, Raleigh, NC 27611

3.4.1.6. Civilian Labor Force - Demographics

The increase in the labor force is the result of changes in the composition of the labor force as well as the increase in the population. The population in the region increased by 38.1 percent (Table 3.35) between 1970 and 1990 and accounts for part of the 78.8 percent increase in the labor force. The other part of the increase is the result of more people working, particularly women, because of the need to bring more income into the family.

3.4.1.7. Civilian Labor Force - Unemployment

The Croatan region has had a higher unemployment rate on the average than has the state of North Carolina (Table 3.39). In 1970, the average was 4.9 percent compared to the state average of 4.3 percent. Both the State and the region had a drop in the rate by 1990, but the regional average was still higher than the State's (4.5 percent compared to 4.1 percent).

Table 3.39. Average yearly unemployment rate in the Croatan Region and the State of North Carolina, 1970, 1980, and 1990.

County	**1970** **%**	**1980** **%**	**1990** **%**	**Change (%)** **(1970-1990)**
Carteret	5.1	8.1	4.2	(0.9)
Craven	5.5	7.0	4.5	(1.0)
Jones	4.1	6.6	4.8	0.7
Average	4.9	7.2	4.5	(0.4)
North Carolina	4.3	6.5	4.1	(0.2)

Sources: Profile, North Carolina Counties, Sixth Edition 1981. Office of State Budget and Management, Research and Planning Services, 116 West Jones Street, Raleigh, NC 27611
Civilian Labor Force Estimates for North Carolina, 1980-1993. Employment Security Commission of North Carolina, Labor Market Information Division, P.O. Box 25903, Raleigh, NC 27611

3.4.1.8. Civilian Labor Force - Agricultural Employment

Agricultural employment in North Carolina in 1990 was about one-half of what it was in 1970. There were 134,000 employed in 1970 and only 66,200 in 1990. Agricultural employment also declined significantly in the Croatan region, but less than the State average.

In 1970, agricultural employment was 2,510 in the Croatan region. By 1990, it had declined to 1,430, a reduction of 43 percent. The percentage declines were about the same in each county, but the decline was most significant in Jones County. In Carteret County, agricultural employment was only 3.5

percent of the civilian labor force in 1970 and 1.0 percent in 1990. Agricultural employment was 6.2 percent of the civilian labor force in Craven County in 1970, and declined to 2.1 percent in 1990.

Jones County's agricultural employment was 820 in 1970, 25.9 percent of the civilian labor force. By 1990, agricultural employment was 10.6 percent of the civilian labor force. The decline in agricultural employment has not been offset by increases in employment in other sectors such as manufacturing or services.

3.4.1.9. Civilian Labor Force - Manufacturing Employment

Manufacturing employment has been increasing at a greater rate in the Croatan region than in the State. From 1970 to 1990, the State increased employment in the manufacturing sectors by 143,100 (19.9 percent). The region added 1,550 jobs (33.2 percent), most of which were in Craven County.

The Croatan region is in transition from a rural to an urban society. Jones County is not moving in this direction as rapidly as the other two and is declining in population (Table 3.34). Jones County does have two major highways (U.S 70 and U.S. 17) crossing it, but neither connects to a major city in the county. The county also suffers from lack of access to major water-based recreational facilities. Of the three counties, Jones County is the most vulnerable to changes in management activities on the CNF.

3.4.1.10. Civilian Labor Force - Services Employment

Services employment includes doctors, nurses, dentists, lawyers, and others providing professional services. Included also are those people working in restaurants, hotels, or other places providing services rather than products. The Economic Security Commission of North Carolina, which provided the estimates, also included agricultural services, and forestry, fishing, and mining as other services. Domestics were not included.

In the past 20 years, employment in services has more than doubled in the State. From 1970 to 1990, services employment increased from 237,500 to 641,400 or by 170.1 percent. Service employment in the Croatan region increased by 227.4 percent during the same period, with the largest increases in Craven County.

The three counties in the Croatan region are very different. These differences are important because attitudes, beliefs, and values of residents would vary among the counties. Reactions to management activities on the CNF would be different depending upon whether the activity is on the east and north (Craven), the east and south (Carteret), or on the west (Jones) sides of the Forest.

3.4.1.11. Attitudes, Beliefs, and Values

The attitudes, beliefs, and values of the people in the three counties surrounding the Croatan National Forest are shaped by length of residence, location, ethnicity, age, and employment.

Length of Residence: There are three distinct groups in the region -- the "traditional" population, the "incomers", and the tourists. The "traditional" population includes descendants of the original European

(mostly Swiss and German) settlers who came to the region in the eighteenth century. This group farmed the land and utilized the natural resources of the region, primarily fisheries and forests.

At the time of the European settlement, there were Native-American tribes in the region, primarily the Tuscaroras. As more European colonists came, tension between them and the Native-Americans escalated, resulting in the Tuscarora War of 1711. After their defeat, the Tuscaroras emigrated to the north. Some were allowed to settle at a reserve at Lake Mattamuskeet in Hyde County. In 1970, only 144 Native-Americans were in the region.

"Incomers" are residents who have discovered the region, perhaps as tourists or summer residents, and have lived in the region only for the last 40 or 50 years. This is the fastest growing group and is becoming more influential politically and economically.

Tourists are transient and are in the region only during the summer. Their influence is felt economically, but their interest in the CNF is limited to recreation, hunting, and fishing.

The "traditional" population tends to view the CNF as "common" land, someplace where they can hunt, fish, and recreate without many restrictions. They may tend to view any regulation as preventing them from doing what is their "right". Attempts to enforce or establish regulations could be met with some resistance. Since their heritage is tied to natural resource utilization, they are less concerned about timber harvesting and other traditional land use activities.

Incomers tend to view the Forest as a place to visit for recreation, enjoy hunting, and fishing. Rules and regulations are viewed by this group as necessary to ensure high-quality experiences. They may be less tolerant of management activities such as timber harvesting and road construction, which change the landscape.

The tourist group utilizes only those parts of the Forest that provide accessible recreation, particularly along the rivers and roads. They tend to place a high value on viewing more natural appearing landscape.

Location: The "traditional" group is concentrated in the more rural areas, particularly in Jones County. They also live in closer proximity to the Forest. The "incomer" group occupies the "outer" rim of the Forest, along the major highways and near the major rivers and Bogue Sound in Carteret and Craven Counties. This group also is located in the cities of New Bern and Havelock. Tourists are in areas close to beaches and waterfronts.

Ethnicity: The Croatan region is becoming less diverse. In 1970, 76.6 percent of the population was classified as White. By 1990, the White population had increased to 77.9 percent. From 1970 to 1990, the White population increased by 40.5 percent, while the Black-American population increased by only 22.4 percent. Native-Americans increased in population by 452 and all Others increased by 1,627. The population shifts are more significant in Carteret and Jones Counties.

Carteret County, in 1970, was 88.5 percent White, 11.1 percent Black-American, and 0.4 percent Native American and Others. By 1990, the population was 90.3 percent White, 8.3 percent Black-American, and 1.4 percent Native American and Others. Jones County was 54.9 percent White in 1970, 45.1

percent Black-American, and 0.0 percent (4 persons) Native American and Others. In 1990, Jones County was 60.4 percent White, 39.1 percent Black-American, and 0.5 percent Native American and Others. In each of the counties, there has been emigration of the "traditional" population and immigration of "incomers".

Craven County's population in 1970 was 73.9 percent White, 25.4 percent Black-American, and 0.7 percent Native American and Others. By 1990, the population was slightly more diverse with 71.9 percent White, 25.9 percent Black-American, and 2.2 percent Native American and Others. This more urban county can be expected to have values, beliefs, and attitudes more like those of the "incomer" population.

Age: As noted previously, the population in the region is getting older. The more urban Craven County has the youngest average population and Carteret has the oldest. The younger population in Craven County partially reflects the influence of the U.S. Naval Aviation Depot at Cherry Point.

The older population in Carteret County is partially the result of the immigration of retirees. Retirees would tend to have the values, beliefs, and attitudes of the "incomer" group, while the older population in Jones County would tend to have more "traditional" values.

Employment: European settlers of the Croatan region were employed primarily in farming, forest industries, and fishing. For many years, employment has been shifting away from resource-based employment to Service and Manufacturing. This shift indicates the growing economic influence of "incomers" and a lessening of the economic influence of the more "traditional" population.

Forest Service Role: The CNF is a major influence on the human population of the three-county region. National Forest lands occupy 16.5 percent of the land base of Carteret County, 14.1 percent of Craven County, and 13.1 percent of Jones County. The traditional resource-based management activities of timber harvesting, hunting, fishing, and outdoor recreation are more suited to the "traditional" population, which is rapidly being replaced by "incomers." Future management would be influenced more by the values, beliefs, and attitudes of "incomers."

The CNF is uniquely positioned to be of service to the surrounding community. The urban population (comprised increasingly of "incomers") surrounds the Forest like a crescent, with water on the outside (the Neuse River, the Atlantic Ocean, and Bogue Sound), and the Forest on the inside. In this position, the communities depend upon the Forest for recreation and for urban services, such as water system sites and landfills.

The Planning Office for the State of North Carolina is projecting an increase in the State population of 9.9 percent between 1995 and 2005. The same projections show Carteret County increasing by 16.2 percent, Craven by 11.8 percent, and Jones declining by 1.3 percent, for an average regional increase of 12.7 percent. These additional people would put even more pressure on the CNF to provide services for a larger urban population.

Environmental Consequences

The sociological impacts as a result of management practices on the CNF are difficult to assess. Changes in management would have little or no effect on regional population or incomes, but

management practices could affect particular segments of the region. This analysis is focused on the changes in attitudes, beliefs, and values associated with changes in timber production, provision of recreation opportunities, land adjustments, and administration of special uses.

Timber Production

Alternative A: Continuing to manage the CNF under the current Land and Resource Management Plan would result in continued conflicts between the "traditional" and "incomers" groups. The "traditional" population accepts the necessity of timber production, and would be advocates of increased harvesting to provide employment and hunting opportunities. The "incomers" would advocate for reduced harvesting levels to retain the pristine appearance of the Forest.

The most probable cumulative effect of continuing to manage the Forest under the current Land and Resource Management Plan would be alienation of both groups. The "traditional" population would consider timber harvests to be too low, while the "incomers" would consider them to be too high. Both groups would consider Forest administrators unresponsive to their values.

Alternative B: Under this alternative, timber harvests would be about half of the current management. This would be responsive to the "incomers" values, but would conflict with those of the "traditional" population. There would be some reduction in regional employment and income, which would affect the "traditional" population.

The cumulative effects for the Forest would be more positive than under current management. Since "incomers" would become a greater percentage of the regional population, the reduction in timber harvests would be acceptable to them. The "traditional: population would be adversely affected.

Alternatives C, C-modified, and D: Under these alternatives, timber harvests would be about three times as high as under current management. This would be responsive to the values of the "traditional" population, but less acceptable to the "incomers". Regional incomes and employment would increase which would benefit the "traditional" population.

Alternative E: Timber production is higher than Alternatives A and B, which would be accepted more by the 'traditional' population. However, the methods of timbering are likely to leave trees, providing aesthetically pleasing scenery, which would be accepted more by the 'incomers'.

The cumulative effects would be less responsive to "incomers" than alternatives A and B. Since "incomers" would become a greater percentage of the regional population, continued habitat manipulation would be less acceptable to them. This could lead to more confrontation with forest users.

Opportunities for Recreation

Alternative A: Under current management, The CNF provides 400,200 recreation visitor days per year. Approximately 30 percent of these are hunting, and 12 percent are fishing; recreation activities of the "traditional" population. Current facilities are not sufficient to accommodate the increasing population of "incomers" and some facilities, such as Siddie Fields and Long Point, are over-utilized on some weekend. The "incomers" are asking for more facilities and a wider variety of opportunities.

The long term cumulative effects would be continued over-crowding of facilities as the population increases. The "traditional" population would continue to hunt and fish, but the "incomers" would become increasingly dissatisfied with recreational facilities. Administrative and law enforcement costs could also increase.

Alternative B: Under this alternative, recreation use would increase to 417,000 visitor days. The "traditional" population would continue to hunt and fish and some current facilities would be enlarged. More water-oriented opportunities would be available, and over-crowding at Siddie Fields would be addressed. These changes would address some of the increased demand from the "incomers" population.

The cumulative effects of changes made under this alternative would partially address the recreation demands of the "incomers" population. Over-crowding would eventually become a problem, and some of the "incomers" demands for a variety of facilities would not be met. Implementation of these alternatives would postpone the sociological problems associated with Alternative A for a decade or so.

Alternatives C,C-modified, and E: Under these alternatives, a 20 percent increase in recreational opportunities would be made available to forest users. The "traditional" population would continue to have opportunities to hunt and fish, and a greater variety of facilities, such as group camps and a rifle range, would be available. These alternatives would satisfy the demand for recreational opportunities for both population groups.

The cumulative effects of these alternatives should be the most acceptable to both population groups. Most future demands should be met.

Alternative D: This alternative differs from alternatives C, C-modified, and E only with the addition of an Interpretive Center. The effects are the same as for alternatives C and C-modified. The cumulative effects for this alternative are the same as for alternatives C and C-modified.

Land Adjustments

Alternatives A and D: Under these two alternatives, approximately 300 acres per year could be purchased or exchanged each year. These adjustments could affect either or both population groups. Since purchases or exchanges are voluntary and all parties have to be in agreement, no adverse sociological effects should occur.

The long-term cumulative effects would be an increase in administrative efficiency for the forest, and an improved working relationship with the general population.

***Alternatives B, C, C-modified, and E*:** Under these alternatives, approximately 900 acres per year could be purchased or exchanged each year. These adjustments could affect either or both population groups. Since purchases or exchanges are voluntary and all parties have to be in agreement, no adverse sociological effects should occur. The long-term cumulative effects would be the same as for alternatives A and D.

Special Uses

The forest administers approximately 2,500 acres of special uses under the current Land and Resource Management Plan. This would be the same for all alternatives. The granting of special uses is a service to the population and benefits the traditional population as well as incomers. No adverse sociological cumulative effects should occur.

3.4.2. ECONOMIC

An economy is the system by which goods and services are produced, distributed, and consumed in a given area. For purposes of this analysis, the economy of the Croatan region is that in the three counties in which the CNF is located -- Carteret, Craven, and Jones. This economy can be described as open, because it interacts with other economies and is a part of a larger economy.

The estimated Gross State Product from the IMPLAN model* of all 100 counties in North Carolina is $ 253.2 billion. The Gross Regional Product (GRP) for the Croatan region is estimated to be $ 3.7 billion, or only about 1.5 percent of the State output. Per capita output in the Croatan region is only about $25,996 compared to the Statewide average of approximately $38,200.

The demographic characteristics of the Croatan region have been described in Human Resources: Sociological. The purpose of this discussion is to compare the economy of the Croatan region to that in the State as a whole. This analysis would focus on the diversity of industry within the region and the dependency of the region on surrounding regions for its economic viability.

3.4.2.1. Economic Diversity

Economic diversity refers to the number and relative importance of industries within a region. In general, the more industries that exist in a region, the greater the capability of the regional economy to weather the economic storms of recession and unemployment. Economic diversity is equivalent to having ones' eggs in many baskets. The better the balance between regional sectors, the more viable the regional economy. There is no magic level of diversity that guarantees the viability of an economy, but comparisons can be made to the State or national economy.

The two components of economic diversity are the number of industrial sectors existing in the region and the division of economic activity among sectors. (Note: all estimates are from the IMPLAN model, which utilizes a database from the 1990 census. These estimates may differ from other published reports.

Number of Industrial Sectors: The IMPLAN database consists of 528 industrial sectors defined by four-digit Standard Industrial Classification (SIC) codes. Four hundred and seventy-nine (479) of these sectors exist in the State of North Carolina. Thus, North Carolina has a very diverse economy. The State has not been affected by recessions as much as some have other States, and the unemployment rate has generally been lower than the national average.

The Croatan region has 184 industrial sectors, 34.8 percent of the national total and 38.4 percent of the North Carolina total. This indicates a concentration of economic activity in fewer sectors as compared

to the State and a much less diverse economy. The unemployment rate in the Croatan region has been generally above the rate for the State.

The individual counties in the Croatan region are less diverse than the region as a whole. They range from the least diverse, Jones with 75 industrial sectors represented (Table 3.40), to the most diverse, Craven with 153 industrial sectors represented. Table 3.40 shows the importance of diversity in all three counties in the Croatan region.

A diverse economy would have a large percentage of its work force in manufacturing (where most of the outputs for export are produced), wholesale and retail trade (to supply goods to the economy) and services. North Carolina has 22.77 percent of its work force in manufacturing, 21.17 percent in wholesale and retail trade, and 19.47 percent in services (Table 3.40). The Croatan region, with its much less diverse economy, has only 8.83 percent of its work force in manufacturing (indicating that it must import many manufactured goods), 21.95 percent in wholesale and retail trade, and 17.77 percent in services.

Table 3.40. Percentage distribution of total employment in North Carolina, the Croatan Region, and Craven, Carteret, and Jones counties by aggregated sectors (1990 database). Number of industrial sectors in each in parentheses.

Distribution of Total Employment					
Aggregated Sector	NC (479) %	Croatan (184) %	Craven (153) %	Carteret (138) %	Jones (75) %
Agr., Forestry, & Fish	2.62	3.35	1.85	4.74	16.57
Mining	0.17	0.16	0.18	0.08	0.53
Construction	7.96	6.90	6.41	7.85	6.74
Manufacturing	22.77	8.83	8.86	8.29	13.37
Trans., Comm., & Util.	4.09	3.04	3.02	2.92	4.57
Wholesale & Retail Trade	21.17	21.95	17.84	29.97	20.45
Fin., Ins., & Real Estate	5.13	5.00	3.89	7.30	3.39
Services	19.47	17.77	15.60	22.32	14.09
Government Enterprises	1.32	2.56	3.44	0.99	1.41
Special Industries	15.30	30.44	38.91	15.54	18.88

Concentration of Economic Activity: The 184 industrial sectors in the Croatan region were aggregated into 10 major sectors (Table 3.41). The aggregated sectors were then summarized by six measures of economic activity -- total income, employment, exports, final demand, value added, and total industrial output. The percentage distribution of each of the measures by aggregated sector is presented for the Croatan region in Table 3.41 and for North Carolina in Table 3.42.

Employment: The Croatan region and the State have similar employment patterns with two major differences. Only 8.83 percent are employed in manufacturing in the Croatan region compared to 22.77 percent in North Carolina. Conversely, 30.44 are employed in special industries in the Croatan region compared to only 15.30 in the State. This is an indication that the region must import manufactured goods and services, but that it is an exporter of employment to special industries and government enterprises.

The aggregate of "special industries", consists of households, federal and local governments, and miscellaneous adjustments to the model. Employment in special industries in the region is primarily

military employment. The primary government enterprise is the USDA Forest Service. The eastern North Carolina region has 8.3 percent of the Federal Government - military employment in the State.
Income: There are several differences between the distribution of employment and the distribution of income in the Croatan region, indicating differences in salary structures. The distribution of income in the region is similar to that in the State in construction; wholesale and retail trade; finance, insurance, and real estate; and services. The greatest differences are in mining, government enterprises, and special industries.

Table 3.41. Eastern North Carolina distribution of six measures of economic activity by aggregated sectors (1990 database).

	Measures of Economic Activity					
Aggregated Sector (Numbers are %)	Employment	Total Income	Value Added	Exports	Final Demand	Total Output
Agr., Forestry, & Fish	3.35	2.81	2.71	5.09	0.74	4.57
Mining	0.16	2.15	2.06	0.25	0.03	2.59
Construction	6.90	5.32	4.98	0.02	8.61	9.29
Manufacturing	8.83	12.21	11.57	77.35	22.85	22.42
Trans., Comm., & Util.	3.04	5.09	5.16	4.65	5.13	5.67
Wholesale & Retail Trade	21.95	11.19	12.98	3.94	11.03	9.88
Fin., Ins., & Real Estate	5.00	12.27	14.71	2.53	13.59	11.92
Services	17.77	13.67	13.03	1.39	15.76	13.08
Government Enterprises	2.56	2.46	2.29	0.04	0.39	2.15
Special Industries	30.44	32.83	30.51	4.74	21.87	18.43

Table 3.42. State of North Carolina distribution of six measures of economic activity by aggregated sectors (1990 database).

	Measures of Economic Activity					
Aggregated Sector (%)	Employment	Total Income	Value Added	Exports	Final Demand	Total Output
Agr., Forestry, & Fish	2.62	1.89	1.82	3.30	0.66	3.22
Mining	0.17	1.72	1.63	2.40	0.27	1.89
Construction	7.96	5.73	5.33	0.02	10.74	8.64
Manufacturing	22.77	30.23	29.55	76.66	29.92	40.50
Trans., Comm., & Util.	4.09	7.85	7.84	4.78	5.54	7.10
Wholesale & Retail Trade	21.17	12.54	14.11	6.58	11.90	9.11
Fin., Ins., & Real Estate	5.13	11.54	13.16	2.77	13.68	9.95
Services	19.47	14.15	13.31	1.55	16.31	12.14
Government Enterprises	1.32	1.76	1.63	0.03	0.39	1.45
Special Industries	15.30	12.58	11.62	1.90	10.59	5.99

About the same percentages are employed in mining in the State (0.17) and in the Croatan region (0.16), but regional employees have a higher percentage of the total income (2.15) than do their counterparts in the State as a whole (1.72).

The distribution of income also can be compared to the distribution of employment identifies industries that pay employees better than others. For example, mining has only 0.16 percent of the employment in the region, but 2.15 percent of the income or a ratio of 13.44 (2.15 divided by 0.16). Other industries with a ratio greater than one are finance, insurance, and real estate (2.45), transportation, communication, and utilities (1.67), manufacturing (1.38), and special industries (1.08). Wholesale and retail trade has the lowest (0.51).
Value Added: As outputs from one industrial sector are utilized by another sector to produce other outputs, there is an increase in value over and above production costs. The sum of all such costs is value

added. For example, trees from the forest products sector are used by the sawmill sector to produce lumber, which may be sold to the wood household furniture sector. At each stage, value is added and the total of all values added at these intermediate steps is captured in the value added estimates (Tables 3.41 and 3.42).

About 30 percent of the value added in the Croatan region is from special industries while about 30 percent of the value added in the state is from manufacturing. The contribution to value added by wholesale and retail trade; finance, insurance, and real estate; and services is about the same in the region and the state. Mining contributes the least in the region.

Exports: Both the State and the Croatan region depend upon manufacturing for about three-quarters of their exports (76.66 and 77.35 percent, respectively). Because the region is a subset of the state, there is more exported to "rest of the world industries" (included in special industries) than for the State (4.74 percent). Most of the output from the agriculture, forestry, and fisheries sector also is exported.

Final Demand: Final demand is a measure of the ultimate consumption of goods and services. For households in a region or State, it is the sum of value added plus imports. The distribution of final demand for the region is similar to the distribution for the State, with minor exceptions.

Final demand is significantly higher for special industries in the Croatan region (21.87 percent), than it is for the State. Demand is lower in manufacturing and construction. All others are essentially equal in distribution.

Total Output: The distribution of Total Output from the aggregated sectors for the Croatan region is not very different from that of the State, with two exceptions. The Croatan region has significantly more of its output from special industries (primarily military), while the State of North Carolina has more of its output from manufacturing and finance, insurance, and real estate.

The comparison of the distribution of all six measures in the region with the state shows that the region is considerably less diverse than the state. Table 3.43 compares the region with the State for employment, total income, and total output.

Table 3.43. Comparison of the distribution of employment, total income, and total output between the Croatan region and the State by aggregated sectors (1990 database).

	Measures of Economic Activity					
	Employment		Total Income		Total Output	
Aggregated Sector	Croatan %	State %	Croatan %	State %	Croatan %	State %
Agr., Forestry, & Fish	3.35	2.62	2.81	1.89	4.57	3.22
Mining	0.16	.017	2.15	1.72	2.59	1.89
Construction	6.90	7.96	5.32	5.73	9.29	8.64
Manufacturing	8.83	22.77	12.21	30.23	22.42	40.50
Trans., Comm., and Utilities	3.04	4.09	5.09	7.85	5.67	7.10
Wholesale and Retail Trade	21.95	21.17	11.19	12.54	9.88	9.11
Fin., Insurance and Real Estate	5.00	5.13	12.27	11.54	11.92	9.95
Services	17.77	19.47	13.67	14.15	13.08	12.14
Government Enterprises	2.56	1.32	2.46	1.76	2.15	1.45
Special Industries	30.44	15.30	32.83	12.58	18.43	5.99

Forest Service and Regional Interactions: Forest Service management primarily affects the wood and paper processing and recreation and tourism sectors. These sectors are examined in more detail to better understand their importance to the regional economy.

3.4.2.2. Wood and Paper Industries

Timber from national forest lands is processed in the wood products and the pulp and paper products sectors. Total employment in each of these sectors and the distribution for the Croatan region and the State of North Carolina are presented in Table 3.44.

As shown in Table 3.44, the wood products sectors represent less than 1 percent of State employment and only 1.79 percent of the employment in the Croatan region. The importance of these sectors in the region and the state wood products sectors are shown in the last column. Employment in the region is 8.05 percent of the State employment in logging camps and contractors, but 12.18 percent of veneer and plywood, most of whom are employed by Atlantic Veneer Corporation in Beaufort.

The State's largest pulp mill, owned by Weyerhaeuser Company, is located in the region. The 620 employees are 87.20 percent of the State total. Weyerhaeuser has utilized most of the roundwood sold from the national forest and most of the sawmill residues from national forest sawtimber. Use of residues is expected to change in the future as timber cutting methods are changed from regeneration of older timber to thinning. The Weyerhaeuser mill is oriented toward chipping, so the roundwood now goes to other mills.

Table 3.44. Total employment and distribution of employment, wood and paper products sectors, in Eastern North Carolina and North Carolina (1990 database).

	Measures of Economic Activity				
	Employment		Total Income		Percent Croatan Employment is of
Aggregated Sector	Croatan Jobs	State Jobs	Croatan %	State %	State %
Wood Products Sectors					
Logging Camps and Cont	396	4,922	0.55	0.13	8.05
Sawmills and Planing	80	8,609	0.11	0.22	0.93
Hardwood Dimension	6	6,168	0.01	0.16	0.10
Veneer and Plywood	776	6,372	1.08	0.17	12.18
Others	22	7,840	0.04	0.21	0.28
Subtotal	1,280	33,911	1.79	0.89	0.28
Pulp and Paper Products Sectors					
Pulp Mills	620	711	0.87	0.02	87.20
Paper Mills	0	5,732	0.00	0.15	0.00
Paperboard Mills	0	3,325	0.00	0.09	0.00
Paperboard Containers	0	9,392	0.00	0.24	0.00
Others	0	819	0.00	0.02	0.00
Subtotal	620	19,979	0.87	0.52	3.10
Total	1,900	53,890	2.66	1.41	3.53

3.4.2.3. Recreation and Tourism

Recreation and tourism are important to the region because of the presence of the military and the large number of summer residents. Activities on the CNF directly affect the quality and quantity of recreation and tourism. There is no single defined industry for recreation and tourism, so several sectors are used as proxies (Table 3.45).

Recreation and tourism are more important to the economy of the Croatan region than to the state. Approximately one in nine are employed in recreation- and tourism-related industries in the region (11.67 percent), while only one in eleven are employed in those industries in the State (9.42 percent). A higher percentage of regional employment is in Eating and Drinking, Miscellaneous Retail, Hotels and Lodging Places, and Amusement and Recreation sectors than is in the State. The Croatan region has only 2 to 3 percent of the State employment in recreation- and tourism-related sectors. The low percentage is because the area is primarily a final destination for tourists and summer residents wanting an ocean or beach experience. Many businesses provide reduced services during the late fall, winter, and early spring months.

Table 3.45. Total employment and distribution of employment, for selected recreation and tourism related sectors, in the Croatan Region and North Carolina (1990 database).

	Measures of Economic Activity				
	Employment		Total Income		Percent Croatan Employment is of
Aggregated Sector	Croatan Jobs	State Jobs	Croatan %	State %	State %
Eating and Drinking	4,377	190,532	6.12	4.94	2.23
Miscellaneous Retail	2,300	113,071	3.22	2.93	2.03
Hotels and Lodging Places	1,142	35,611	1.60	0.92	3.21
Automobile Rental	83	7,380	0.12	0.19	1.12
Amusement and Recreation	439	16,834	0.61	0.44	2.61
Total	8,341	16,834	11.67	9.42	2.30

3.4.2.4. Economic Dependency

The high percentage of employment in recreation and tourism indicates that these are sectors on which the region is dependent for exports (tourists purchase goods and services within the region). Overall, exports total $305.2 million or about 8.9 percent of the total output for final demand of $3.428 billion, approximately three-quarters of which come from manufacturing (Table 3.41). That regional percentage is lower than the statewide percentage of 10.3 percent.

Table 3.46 presents the distribution of employment and income associated with the export component of the regional economy. These percentages include the export activity presented in Table 3.41 plus indirect activity (industries supplying goods and services to exporting industries) and induced expenditures (household expenditures of income associated with export production) generated by export-related production. Direct, indirect, and induced income and employment estimates were developed using total exports and multipliers generated in the IMPLAN model.

Table 3.46. Croatan Region distribution of export related employment and income by aggregated sectors (1990 database).

	Measures of Economic Activity	
Aggregated Sector	Total Employment %	Total Income %
Agr., Forestry, & Fish.	9.40	5.81
Mining	0.12	0.26
Construction	0.06	0.03
Manufacturing	60.06	57.61
Trans., Comm., & Util.	8.81	5.41
Wholesale & Retail Trade	11.83	7.44
Fin., Ins., & Real Estate	4.95	3.99
Services	4.65	2.31
Government Enterprises	0.12	0.09
Special Industries	0.00	17.05

As shown in Table 3.46, most of the employment and income associated with exports is in the manufacturing sectors (60.06 percent and 57.61 percent, respectively). Seventeen percent of export income is from rest of the world industries which is a subset of the special industries aggregate. This percentage represents the regional residents who work outside of the region and bring income back into the region.

In the Croatan region, one sector (pulp mills) contributes over one-half of the total production for export (59.7 percent). This sector has 40.7 percent of the income and 33.8 percent of the employment associated with production for export (Table 3.47).

The total exports to rest of the world industries represent regional residents working "abroad" and can be used as a measure of internal dependency of the constituent counties in the Croatan region. As shown in Table 3.48, Jones has the most residents working "abroad" and Craven and Carteret have the least. Jones county also has the fewest industrial sectors.

The distribution of industrial sectors within the region is more important than the number of sectors. Counties in the region have a wide range in the number of sectors represented (Craven has more than twice as many as Jones). This number affects each county's dependency on the others for buying and selling of goods and services. Table 3.47 presents the total exports distributed by the 10 aggregated sectors for the State, the region, and each county.

Table 3.47. Croatan Region distribution of exports and related direct, indirect, and induced employment and income by largest exporting sectors (1990 database).

Sector	Exports $	Total Income $	Total Employment Jobs
Pulp Mills	182,056,400	66,323,147	1,268
Commercial Laundry Equipment	17,818,920	8,535,263	378
Rest of the World Industries	14,464,470	27,787,693	0
Wholesale Trade	11,883,510	11,945,304	432
Logging Camps and Contractors	11,755,200	4,995,960	163
Power Driven Hand Tools	8,561,234	4,994,624	120
Feed Grains	6,467,929	5,284,298	108
Water Transportation	6,103,531	2,354,742	125
Veneer and Plywood	6,077,984	3,296,091	142
Total	265,189,178	135,517,122	2,736

Table 3.48. Exports by rest of the world industries by county in the Croatan region (1990 database).

Rank (Most to Least)	County	Number of Sectors	Total Exports
1	Jones	75	12,602,910
2	Carteret	138	1,406,870
3	Craven	153	454,690
		Total	14,464,470

The three-county Croatan region is very similar to the state in the distribution of exports. As shown in Table 3.49, the region generally is an exporter of agriculture, forestry, and fisheries; manufacturing; and rest of the world industries (residents working outside the region). Table 3.49 also shows some of the flows of goods and services among the three constituent counties in the region.

Jones County is the least diverse with only 75 industrial sectors represented. It must import most of its goods and services, but it does have some exports. Approximately three-fourths of its agriculture, forestry, and fisheries sector exports are from two industrial sectors, Feed Grains and Forestry Products. Sixty percent of all exports are represented by rest of world industries, Jones county residents working outside the county.

Table 3.49. Percentage distribution of Total Exports in North Carolina, the Croatan Region, and Jones, Carteret, and Craven counties by aggregated sectors (1990 database). Number of Industrial Sectors in each in parentheses.

	Distribution of Total Exports				
Aggregated Sector	NC (479) %	Croatan (184) %	Jones (75) %	Carteret (138) %	Craven (153) %
Agr., Forestry, & Fish.	3.30	5.09	21.31	10.15	2.61
Mining	2.40	0.25	0.19	0.13	0.28
Construction	0.02	0.02	0.01	0.05	0.02
Manufacturing	76.66	77.35	12.01	54.58	87.83
Trans., Comm., & Util	4.78	4.65	1.53	14.47	2.92
Wholesale & Retail Trade	6.58	3.94	3.81	7.84	3.16
Fin., Ins., & Real Estate	2.77	2.53	0.76	7.35	1.71
Services	1.55	1.39	0.27	2.54	1.25
Government Enterprises	0.03	0.04	0.02	0.08	0.03
Special Industries	1.90	4.74	60.09	2.91	0.19

Carteret County is much more diverse with more potential for exports. Like Jones County, Carteret also exports much of the products from the feed grains and forest products sectors. Ninety percent of the county's exports from manufacturing are from two sectors, commercial laundry equipment and veneer and plywood. Because the Carteret County is adjacent to the Atlantic Ocean, it also exports water transportation and real estate services, the latter to summer residents.

Craven county is the most diverse county in the region. Like Jones and Carteret, it exports feed grains and forestry products. Three-quarters of all its exports, however, are from one sector, pulp mills. The largest pulp mill in the state is located in the county. Other exporting sectors are logging camps and contractors and power driven hand tools.

3.4.2.5. Relationship Of Croatan National Forest To Eastern North Carolina

The CNF contributes to the economy of eastern North Carolina in several ways. First, it provides income and employment in timber processing sectors through the sale of timber. Second, it provides opportunities for developed and dispersed recreation activities, including hunting and fishing. Expenditures by the Forest Service and its employees create demand for goods and services from regional industrial sectors, and payments to counties from revenues received contribute to educational and highway expenses.

Of an estimated a total of 754 jobs supported by the timber program for the National Forests in North Carolina, 44 are estimated to be in the Croatan region. The FY 1990 Recreation Information Management (RIM) report showed that the Croatan National Forest had 377,200 recreation visitor days (RVDs). Applying coefficients for dispersed and developed recreation generated with the IMPLAN model, these RVDs generated 523 jobs. The total of 567 is approximately 0.8 percent of the regional total of 71,525.

An estimated regional income from timber harvesting is $15,867,500 of which $967,698 would have been on the Croatan. Using IMPLAN income coefficients for the 377,200 RVDs, $10,434,484 of income would have been generated in the region. The total of $11,402,182 is approximately 0.3 percent of the regional income of $3,732,523,913.

Although the region depends upon its timber and wood based sectors for exports, the activities on the Croatan National Forest have only a minor impact on the region as a whole. The 44 jobs supported by the timber program are significant to the wood processing sectors, but represent only about 2.3 percent (Table 3.44). These jobs are particularly important in sectors processing veneer and plywood. Much of the roundwood harvested from national forest land in the future may go out of the region.

The estimated 523 recreation-related jobs supported by the CNF represent only 6.3 percent of the regional total (Table 3.45). The Forest Service impact is greater than that percentage indicates because of the recreational opportunities provided. Visitors to the region may be engaged in more than one activity and the national forests are providing the recreational environment.

Returns to Counties

Carteret, Craven and Jones Counties contain Croatan National Forest lands and also receive direct payments from the U.S. Treasury as dictated by the 1976 Payment in Lieu of Taxes Act (PILT) (PL-94-565) and the 2000 Secure Payments for States and Counties Containing Federal Lands Act (PL 106-393).

PILT payments are made every year based on the number of acres of federally owned land in each county. Originally set at 75 cents an acre, this PILT amount has been increased by Congress in recent years and currently averages a little over one dollar an acre per year. The exact amount is determined by annual Congressional appropriations. In 2001, the three counties received PILT payments of $191,417.

In 2000, Congress passed PL 106-393, which replaced the 1908 Twenty-five Percent Act. Previously, 25% of all receipts generated on national forest lands were returned to local counties to be used to

support local schools. However, declining revenues from timber sales in the 1990s caused these payments to decline significantly nationwide.

PL 106-393 gave each county the option of "locking in" and starting in 2001 being paid yearly an amount equal to the highest three average of what they had received in 25% payments over the 14 year period from 1986-1999. All counties in North Carolina elected to lock in the high three average payment. As a result, payments to Carteret and Craven Counties increased from $27,829 in 25% Funds in 2000 to $146,379 in 2001 under PL 106-393. Subject to renewal by Congress, and county decisions to stay with this method of payment, these counties will receive this same yearly payment for the foreseeable future. As a result of this new law, therefore, payments to counties will not vary by alternative, since they no longer are directly linked to 25% of the annual receipts generated by the Croatan National Forests timber, recreation, or special use receipts.

Environmental Consequences

Economic Impact

The economic impacts as a result of management practices on the CNF are changes in employment and income levels of the regional population. Of all the management activities, the two which have the most impact are the harvesting of timber and the provision of recreation opportunities. Table 3.50 summarizes the employment and income associated with implementing each of the proposed alternatives.

Table 3.50. Employment (number of full-time jobs), income (in 1997 dollars), and payments to counties for timber harvesting and recreation on the CNF by alternative (first decade).

	Timber Harvesting		Recreation	
Alternatives	Employment Number	Income $	Employment Number	Income $
A	35	694,405	582	12,754,359
B	20	349,179	614	13,566,742
C	126	2,799,528	733	16,637,482
C-Modified	126	2,799,528	733	16,637,482
D	92	2,004,104	738	16,777,863
E	51	1,834,845	730	16,249,782

The cumulative impact on the wood product sector for all alternatives would be sustaining employment and income in the local economy. Alternatives C/C-modified would contribute the highest levels in the first 10-year planning period, but would decline in subsequent decades, due to its departure from sustainable declining yield.

Effects of Timber Management

Employment and income are estimated using the IMPLAN (IMPact PLANning) model developed by the Forest Service at Fort Collins, Colorado. The model utilizes county employment data for 1990 (updated to 1993). Coefficients were developed for the three-county region for changes in total harvest, sawtimber, and pulpwood. Also included are the employment and income associated with expenditures for the timber program by the Forest Service and payments to the three counties to supplement education and road costs.

When national forest timber is sold, jobs are created for the harvesters and haulers of the timber (direct). These workers then use their income to buy goods and services in the region (indirect). This creates the need for the production of more goods and services to replace that which was purchased (induced). Table 3.50 includes estimates the direct, indirect, and induced employment and income created as a result of implementing each alternative.

Under the current Land and Resource Management Plan (Alternative A), 35 jobs would be supported in the region with a total income of $694,405. Timber harvesting would be reduced under Alternative B and increased approximately three-fold under alternatives C and D. Alternative C would have the highest employment (126 jobs supported) and income ($2,799,528). Alternative E would provide an estimated 51 jobs and $1,834,845 of income.

Effects of Recreation Management

Each visitor to the Croatan requires goods and services such as gasoline for an automobile, food, lodging, clothing, and other supplies. The IMPLAN model provides estimates based upon the type of recreation activity (e.g., camping, picnicking, hunting, fishing). These estimates take into account the capacity of facilities and the estimated duration of the visit. Table 3.51 shows these estimates for each alternative.

Expenditures by visitors to the national forest in the region have a multiplier effect. Eating in a restaurant, for example, creates jobs for restaurant employees as well as those who supply the restaurant. The estimates in Table 3.50 attempt to capture all of the direct, indirect, and induced jobs generated by visitors to the national forest.

Under current management (Alternative A), approximately 400,200 recreation visitor days would be generated each year. The direct, indirect, and induced employment associated with these visits is estimated to be 582 jobs with an estimated income of $12,754,359. Recreation capacity would increase under each of the other alternatives. In Alternative D, the increased capacity would generate approximately 480,000 visitor days, resulting in 738 jobs supported with a total income of $16,777,863.

Cumulatively, since recreation capacity on the Forest would increase under all alternatives and regional population is expected to increase, employment and income would continue to increase in the future.

Economic Efficiency

The present net value of alternatives represent the discounted projected costs and priced benefits over the planning cycle of 160 years. Priced benefits include projected forest products receipts, and recreation visitor days. PNVs for minerals were not calculated due to the low opportunity for mineral development. Table 3.51 shows the PNVs calculation for timber and recreation outputs.

Table 3.51. Presnet AET values of timber products and recreation uses at 4% discount, 160 year planning horizon.

Alternative	**A**	**B**	**C**	**C-modified**	**D**	**E**
Forest Products PNV (M$)	23,169	4,392	32,078	32,078	27,118	20,900
Recreation PNV (M$)	357,048	361,274	375,005	372,510	375,139	374,820
Total	**380,217**	**365,666**	**407,083**	**404,588**	**402,257**	**395,720**

The highest level of timber output is achieved through Alternative C/C-modified. It departs from the sustainable non-declining yield in the first ten-year planning period. The high level of timber output that occurs early in the planning horizon boosts the PNV substantially higher than any other alternative. The opportunity costs of the other alternatives are due to the constraint for sustainable non-declining yield and lower timber output, especially in the first planning period.

Alternative D has the highest level of recreation visitor days by allowing high levels of access and increasing access where possible. The high levels of access are traded off in the other alternatives by closing roads, especially the unauthorized access. Alternatives A and B go further in trading off recreation outputs by de-emphasizing recreation site developments.

Unpriced benefits accrue for each alternative. These non-quantifiable benefits are described through the goals, objectives, and the desired conditions attained through the management emphasis of each alternative.

CHAPTER 4: LIST OF PREPARERS

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Kathryn Ludlow, former Landscape Architect
Edward Brown, former Silviculturist

CHAPTER 5: AGENCIES AND INDIVIDUALS RECEIVING EIS

Copies of the DEIS were sent to the following Agencies and Individuals:

5.1. Elected Officials

Governor Mike Easley
Honorable John Edwards
Honorable Elizabeth Dole
Honorable Frank Ballance
Honorable Walter Jones
Honorable Mike McIntyre

5.2. Federal Agencies

Agriculture, US Department of (USDA)
Forest Service
Bureau of Indian Affairs
Environmental Protection Agency
Federal Highway Administration
Interior, US Department of (USDI)
Park Service
Fish and Wildlife Service
Marine Corps Air Station, Cherry Point
Marine Corps Base, Camp Lejeune
NOAA
Occupational Safety and Health
Soil Conservation Service
Transportation, US Department of
United States Army Corps of Engineers
United States Air Force
United States Department of Navy

5.3. Indian Tribes

Coharie Intra-Tribal Council
Cumberland County Indian People
Guilford Native American Association
Haliwa-Saponi Trive
Lumbee Regional Development Association
Meherrin Indian Tribe
Metrolina Native American Association
Waccamaw Siouan Development Association

5.4. State Agencies

Agricultural Extension Service
North Carolina Department of Agiculture
North Carolina Department of Cultural Resources
North Carolina Department of Environment, Health, and Natural Resources
North Carolina Department of Transportation
North Carolina Division of Coastal Management
North Carolina Division of Forest Resources
North Carolina Division of Marine Fisheries
North Carolina Forest Service
North Carolina Natural Heritage Program
North Carolina Museum of Natural History
North Carolina Wildlife Resources Commission

5.5. Regional/Local

Carteret County Board of Commissioners
Carteret County Manager
Carteret County Parks and Recreation
Carteret County Tourism Bureau
City of Havelock
City of New Bern
Craven County Board of Commissioners
Craven County Economic Development Commission
Jones County Board of Commissioners
Jones County Administrator
Jones County Economic Development
Mayor of Beaufort
Mayor of Havelock
Mayor of Maysville
Mayor of New Bern
Mayor of Pollocksville
New Bern Chamber of Commerce
Town of New Port

5.6. Schools/Institutions

Anson Technical Institute
Appalachian State University

Cawtaba College
Duke University
East Carolina University
Furman University
Harvard University
Johnson C. Smith University
North Carolina A&T University
North Carolina State University
University of North Carolina - Greensboro
University of North Carolina - Chapel Hill
University of North Carolina - Charlotte
University of North Carolina - Wilmington
Wake Forest University
Warren Wilson College
Wayne Community College
Winthrop College
Yale University

5.7. Libraries

Anson County Public Libray
Central NC Regional Library
D.H. Hill Library
Duplin County Library
Engineering Technology Library - Duke Power
Greensboro Public Library
Hoke County Library
Johnston County Public Library
Pack Public Library
Pender County Library
Rockingham County Public Library
Sheppard Memorial Library

5.8. Individuals

Ivy Albertson
Leslie Albertson
George Allred
John Aneina
John Angst
Giles Arthur
Hal Atkinson
Harold Austin
Stephen Austin
Carl Barnes
M.E. Barnett
Harold Bate
Charles Beier
C.O. Belangia
Robert Belding
Darrell Bell
Eliose Bell
Wayne Bell
Vince Bellis
Billy Benners
Thomas Berg
Clyde Best
Jan Higgin Botham
James Botts
Geoff Bowman
Stephen Boyce
Richard Boyd
William Boyd
Bob Bridges
Robert Bright
Pat Brinkley
Mark Brosseau
Edward Brown
William Brown
Richard Bruce
Paul Bullard
Keith Burch
Robert Campbell
Charles Canady
Henry Carey
Herbert Carlton
Derb Carter
J.H. Carter
Mattie Carter
E.L. Cato
Donald Caudle
Albert Chester
Beth Chester
Henry Colton
John Cockerman
Noah Collins
Carl Coltrane
Bob Conner
Elizabeth Conner
Buddy Connor
Ray Conway
J.D. Cooper
W.M. Couch
Sam Craig
Ralph Cullom
Earl Dail
Stuart Daniels
Donnie Darnell
V.H. Dassow
Joel Davis
Steven Davison
James Delemar
Hugh Devine
Alex Diblick
Molly Diggins
Dennis Dillahunt
Jeanne Doreschuk
Margaret Drummond
Thomas Dunn
D.G. Durrence
Bob Emory
Brenda Etheridge
Joe Evans
Joseph Evans
Sid Fields

Doug Fink
Ken Fish
R.D. Fisher
Lawrence Fitzpatrick
Bill Flournoy
J.G. Formy-Duval
Thomas Fowler
Mark P. Franke
Vich Franklin
Andrew Fuller
Dot Fuss
John Fussell
Paul Gallimore
Macon Garner
Terry Garren
Wayne Gaskins
Alan Geer
Bob Gerry
Earl Gillis
R.E. Godette
Junius Godwin
Bob Goodman
John Goodwin
Robert Graham
C. Blaine Gregory
William Griffin
Edwin Grushiniski
A.C. Hadley
Russ Hallberg
Doris Hammett
Leon Harkins
Tom Harris
Edward Harrison
Kenneth Harrison
Leonard Harwood
T.M. Hasell, Jr.
Vaughn Hatley
Lark Hayes
Adrien Hemby
Tom Henson
Mack Hester
William Hettler
Charlie Hill
Dollie Hill
Elaine Hiner
Randy Hiner
C.A. Hinson
Bill Holman
William Holman
Paxon Holz
David Hook
Wesley Hopkins
Jack Horan
Roger Houser
James Huff
Garvin Hughes
Joseph Hughes
Samuel Hughes
Chuck Hunter
Jeff Hunter
James Hutchens, Jr.
Cindy Ipock
Jeff Irvin
Gene Jackson
Mary Jacques
Rene Jacques
Peter Jeleneusky
Claude Jones
John W. Jones
Richard Jones
Roger Jones
Roy Jones
Steve Kelley
Edward Kelly
Rodney Kennedy
Jean Kerschner
Ron Kilburn
Henry King
Robert King
Peter Kirby
Horace Knapp
Lindsay Knight
Jan Kohlmeyer
Marion Larabee
Mr. League
John Leasure
Richard Leblond
William Lewis
David Liden
Gerald Lieberman
Ada Lupton
Larry Mabry
Joe Maddry
Rich Maggi
Dorothy Maltbie
Jim March
Bobbie Marr
Charles Marr
Ernest Marshall
Dr. M.D. Martin
Terry Martin
Ann Maude
Frank McBride
Chester McConnell
Ray McCotter
Donald McCoy
Linda McGowan
Richard McGowan
Robert McKim
Eleanor McKim
Cliff McLean
Laura McLean
Robert McNeill
James Mead
Ruth Mead
Debby Meade
Dave Meador
Pam Michel
Lewis Mielke
Richard Mills
A.L. Mitchell
Walter Mizelle
Bruce Mock
A.B. Moore
Shade More, Jr.
Don Morris
William Morris
David Morton
Bill Moseley
Bill Mrazek
Lynn Mrazek
Karl Munn
A.P. Mustian, Jr.
Alan Myrick
Charles Nichols
Jim Noles
Alfred Norton
Charles O'Rear

Kirk Otey
Ray Overcash
Don Owen
Leon Owen
Victor Owen
Bobby Padgett
Richard Parker
Dan Parr
Bob Passarelli
Robert Patterson
Sam Pearsall
Eugene Perryman
Charles Peterson
Charlie Phelps
Blaine Phillips
Dan Pittillo
Allen Plaster
Allyn Powell
Alan Powell
Joanne Powell
Charles Propst
Hubert Pulley
Douglas Rankin
Blaine Ray
Lee Reading
Dan Reasor
Ray Rimmer
Donald Robbins
Joseph Roise
Jennifer Rollen
Lela Belle Rose
Jeff Ross
David Rowe
Edward Rudzik
John Runkle
Ruth Sanford
Kimberly Schley
William Schley
George Scott
A.L. Sester
Charles Shaw
Terry Shayne
Denise Sherrill
Terry Sholar
Burt Shuford
Joan Shuford
R. Simmons
Bob Simpson
Mary Simpson
Alvin Smith
Grace Smith
Jeff Smith
Manley Smith
Michael Smith
Steven Smith
Robert Smythe
Robert Snipes
Ingrid Swenson
Martha Stirewalt
Mickey Stokes
Jason Strohman
Jessie Sullins
John Swanson
Monica Swihart
A.B. Swindell
E.W. Temple
Charles Thomas
Mike Thomas
Steve Thomas
J. C. Thompson
Ken Thompson
L.N. Thompson
James Todd
John Tompkins
Roger Tooker
Virginia Tooker
Dave Toon
Guy Troy
G.V.Troyer
James Tucker
David Turner
William Utley
Jerald Vandevoord
Jeff Walters
Alex Warlick
Stephen Warner
Woodrow Weeks
William Weisner
Jim Welborn
Robert D. West
Leon Wetherington
George Whitley
Steve Whittemore
Bobby Willis
David Woods
Austin Wright
Nolan Yount

CHAPTER 6: GLOSSARY

--A--

Active Cluster - A specific red-cockaded woodpecker cluster that is occupies in a given survey year. A cluster is determined to be active when there are nesting or roosting red-cockaded woodpeckers present, or when one or more cavity trees exhibit fresh pitch wells and resin flow, reddish under-bark appearance and/or fresh chipping are present at the cavity entrance.

Administrative Site - Structures and surrounding areas on the Forest including offices, work centers, fire towers, and federally owned residences.

Age Class - An interval into which the age-range of trees is divided for classification or use, usually 10 years.

Age Class Distribution - Frequency of age classes of trees in a given area.

Air Quality Standard - The prescribed level of pollutants in the air that cannot be exceeded legally during a specified time in a specified geographical area in accordance with EPA regulations.

Air Pollution - The presence of contaminants in the air in concentrations that interfere directly or indirectly with human health, safety or comfort or with the full use and enjoyment of his/her property.

All Terrain Vehicle (ATV) - A vehicle characterized by its ability to negotiate most kinds of terrain by virtue of traction devices such as wide tracks, large low-pressure rubber tires, or all-wheel drive.

Allowable Sale Quantity (ASQ) - The quantity of timber that may be sold from the area of suitable land covered by the Forest Plan within a time period specified by the Plan.

Alluvium - Unconsolidated material including gravel, sand, silt and clays deposited by running water.

Alternative - A proposed or possible course of action.

Analysis Area - An aggregation of like capability areas; each analysis area contains all capability areas with similar physical, biological and administrative conditions. Analysis areas consist of a collection of land areas of sufficiently similar character to be reasonably analyzed together.

Analysis of Management Situation (AMS) - A determination of the ability of the planning area to supply goods and services in response to society's demand for those goods and services.

Anaerobic - The absence of free oxygen or living in the absence of free oxygen.

Anadromous Fish - Those species of fish that mature in the sea and migrate into streams to spawn.

Annosum Root Rot - A disease of trees (primarily conifers) which is caused by the fungus *Heterobasidion annosum*. It is often spread by airborne spores which are deposited on the surface of newly-cut tree stumps. The fungus grows through out the stump and then can spread to nearby live trees through root grafts with the stump. Infected trees are often leaning or completely uprooted while still alive due to the decay of support roots.

Aquifer - A water-bearing rock, rock formation or group of rock formations.

Aquatic - Pertaining to water; living or growing in or on water.

Arterial Road - A road which provided service to large areas and usually connects with public highways or other Forest arterial roads to form an integrated network of primary travel routes.

--B--

Basal Area - The cross sectional area (square feet at 4 1/2 feet above ground level) of trees occupying an acre of land. Basal area is used to measure the density of a stand of trees.

Bedding - Method of site preparation which plows, mixes and loosely piles topsoil and litter into elevated beds. Normally done on wet sites to improve soil drainage.

Benchmark - An analysis reference point of the maximum physical/biological capability to produce a resource yield from Forest lands while maintaining minimum legal requirements for production of other resources and maintenance of soil and water productivity. Benchmarks define the area within which alternatives can be formulated.

Best Management Practice (BMP) - A practice or a combination of practices that is determined to be the most effective and practical means of preventing or reducing a amount of pollution generated by non-point sources to a level compatible with water quality goals.

Between-Stand Spatial Diversity - The distribution, arrangement and abundance of different plant and animal communities and species at a multi-stand level.

Biennial - Occurring every 2 years.

Biochemical - Characterized by, produced by, or involving chemical reactions in living organisms.

Biological diversity - The variety of life in an area including the variety of genes, species, plant and animal communities, ecosystems and the interaction of these elements.

Black Turpentine Beetle - A bark beetle, *Dendroctonus terebrans*, that attacks southern pines in the bottom 10 feet of the trunk. It primarily infects trees that have incurred root damage or mechanical injury. Trees will die only if the attacks are very heavy.

Blue Stain Fungi - A group of fungi predominantly from the genera *Ceratocystis* and *Ophiaotoma.* These fungi cause primarily sapwood discoloration, but seldom cause decay. The stains range from grayish through dark blue to blackish.

Board Foot - A unit of timber measurement equaling the amount of wood contained in an unfinished board 1 inch thick, 12 inches long and 12 inches wide.

Bole - The Stem portion of trees; from the ground to the canopy, or trunk.

Botanical Areas - An area which has been classified for special management by the Forest Service as containing specimens or group exhibits of plants, plant groups and plant communities which are significant because of form, color, occurrence, habit, location, life history, arrangement ecology, environment, rarity and/or other features.

Brood Habitat - An area which provides food, water, cover and space for young animals to live.

Brown Spot Needle Blight - A serious disease affecting longleaf pine caused by the fungus *Scirrhia acicola.* Young grass stage seedlings are particularly vulnerable to severe infections and may die or experience a delay of one to several years in emerging from the grass stage (candling).

Browse - Leaf and twig growth of shrubs, woody vines and trees available for animal consumption, usually based on the current year's growth.

Buffer-Filter Strip - A designated land area, along the perimeter of some land use, whose own use is regulated so as to resist, absorb, filter or otherwise preclude or control unwanted development, material or other intrusions into areas beyond the buffer.

Burning Regime - A planned program of prescribed fire in which an area is burned periodically according to a scheduled cycle.

--C--

Canopy - The more or less continuous cover of branches and foliage formed collectively by the crown of adjacent trees and other woody growth.

Capability Areas - Discrete and recognizable units of land or water classified according to the physical, biological and administrative conditions of the area. Their ability to produce resources yields an their production limitations are homogeneous.

Carbon Dioxide CO - A colorless, odorless, nonpoisonous gas that is a normal part of the ambient air. CO is a product of fossil fuel combustion, and some researches have theorized that excess CO raises atmospheric temperatures.

Carnivorous Plant - A plant that traps animals, primarily insects, digests them and uses the nutrients to supplement those lacking or limited in the soil.

Cavity Nester - Wildlife species that excavate and/or occupy cavities in trees and snags.

Cavity Tree - A tree that contains a red-cockaded woodpecker cavity or start hole.

Clearcutting - The removal, in a single cut, of all trees in a stand. It is a method of regenerating an even-aged stand. Regeneration may be accomplished by natural seeding, direct seed seeding or planting seedling.

Closed Road - A road which is permanently or periodically closed to motorized vehicle travel.

Collector Road - A road which serves smaller land areas than arterial road and is usually connected to a Forest arterial road or public highway.

Cluster or Cluster Site - A site in which a clan of red-cockaded woodpeckers nest or roost. It includes the total number and area of cavity trees plus at least a 200-foot zone around them.

Commercial Forest Land (CFL) - Forest land that is producing or is capable of producing crops of industrial wood and; (a) has not been withdrawn by Congress, the Secretary, or the Chief; (b) existing technology and knowledge is available to ensure timber production without irreversible damage to soils, productivity or watershed conditions; and (c) existing technology and knowledge, as reflected in current research and experience, provides reasonable assurance that adequate restocking can be attained within five years after final harvesting.

Commodity - A tangible or physical yield, such as timber, forage, minerals, water, etc., synonymous with RPA's market.

Compartment - An administrative unit of land comprised of several stands and ranging in size from 1,000 to 2,000 acres.

Constant Service Road (Constant entry road) - A road developed and operated for continuous or annual recurrent service.

Constraints - Limitations; things which cannot be done or things which must be done.

Consumptive Use - Those uses of a resource that reduce its supply, such as timber harvesting or fishing.

Continuous Inventory of Stand Condition (CISC) - A computerized data base used by forests in the Southern Region to store stand condition data such as forest type, acres, age stocking level, work needs and similar stand attributes.

Conversion - A change from one tree species or community of species to another.

Corridor - A narrow strip of land, usually for location of transportation of utility rights-of-way within its boundaries.

Cost Effective - Achieving a specified level of yields while minimizing cost, subject to constraints.

Cost Efficient - Achieving a specified level of yields while maximizing net benefit, subject to constraints.

Council on Environmental Quality (CEQ) - An advisory council to the President established by the National Environmental Policy Act of 1969. It reviews federal programs for their effect on the environment, conducts environmental studies and advises the President on environmental matters.

Crown Closure - Percent of tree canopy closure.

Cubic Foot (CF) - The amount of timber equivalent to a piece of wood having dimensions of one foot by one foot by one foot.

Culmination of Mean Annual Increment (CMAI) - The age at which the average annual growth is greatest for a stand of trees. Mean annual increment is expressed in cubic foot measure and is based on expected growth according to management intensities and utilization standards assumed in accordance with 36 CFR 219.16 ((a)(2)(i) and ii).

Cultural Resources - The remains of sites, structures or objects used by humans in the near (historical) or distant (archaeological) past.

Cumulative Impact (Effect) - The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions regardless of what agency (Federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. (40 CFR 1508.7)

Current Management - Management of Croatan National Forest under existing standards and guidelines with annual yields and costs based upon the average outputs and costs for Fiscal years 1981 - 1985.

--D--

DBH (Diameter Breast Height) - Diameter of a tree approximately 4 1/2 feet above the ground.

Demand - The amount of a good or service that users would be willing to take at a specified price, time period and conditions of sale.

Desired Future Condition - An expression of resource goals that have been set for a unit of land. It is written as a narrative description of the landscape as it will appear when the goals set for it have been achieved. It includes a description of physical and biological processes, the environmental setting and the human experience.

Developed Recreation - Recreation that requires facilities and results in concentrated use of an area. Examples are campgrounds and picnic areas.

Direct Effects - Effects which are caused by an action taken and occur at the same time and place as the action.

Dispersed Recreation - Recreation outside of developed recreational facilities. Examples are hiking and driving for pleasure.

Diversity - The distribution and abundance of different plant and animal communities and species within the planning area.

Dormant Season - A period in which certain plant species exhibit a special condition of arrested growth in which the plant and such plant parts as buds and seeds do not begin to grow without special environmental cues such as photo period.

Draft Environmental Impact Statement (DEIS) - A draft version of the Environmental Impact Statement which must follow the requirements of NEPA, the Council on Environmental Quality (CEQ) guidelines and directives of the agency responsible for the project proposal.

--E--

Early Forest Succession - The biotic community that develops immediately following the removal or destruction (e.g., from wildfire) of the vegetation in an area. This habitat is characterized by an abundance of grasses, brush and forbs. A forest canopy is generally not present but some scattered trees may offer partial shaded.

Ecological Classification System - A hierarchial system used to help organize and coordinate the classification of ecological types and ecological units and to make comparisons. Classification is ecologically based and integrates existing resource data such as climate, typography, geology, soil, hydrology and vegetation. The system includes many levels (from a top down approach): domain, division, province, section, subsection, landtype association, landtype, landtype phase and site.

Ecological Management Unit - A unit of soil classification that describes the landform, soil texture, water regime, certain behavior patterns of soil (pans, sand-cap, etc.) and key modifiers (soil that are extremely acid, shallow in depth, sodium, etc.).

Ecological Sub-unit - An intermediate level in the ecological classification system based on landform, natural vegetative communities and soils.

Ecological Unit - A group of landtypes. The landtypes in the associations are sufficiently homogeneous to be considered as a whole for modeling the future outputs and effects of planned management activities. These units may not follow watershed boundaries and are defined on the basis of general similarities in geology, climate, landform and vegetation.

Ecology - The science of the interrelationships between organisms and their environment.

Economic Dependency - The percentage of income and employment that is associated with the basic economy. It can be expressed in total or by market sectors.

Economic Diversity - The number of market sectors in an area and the distribution of economic activity within these sectors. The economic activities used to define economic diversity include total income, employment, exports, final demand, value added and industrial output.

Economic Efficiency - A measure of how well inputs are used to achieve yields when all inputs and yields (including environmental) are identified and valued. It is usually measured by incremental present net value. Other measures, such as benefit/cost ratio, or rate of return may be used.

Ecosystem - The sum of the plant community, the animal community and environment in a specified area. This includes all living and non-living things and the processes associated with these components. Ecosystems are characterized by composition, structure and process. Humans are a part of the ecosystems.

Ecosystem Management - The use of an ecological approach to achieve to multiple-use management of national forests and grasslands by blending the needs of people and

environmental values in such a way that national forests and grasslands represent diverse, healthy, productive, and sustainable ecosystems.

Edge - An area where plant communities meet or where successional stages of vegetative conditions within plant communities come together, e.g., forest and meadow.

Emission - A discharge of pollutants into the environment, partially or completely treated or in its natural state. Generally used in regard to discharge into air.

Endangered Species - Any species which is in danger of extinction throughout all or a significant portion of its range.

Endangered Species Act (ESA) - A law requiring federal agencies to conserve endangered and threatened species, and strictly prohibits any person from harassing or harming any listed species. It also requires federal agencies to develop information about the potential impacts of proposed actions on a listed species before the National Environmental Policy Act of 1969.

Environmental Assessment (EA) - An analysis of all actions and their predictable short and long-term environmental effects, which include physical, biological, economic and social factors and their interactions. Also, a concise public document required by the regulations for implementing the procedural requirements of the National Environmental Policy Act of 1969.

Environmental Effect - An environmental consequence as a result of a proposed action. It includes both direct and indirect effects.

Environmental Impact Statement (EIS) - A formal document which must follow the requirements of NEPA, the Council on Environmental Quality (CEQ) guidelines and directives of the agency responsible for the project proposal.

Erosion - The wearing away of the land's surface by forces such as running water, wind, ice or geological agents. It includes detachment and movement of soil or rock fragments by water, wind, ice or gravity.

Escape Cover - A portion of the habitat which provides refuge for animal species and protects them form harassment and predation.

Escaped Fire - A fire which has exceeded, or is anticipated to exceed, pre-planned initial action capabilities or the fire management direction.

Estuaries - Areas where the fresh water meets salt water.

Even-aged Timber Management - The combination of actions that results in the creation of stands in which trees of essentially the same age grow together.

Exotic - Refers to a non-native or introduced plant or animal species.

Extirpation - A species that is being removed from a geographical portion of its original range; the species still exists, but its range is now much smaller.

--F--

Facility - A single or contiguous group of improvements that exists to shelter or to support Forest Service programs.

Fauna - The animals of a given region or period.

Federal Register - The designated document that notifies the public of federal actions and includes such things as Notice of Intent, calls for public involvement, etc. This document also publishes the regulations needed to implement those federal actions.

Feral - Animals that have reverted from domestication to a wild state.

Final Environmental Impact Statement - The document that follows a draft environmental impact statement and contains analysis regarding forest programs that will have a significant impact on the environment.

Fire Intensity Level - A term describing fire behavior based on flame length and heat generated by fire in BTU/Sec-Ft used in estimating fire suppression requirements and fire effects on resources.

Fire Lines - A linear barrier used to stop prescribed burns and wildfires by removing or treating fuels. Fire lines may include the use of mechanically plowed lines, water, retardants, etc.

Fire Regime. Burning Regime.

Floodplain - Low land and relatively flat areas joining inland and/or coastal waters. The minimum area included is that subject to a 1 percent (100-year recurrence) or greater chance of flooding in any given year. Executive Order (EO) 11988 provides direction in the management of these areas to avoid losses of life, property, wildlife or other beneficial values.

Flora - The plants of given region or period.

Forage - The vegetation that is eaten by wildlife species.

Forb - Any herbaceous plant other than grass-like plants.

Forest Fragmentation - The condition is isolated forested habitats that adheres to the principles of island biogeography (also known as insular ecology). It can be described in terms of patterns of alternate land uses which separate forest patches such as croplands, pastures, power line rights-of-way, highway corridors, and other non-forest habitat. Three primary factors which interact to determine whether a forest is subject to fragmentation are patch size, isolation and total forest reserve which are in the system. Habitat fragmentation is a relative term which must be associated with a particular habitat and species.

Forest Land - Land at least 10% occupied by forest trees of any size, or formerly having had such tree cover, and not currently developed for non-forest use.

Forest Plan - A plan which gathers and coordinates the direction to be followed in the overall management of the National Forest.

Forest Tent Caterpillar (*Malcosoma disstria*) - Outbreaks occur periodically on oaks and tupelo gum. Growth loss and dieback occur, but trees are seldom killed. Control action is rarely warranted.

Forest Type/Cover Type/Stand Type - A classification of forest land based upon the tree species with the most live tree crown dominance.

FORPLAN - A linear programming model used to facilitate analysis of the alternatives.

Fuels - Living or dead plant material that will burn when weather conditions are correct.

Fuel Loading - An estimate of the entire accumulation of vegetative matter on a given area, expressed in tons per acre.

Fuel Model - A mathematical expression of fire fuels used in estimating wildfire or prescribed fire behavior.

Fusiform Rust - A common forest tree diseased caused by a fungus (*Cronartium quercuum f. sp. fusiforme*). This disease primarily affects loblolly and slash pine.

--G--

Game - The species of wild animals that are hunter, fished or trapped.

Genetically Improved - Most often referred to in terms of pine seedlings grown in seed orchards or nurseries that have been genetically manipulated to enhance certain features such as pest resistance.

General Forest Area - An area in which no single resource is singled out for emphasis.

Geographic Information System (GIS) - An informational processing technology to input, store, manipulate, analyze, and display spatial resource data to support the decision making processes of an organization. Generally, it is an electronic medium for processing map information, typically used with manual processes to effect specific decisions about land base and its resources.

Goal - Concise statement that describes a desired condition to be achieved sometime in the future. It is normally expressed in broad, general terms and is timeless in that it has no specific date by which it is to be completed. Goal statements form the principal basis from which objectives are developed. (36 CFR 219.3)

Goods and Services - The various outputs, including on-site uses, produced from forest resources.

Guideline - A preferred course of action. Guidelines promote achieving Forest Plan goals and objectives in a manner that permits operational flexibility to respond to variations such as changing site conditions or changed management circumstances.

--H--

Habitat - The physical and biological environment of a plant or animal where all essentials for it development, existence and reproduction are present.

Habitat Linkages - Corridors of lands connecting similar wildlife habitat areas.

Habitat Management Area (HMA) - The desired future demographic configuration of a red-cockaded woodpecker population. It is an area dedicated to RCW management.

Hardwoods - Broad-leaved and deciduous trees.

Harvests - Cutting and removing trees from a forest.

Herbicide - A chemical compound used to kill or control growth of selected plant species.

Hunt Camp - A dispersed recreation site with rustic or minimum facilities normally used by hunters, etc.

Hydric Soils - Soils which are saturated, flooded or ponded long enough during the growth season to develop anaerobic conditions in the upper region of the soil.

--I--

IMPLAN - A computer-based system used by the Forest Service for constructing non-survey input-output models to measure economic input.

Improvement Cut - Cutting that adjusts species composition, tree quality or stand health in stands which are older than the sapling stage.

Inactive Cluster - A cluster site where there are no red-cockaded woodpeckers present and when none of the cavity trees exhibit active resin wells. Active resin wells are noted by recent pecking and clear, fresh resin flowing form the well, reddish under-bark appearance or fresh chipping of cavity entrance of plate.

Inclusions - A community of trees and other plants with all the attributes of a stand, but not meeting minimum stand size or shape criteria.

Indirect Effects - The effects which are caused by the action and occur later in time or farther removed in distance, but are still reasonably foreseeable.

Insectivorous Birds - Birds whose primary diet consist of insects.

Interdisciplinary Team (ID Team) - A group of individuals with skills from different resources assembled to identify and resolve issues and problems.

Interim Standards and Guidelines for the Protection and Management of the Red-cockaded Woodpecker Habitat within 3/4 Mile of Cluster Sites --Red-cockaded woodpecker management issued May 9, 1990 - The guidelines updated the direction found in the "1985 Recovery Plan" and is in effect until the EIS for RCW management is finalized.

Intermediate Stand Treatment or Harvest - Any removal of a portion of the trees from a stand between the time of its formation and the regeneration cutting.

Intermittent Service Road - A road developed and operated for periodic service and closed for more than one year between periods of use.

Interpretive Sites - Site at which a broad range of natural or cultural phenomena are interpreted or described for the enjoyment of the public.

Intertidal Drainages - Areas between high and low water levels that flow off gradually.

Intolerant Species - Those plant species that do not grow well in shade.

Invertebrate Species - Animals that are lacking a spinal column. Most Forest connotations deal with insect populations.

Ips Beetle - A pine bark beetle (*Ips avulsus, Ips grandicollis, Isp calligraphus*) that usually attacks only injured, dying, or recently felled trees and fresh logging debris. Infestations are particularly common in trees weakened by drought or stuck by lighting.

Irretrievable - Applies to losses of production, harvest, or use of renewable natural resources.

Irreversible - Applies primarily to the use of nonrenewable resources, such as minerals or cultural resources, or to those factors, such as soil productivity, that are renewable only over long time periods; also includes loss of future options.

Issue - A subject or question of widespread public discussion or interest regarding management of National Forest system lands.

--K--

Key Area - Areas of land which supplement specific habitat requirements (food, water or cover).

--L--

Late Succession - A stage of forest development where the majority of trees are mature or over mature.

Landform - Any physical, recognizable, form or feature of the earth's surface having a characteristic shape and was produced by natural causes.

Legume - A simple, dry, dehiscent, podlike fruit which splits along two seams, as pea pod.

Linear Programming - A mathematical technique for determining the effects of alternatives on resources allocations.

Local Road - These roads connect terminal facilities (log landings, skid trails, recreational sites, etc.) With Forest collector or Forest arterial roads, or public highways.

Long-term Effects - Those effects which generally occur after 20 years.

Long-term Sustained Yield Capacity - The highest uniform wood yields from lands being managed for timber production that may be sustained under a specified management intensity, consistent with multiple use objectives.

Low Human Disturbance - Areas where timber harvesting, prescribed burning and other management methods are allowed but at a lower magnitude than in the general forest area. Road density is generally less than in the general forest area.

Low Impact Recreation - Recreational activities which have little or no effects on the natural environment such as hiking, bird watching, etc.

--M--

Management Area - Areas of the Forest with similar management objectives where compatible prescriptions are applied.

Management Attainment Report (MAR) - An annual accomplishment report of budgeted and targeted items required by Forest Service Policy.

Management Concern - A matter of importance to the management of the National Forest system lands, which is identified internally by the agency.

Management Direction - A statement of multiple use and other goals and objectives, the management prescriptions and the associated standards and guidelines for governing them.

Management Emphasis - The multiple use values to be featured or enhance.

Management Indicator Species - A particular type of plant or animal whose presence in a certain location or situation is a fairly certain sign or indication that particular environmental conditions are also present.

Management Prescription - Management practices selected and scheduled for application on a specific area to attain multiple use benefits and others goals and objectives.

Management Team - Decision-making group consisting of the Forest Supervisor, Staff Officers, District Rangers and Forest Staff.

Mast - The fruit of all flowering plants used wildlife. Soft mast includes fruit with fleshy exteriors such as berries, drupes, and pomes and is represented by plants such as cherries, dogwoods, hollies, mulberries, blackberries and blueberries. Hard mast includes fruits with dry or hard exteriors such as achenes, nuts (includes acorns), samaras, cones, pods, seeds, and capsules. Examples include oaks, hickories, pines, yellow poplars, beech, honey locusts, hornbeams, hazelnuts, legumes, and grasses.

Maximum Modification (VQO) - Visual quality objective meaning man's activity may dominate the characteristic landscape.

Mean Annual Increment - The average annual growth of a tree, calculated by dividing the total growth it has accrued over its life by its age in years at the time measurement.

Mid-story - A middle canopy layer of smaller trees that occur under an overstory of trees. These trees are usually of a different species than the large tree and can grow in almost total shade.

Mitigation - Actions taken to avoid, minimize, reduced, eliminate or rectify the impact of a management practice.

Mixed Stands - A stand which is made up of more than one trees species. A mixed stand would have no single species comprising more than 70% of the total stand.

Modification (VQO) - A visual quality objective meaning man's activity may dominate the characteristic landscape but must, as the same time, utilize naturally established form, line, color and texture.

Monitoring and Evaluation - Collecting information, usually a sample, to determine how well Forest Plan goals and objectives have been met. Evaluation asks the questions, "Did we do what we said we would?" "Did the project/activity work?" "Are initial Plan assumptions valid?"

Multiple Use Management - The management of all the various renewable surface resources of the National Forests so that they are used in the combination the twill best meet the needs of the American people.

--N--

National Environmental Policy Act (NEPA) of 1969 - This is the basic national charter for protecting the environment. It establishes policy, set goals (Section 101), and provides means (Section 102) for carrying out the policy. (40 CFR 15001.1)

National Forest Management Act (NFMA) - A law passed in 1976 as an amendment to the Forest and Rangeland Renewable Resources Planning Act, requiring the preparation of Regional Guides and Forest Plans, and the preparation of regulations to guide them. (36 CFR 219)

National Register of Historic Places - A listing maintained by the National Park Service or areas which have been designated as being of historical significance.

Native Species - A plant or animal species indigenous to an area.

Natural Regeneration - The renewal of a forest stand by natural means, or without efforts to seed or plant trees. The new trees grow from self-sown seeds or by vegetative means such as root suckers.

Neotropical Migrants - North American birds that migrate to the neotropics (South America, Central America and Caribbean) during the winter but nest in North America.

Net Public Benefit - The overall value to the nation of all yields and positive effects (benefits) less all associated inputs and negative effects (costs) whether they can be quantitatively valued or not. Net public benefits are measured by both quantitative and qualitative criteria rather than a single measure or index.

Net Value Change - (Also Net Resource Value Change). The sum of the changes in resource values on a land area that results from increases (benefits) and decreases (damages) in resource outputs as a consequence of fire.

Nitrogen-fixing Plant - Plants which convert atmospheric nitrogen into nitrogen compounds.

Nonchargeable Volume - All volume that is not included in the growth and yield projections for the selected management prescriptions used to arrive at the allowable sale quantity.

Non-commercial Forest Land - Forest land which is incapable of producing crops of industrial wood or has been designated as Unsuitable for Timber Production.

Non-consumptive Use - That use of a resource that does not reduce its supply such as boating and swimming.

Nongame Species - Animal species that are not usually hunter, fished or trapped.

Non-price Yields - Those yield for which there is no available transaction evidence and no reasonable basis for estimating a market value commensurate with market values associated with price outputs.

Nondeclining Yield - A timber flow constraint which ensures that harvests in each period after the first will be greater than or equal to the harvest in the preceding period.

Non-forest Land - Lands never having or incapable of having ten percent or more of the area occupied by forest trees, or lands previously having such cover and currently developed for non-forest use.

Non-point Source Pollution - Pollution whose source is general rather than specific in origin.

Not Appropriate for Timber Production - Lands that (1) are proposed for uses which preclude timber production, (2) other objectives limit timber production on so that the minimum management requires in CFR 219.27 cannot be met, or (3) are not cost-efficient in meeting Forest objectives over the planning horizon. [36 CFR 219.14(c)]

Not Suited (Unsuitable) for Timber Production - Lands identified as inappropriate for timber production. [36 CFR 218.14(a)(b)]

Notice of Intent (NOI) - A notice printed in the Federal Register announcing that an Environmental Impact Statement will be prepared. (40 CFR 1508.22)

Nutrient Displacement - the movement of organic matter and nutrients off site by mechanical means.

Nutrient Leaching - The movement and subsequent loss of nutrients through the soil.

--O--

Objective - A concise, time-specific statement of measurable planned results that respond to pre-established goals. An objective forms the basis for further planning to define the precise steps to be taken and the resources to be used in achieving identified goals. (36 CFR 219.3)

Objective Function - The item to be maximized (or minimized) in the problem's solution.

Obliteration - (of roads) - To remove all traces, indications, and significance of.

Off-site Tree Species - Pertains to any tree or trees that have been planted or naturally seeded onto a site that historically had other tree species present.

Old Growth - Forest ecosystems distinguished by old trees and related structural attributes. Specific attributes vary according to Forest type, climate, site conditions and disturbance regime.

Opportunity Costs - The value of the most economic use for an input that is foregone by using it differently in a given alternative.

OHV (Off-highway vehicle) - Any vehicle capable of traveling over land where no road exists.

Outputs - The goods, services, and products which are measurable and capable of being used to determine the effectiveness of programs and activities in meeting objectives. Also goods, end products or services that are purchased, consumed or used directly by people.

Overstory - Trees which over-top the other trees.

--P--

Pales Weevil (*Hylobius pales*) - A weevil in which adults feed on newly-planted pines particularly on recent cutover sites. The are the most serious pest of pine reproduction.

Palustrine - Living or thriving in a marshy environment.

Partial Cut - A variety of silvicultural practices where a portion of the stand is removed and a portion is left.

Partial Retention - A visual quality objective which in general means man's activities may be evident but must remain subordinate to the characteristic language.

Perennial Stream - Surface waters that flow throughout the year; receive water not only from precipitation, but also from underground sources at spring and seeps and owe their permanency to the ground water in the area adjoining the stream being at a higher elevation than the stream bed.

Pests - Any animal or plant that during some portion of its life cycle, inhibits the establishment or growth of some other species of plant or animal favored by man. Also refers to those insects and diseases that can be detrimental to achieving resource management objectives.

PETS Species - An acronym for proposed, endangered, threatened or sensitive plant, or animal species for listing pursuant to the Endangered Species Act.

People-at-one-time (PAOT) - A recreation-capaacity measurement term indicating the number of people that can comfortablly occupy or use a facility.

Photosynthesis - The conversion of light energy to chemical energy; the production of carbohydrates from carbon dioxide and water in the presence of chlorophyll by using light energy.

Physiognomy - External aspect or characteristic.

Physiographic region - An area of land having a particular pattern of landforms that differ significantly from adjacent areas.

Pine Sawfly (*Neodiprion sps.*) - Species of sawflies which primarily feed on the needles of conifers, sometimes causing complete defoliation and mortality.

Pine Stand - A stand of trees in which 70 percent or more of the dominant and codominant crowns are pine.

Pine Tip Moth (*rhyacionia frustrana)* - A moth whose larvae infest the buds and shoots of young pine trees causing reduced height growth and poor form. They attack all species of southern pines except longleaf pine.

Pine-Hardwood Stand - A stand of trees in which 51 to 69 percent of the dominant and codominant crowns are pine.

Planned Ignition - A fire started by a scheduled, deliberate management action.

Planning Horizon - The overall time period considered in the planning process that spans all activities covered in the analysis or plan and all future conditions and effects of proposed actions which would influence the planning decisions.

Planning Period - One decade (10 years). The time interval within the planning horizon that is used to show incremental changes in yields, costs, effects and benefits. (36 CFR 219.3)

Planning Process - The regulations as established in 36 CFR 219 for developing, adopting, and revising land and resource management plans for the National Forest System as required by the Forest and Rangeland Renewable Resources Planning Act of 1974 as amended by the National Forest Management Act of 1976.

Plant Communities - An association of plants of various species found growing together in different locations with similar site characteristics.

Potable Water - Water suitable for drinking or cooking purposes from both health and aesthetic considerations.

Potential Yield - The maximum possible harvest during the 10-year plan period under intensive management on regulated land.

Precommercial Thinning - The selective felling or removal of trees in a young stand prior to commercial thinning.

Predator - An animal species that obtains its food by hunting other animal species.

Preferred Alternative - The alternative recommended for implementation as the Forest Plan.

Prescribed Fire - A wildland fire burning under pre-planned, specified conditions to accomplish specific planned objectives. It may result from either a planned or unplanned ignition.

Prescription - Management practices selected and scheduled for application on a specific area to attain goals and objectives.

Present Net Value - Discounted benefits less discounted costs associated with providing all yields to which monetary values can be assigned.

Preservation (VQO) - A visual quality objective that allows for natural changes only.

Price Yields - Those yields which are or can be exchanged in the market place.

Primitive ROS Class - A classification of the recreation opportunity spectrum characterized by an essentially unmodified environment, where trails may be present but structures are rare, and where probability of isolation from the sights and sounds of man is extremely high.

Progeny Test Areas - Areas devoted to testing and measuring procedures to determine the genetic feasibility of seed orchard production.

Programmatic - Pertaining to the overall system under which action may be taken to achieve desired conditions.

Project-level Decision - Decisions such as building a hiking trail, constructing a campground, or making a timber sale, which apply to a specific site.

Proposed Action - A proposal by the Forest Service to authorize, recommend or implement an action.

Proposed Species - A species which data supports as listing as a federally endangered or threatened species. It is considered proposing the alternatives including the proposed action. (40 CFR 1502.13)

Purpose and Need - A statement which briefly specifies the underlying purposed and need to which the agency is responding in proposing the alternatives including the proposed action. (40 CFR 1502.13)

--R--

Raptors - Birds of prey such as hawks and eagles.

Rare - Plant or animal species which are uncommon in a specific area. All endangered, threatened and sensitive species can be considered rare, but the converse is not true.

Record of Decision - A document separate from but associated with an Environmental Impact Statement which states the decision, identifies all alternatives, specifying which were environmentally preferable, and states whether all practicable means to avoid environmental harm from the selected alternative have been adopted, and if not, why not.

Recreation Opportunity Spectrum (ROS) - A land classification system which categorizes National Forest land into six classes, each class being defined by its setting and by the probable recreation experiences and activities it affords.

Recreation Site Modification Levels - A system which categorizes recreational facilities by degree of the modification.

Development Scale:

1 Minimum site modification - Rustic or rudimentary improvements designed for protection of the site rather than comfort of the users. Use of synthetic materials excluded. Minimum controls are subtle. No obvious regimentation. Spacing informal and extended to minimum contracts between users.

2 Little site modifications - Rustic or rudimentary improvements designed primarily for protection of the site rather than the comfort of the users. Use of synthetic materials avoided. Minimum controls are subtle. Little obvious regimentation. Spacing informal and extended to minimize contracts between users. Motorized access provided or permitted. Primary access over primitive roads. Interpretive services informal, almost subliminal.

3 Site modification moderate - Facilities about for protection of site and comfort of users. Contemporary/rustic design of improvements is usually based on use of native materials. Inconspicuous vehicular traffic controls usually provided. Roads may be hard surface and trails formalized. Development density about 3 family units per acres. Primary access may be over high standard roads.

4 Site heavily modified - Some facilities designed strictly for comfort and convenience of users. Luxury facilities not provided. Facility design may incorporate synthetic materials. Extensive use of artificial surfacing of roads and trails. Vehicular traffic control usually obvious. Primary access usually over paved roads. Development density 3-5 family units per acre. Plant materials usually native. Interpretive services often formal or structured.

5 High degree of site modification - Facilities mostly designed for comfort and convenience of users and usually include flush toilets; may include showers, bathhouses, laundry facilities, and electrical hookups. Synthetic materials commonly used. Formal walks or surfaces trails. Regimentation of users is obvious. Access usually by high-speed highways. Development density 5 or more family units per acre. Plant materials may be foreign to the environment. Formal interpretive services usually available. Designs formalized and architecture may be contemporary. Mowed lawns and clipped shrubs not unusual.

Recreation Visitor Day (RVD) - The unit of measure of recreation use. It is any combination of people and hours whose product is 12; i.e., 1 person for 12 hours, 2 people for 6 hours, 3 people for 4 hours, etc.

Recruitment Stand - A stand of trees which is at least 10 acres in size and is identified as potential nesting habitat required to meet the identified population goal on a compartment basis for red-cockaded woodpeckers. Recruitment stands are located between 1/4 mile and 3/4 mile from a cluster site. Foraging habitat is required for recruitment stands.

Red-cockaded Woodpecker Cluster - A group of pine trees containing live cavities excavated, maintained and used by a clan of red-cockaded woodpeckers for nesting and roosting. The aggregate of cavity trees composing each cluster has a minimum 200-foot buffer around it.

Red Heart - Disease generally of overmature pine (caused by the fungus *Phellinus pini*) in which the heartwood of the diseased tree is decayed.

Rediversion Canal - A canal from Lake Moultrie on the Cooper River which diverts water into the Santee River.

Regeneration - The actual seedling and saplings existing in a stand; or the act of establishing young trees naturally or artificially.

Regeneration Harvests - Methods of tree harvesting such as clearcutting, shelterwood or single tree selection to replace existing trees in an area with younger trees to achieve either short or long term objectives.

Region - A Forest Service administrative unit. The Croatan National Forest is a part of the Southern Region.

Regional Forester - The Forest Service official responsible for administering a single Region.

Release - Freeing trees from competition for light, water and nutrients by removing or reducing the vegetation growth that is over topping or closely surrounding them.

Relict Tree (Relicts) - A pine tree which is left over from the original forests that were logged during the period from 1890-1930. They are usually more than 100 years old and exhibit characteristics of high quality red-cockaded woodpecker cavity trees: presence of red-heart fungus at average cavity height, 14 inches DBH or larger, high ratios of heart wood to sap wood, and large, flat topped crowns with large limbs.

Replacement Stand - A stand of trees at least 10 acres in size, identified within 1/2 mile of a red-cockaded woodpecker cluster site as replacement nesting habitat for the existing cluster. The closer the replacement stand can be placed to the cluster site the better, with the idea being adjacent to the cluster site. The number of replacement stands equals the number of active and inactive clusters. Foraging habitat is not required for replacement stands because they are replacement nesting habitat for an existing cluster with foraging habitat already assigned.

Research Natural Area (RNA) - An area classified as a physical and biological unit in as near a natural condition as possible, which exemplifies typical or unique vegetation and associated biotic, soil, geologic and aquatic features.

Resilience - The capability of plants, animals or environments to return to a previous state or condition after alteration.

Retention - A visual quality objective which, in general, means human activities are not evident to the casual forest.

Revenue - Money received from land based activities on the National Forest such as the sale of wood products, fees from campgrounds or special use permit fees.

Right-of-way - An accurately located strip of land with defined area, within which the user has authority to conduct operations approved or granted by the landowner.

Riparian Areas - Geographically delineated areas, with distinctive resource values and characteristics, that are comprised of the aquatic and riparian ecosystems, floodplains and wetlands. They include all areas within a horizontal distance of 100 feet from the edge of perennial streams or other water bodies.

Riparian Ecosystems - A transition between the aquatic ecosystem and the adjacent terrestrial ecosystem and identified by soil characteristics and distinctive vegetation communities that require free or unbound water.

Riverine - Living or situated on the banks of a river.

Road Density - The measure of road miles per land area.

Roaded Natural - A classification of the recreation opportunity spectrum that characterizes a predominately natural environment with evidence of some resource utilization.

Roadless Areas - (East of the 100th meridian). An area which contains no more than a half mile of improved road for each 1,000 acres and the road is under Forest Service jurisdiction.

Roadless Area Review and Evaluation II (RARE II) - The assessment of roadless and undeveloped land areas within the National Forests as potential wilderness areas.

Roads, Forest System - Roads that are part of the Forest development transportation system, including all existing and planned roads, as well as other special and terminal facilities designated as Forest development transportation facilities.

Rotation - The number of years required to establish and grow timber crops to a specified condition of maturity for regeneration harvest.

Roundwood - Trees that are used without being milled (fence post, telephone poles, pulpwood, etc.).

RPA - The Forest and Rangeland Renewable Resources Planning Act of 1974. Also refers to the national assessment and recommended program developed to fulfill the requirements of the Act.

RPA Program - The recommended of direction for long-range management of renewable resources of National Forest system lands.

Rural Class - A recreation opportunity spectrum classification for areas characterized by a substantially modified natural environment.

--S--

Salvage - Removing trees that are dead or in imminent danger of being killed by injurious agents.

Sawtimber - Trees that will yield logs suitable in size and quality for the production of dimension lumber.

Scenery Management System (SMS) - A process to classify national Forest lands based on their visual characteristics. This system updated and replaces the Visual Management System (VMS).

Schedule - Lands needed for timber production to meet forest plan goals and objectives. This serves as basis for determining allowable sale quantity, and for determining long-term sustained yield timber capacity.

Scoping - The process by which the Forest Service determines the extent of analysis necessary for an informed decision on a proposed action.

Sediment - Solid material, both mineral and organic, that is being transported or has been moved from its site of origin by air, water or gravity and has come to rest on the earth's surface either above or below sea level.

Sediment Yield - Amount of solid waste delivered into a watercourse.

Seed Orchard - An area containing trees, selected on certain desired heritable characteristics, which are bred to produce seed.

Seed Tree Cutting - The removal in one cut of most of the mature timber from an area except for a small number of desirable trees retained to provide seed for regeneration.

Semiprimitive Motorized (ROS) Class - A classification of the recreation opportunity spectrum characterized by a predominantly unmodified natural environment of a size and location that provides good to moderate opportunity for isolation from signals and sounds of man. Management excluded motorized equipment.

Sensitive Species - Those species which (1) have appeared in the federal register as proposals for classification and are under consideration for official listing as endangered or threatened species,

(2) are on an official State list, or (3) are recognized by the Regional Forester to need special management in order to prevent the need for their placement on Federal or State lists.

Shelterwood cut - A method of establishing a new stand by gradually removing the existing trees so that new seedlings or sprouts become established under the protection of the remaining trees. Normally, this is done in two separate harvests over a 5 to 10 year period.

Short-term effects - those effects which will usually occur within the next 20 years.

Shrink Swell Clays - Clays that swell when moisture increases and shrink when moisture decreases.

Significant Environmental Effects - This is defined as used in NEPA, 40 CFR 1508.27 which is considered in context and intensity.

Silviculture - The art and science of controlling the establishment, composition and growth of forests.

Silviculture System - A combination of interrelated actions whereby forests are tended, harvested and replaced.

Silvicultural Treatments - Activities used in controlling forest establishment, growth and composition such as harvesting trees, preparing sites, thinning, release, prescribed burning, precommercial thinning or fertilization.

Single Tree Selection Cut - A cut that removes individual mature or immature trees based on their age, merchantability, health, seed production capability, and potential to increase in volume and quality.

Site Specific - Pertaining to an area where an individual project takes place such as a timber sale area, a campground, a trail route, etc.

Skid Trail - Travelway used to drag or transport trees from the stump to a landing area for loading on a truck.

Slash - Woody debris left after logging, pruning, thinning or brush cutting.

Sludge - Solids removed from sewage during waste water treatment.

Snag - A standing dead tree, used by wildlife species for nesting, roosting, perching, courting and/or foraging for food.

Softwoods - Coniferous trees, usually evergreen, having needles or scale-like leaves.

Soil Compaction - Reduction of soil volume which results in alteration of soil, chemical and physical properties.

Soil Fertility - The quality of a soil that enables it to provide nutrients in adequate amounts and in proper balance for the growth of specified plants.

Soil Productivity - The capacity of a soil to produce a specific crop.

Soil Profile - A progression of distinctive layers of soil from the surface to bedrock.

Soil Texture - The relative proportions of sand, silt and clay in a soil.

Southern Pine Beetle - (SPB) - A native bark beetle (*Dendroctonus frontalis*) that is the most destructive insect pest of pine in the South. It attacks all species of southern pine, but refers loblolly in the coastal plain. When present in low numbers, the insects attack stressed trees or trees infested infested by other bark beetles. However, during outbreak periods, SPB attacks and kills large groups of pines potentially affecting affecting hundreds of acres.

Spatial Feasibility - The capability of alternative solutions to be practically implemented on the ground.

Special Interest Area - Areas established and managed for their unique special features. Examples are scenic and botanical areas.

Special Use Permits - Authorization for use and occupancy of National Forest system land.

Species Composition - The relative amounts and mixtures of tree species within an area.

Spotting - Ignition of fires outside the perimeter of a large fire as a result of windblown firebrands.

Spurges - Any of several plant species in the family *Euphorbiaceae*.

Stand - A timber plant community possessing sufficient uniformity regarding vegetation type, age class, vigor, size class and stocking class to be distinguishable form adjacent communities.

Standard - Requirements which preclude or imposed limitations on resource management practices and uses generally for resource protection, public safety or addressing an issue. Standards are measurable, capable of being monitoring, and attainment is mandatory. Deviation requires a plan amendment.

Stocking - The degree of occupancy of land by trees as measured by basal area or number of trees and as compared to a stocking standard; that is, the basal area or number of trees required to fully use the growth potential of the land.

Suitable Red-cockaded Woodpecker Habitat - Southern yellow pine (except sand pine) and southern yellow pine-hardwood types are considered as potentially suitable red-cockaded woodpecker habitat.

Succession - The progressive development of vegetation through the replacement of one plant community by another.

Successional Stage - A stage or recognizable condition of a plant community that occurs during its development form bare ground to climax; for example coniferous forests in the southeast progress through grass-forb to pole-sapling to young to mature to old growth stages.

Supply - The amount of an output that producers are willing to provide at the specified price, time period, and condition of sale.

Sustained Yield - The achievement and maintenance in perpetuity of high-level annual or regular periodic yield of the various renewable resources without impairment of the productivity of the land.

System Roads - Roads on the Forest are comprised of roads under jurisdictions of the Forest Service, state, county, or other federal agencies. Roads under the jurisdiction of the Forest Service are called Forest Development Roads and are often referred to as system roads.

--T--

Temporary Roads - Any short-lived road not intended to be part of the transportation system and not necessary for future resource management.

Tent Catepillars (*Malacosoma disteria*) - the larva of this species is a common defoliator of forest trees. The most preferred trees are oaks and gums.

Threatened Species - Any species listed in the Federal Register which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Tidal Surge - An unusually high sea wave pushed ahead of a hurricane.

Tiering - Incorporating information contained in an EIS (Environmental Impact Statement), such as the Forest Plan EIS, by reference in subsequent environmental documents.

Timber - A wood product suitable for use in construction. Sometimes used in reference to standing trees containing a potential wood product.

Timber Site Index - A measure of site productivity based on the maximum rate of tree height growth.

Timber Stand Improvement (TSI) - Activities conducted in young stands of timber to improve growth rate, form and composition of the remaining trees.

Tolerant Species - Species that reproduce and form understories beneath canopies of less tolerant trees or even beneath their own shade.

Traffic Service Levels - Traffic service levels describe the significant traffic characteristics and operating conditions for a road.

Trail Heads - The point at which a trail begins which often includes parking and a bulletin board.

Transient Species - Wildlife that pass through an area with a short duration of stay.

Transition Zones - Areas of variable size where one forest type or landtype blends with an adjacent type. Most often used to refer to an area where pine forest types blend with hardwood forest types.

Travel Corridor - A road, trail or waterway used by people; or a strip of land used by wildlife.

3/4 Mile Zone - The National Forest lands around a red-cockaded woodpecker cluster site which would be managed using this conservation strategy. This zone is a 3/4 mile radius circle from the center point of the cluster site and covers approximately 1,117 acres. In practice, this zone might not be a perfect circle because of intermingled private lands, topographic features and vegetation types that would not be included within the boundary.

Twenty-Five Percent Fund - Funds distributed under the authority of the Act of May 23, 1908, as amended (16 U.S.C. 500). Twenty five percent of all moneys received during each fiscal year from a National Forest is paid to the countries in which the National Forest located for the benefit of public schools and public roads.

--U--

Understory - The trees and other woody species growing under a more-or-less continuous cover of branches and foliage formed collectively by the upper portion of adjacent trees and other woody growth.

Uneven-aged Management - The application of a combination of actions needed to simultaneously maintain continuous high-forest cover, recurring regeneration of desirable species, and the orderly growth and development of trees through a range of diameter or age classes to provide a sustained yield of forest products. Cutting is usually regulated by specifying the number of proportion of trees of particular sizes to retain within each area, thereby maintaining a planned distribution of size classes. Cutting methods that develop and maintain uneven-aged stands are single-tree selection and group selection. (36 CFR 219.3)

Unique Areas - Special areas which are managed for scenic, botanical, geologic or historic values.

Unplanned Ignition - A fire started at random by either natural or human causes, or a deliberate incendiary fire.

Unscheduled - Lands not needed for timber production to meet forest plan goals and objectives. The includes financial and economic considerations or lands where there is a need to defer a

determination of suitability. They are not used in the determination of allowable sale quantity or long-term sustained yield. Harvest is permitted for salvage sales, protection of non-timber multiple use values, and activities that meet non-timber objectives of the Plan.

Unsuitable for Timber Production - Lands identified as inappropriate for timber production.

Urban ROS Class - A classification of the Recreation Opportunity Spectrum in which the natural setting is dominated by man-made structures and the sites and sounds of man predominate.

User Fees - A fee charged for the use of the forest such as for camping, hiking, swimming, hunting, rights-of-way, etc.

--V--

Vegetation Management - The management of vegetation by practices such as grazing, prescribed burning, herbicide use, timber harvesting, and tree planting or removal to meet wildlife, visual, timber, special area, water and other management objectives.

Viability - The population of sufficient numbers to maintain its existence over time in spite of normal fluctuations in population levels.

Viewshed - Portion of the Forest that is seen from a major travel route, or high use location.

Visual Management System - A process to classify National Forest lands based on their visual characteristics. This system has been updated and is now called the Scenery Management System (SMS).

Visual Quality Objective (VQO) - The degrees of acceptable alteration of the characteristic landscape.

Visual Resource - The composite of basic terrain, geologic features, water features, vegetative patterns, and land-use effects that typify a land unit and influence the visual appeal the unit may have visitors.

--W--

Water Yield - The total net amount of water produced on the Forest including stream flow and ground water recharge.

Wet Sites - Areas with very poorly and poorly drained soils.

Wetland - Areas that are inundated by surface or ground water with a frequency sufficient to support, and under normal circumstances do or would support, a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflows, mud flats and natural ponds (very poorly drained soils are associated with wetlands).

Wild and Scenic Rivers - Those rivers or sections of rivers designated as such by congressional action under the 1968 Wild and Scenic Rivers Act, as supplemented and amended, or those sections of rivers designated as wild, scenic, or recreational by an act of the Legislature of the State or States through which they flow.

Wilderness - Congressionally designated areas that are essentially unaltered and undisturbed by man. Management in these areas preserves and protects their physical and biological characteristics.

Wildlife - Any wildland fire not designated and managed as a prescribed fire within an approval prescription.

Wildlife and Fish User Day (WFUD) - A unit used to measure the amount of use the public gets from wildlife and fish found on the Forest. One WFUD represents one person hunting, fishing or viewing wildlife for a period of 12 hours.

Wildlife Corridor - Continuous habitat that link other, similar areas.

Wildlife Openings (WLO) - Areas maintained in an open, early successional stage to provide habitat for wildlife.

Within-stand Diversity - The relative variety of life in a forest stand.

Wood Products - Products derived from trees such as sawtimber, roundwood and fuelwood.

--Y--

Yield Table - A tabular statement of yields expected to be produced under a specified set of conditions.

CHAPTER 7: INDEX

FEIS APPENDIX A: RESPONSES TO PUBLIC COMMENT AND COMMENTS

A.1. BIOLOGICAL DIVERSITY

KEY INTEREST: Breadth of approach to biological diversity

COMMENT: The DLRMP and DEIS consistently take an unduly narrow approach to addressing biological diversity issues on the Croatan. This cursory list of biological diversity issues ignores a vast range of listed and sensitive species and natural communities that may not be as well known, but are nonetheless of similar if not greater importance. The FS should comprehensively revise this list of issues to include conservation of not only the well known mammals and birds, but also the lesser known mammals, birds, reptiles, amphibians, and plants. In addition, the FS should address conservation of the community types that these species utilize.

COMMENT: Biological diversity must be addressed fully at all levels: individuals, populations, species, and ecosystems.

COMMENT: The Plan attempts to "squeeze" biological diversity concerns into three categories: 1) RCWs, 2) black bears, and 3) those neotropical migrants that occur within hardwood swamp forests. There are many biological diversity issues within the Croatan that have little or nothing to do with the above three issues.

COMMENT: Given that biological diversity refers to the complete spectrum of flora and fauna species and all vegetative structural characteristics, we feel that the discussion should involve more than two animal species and one bird species.

COMMENT: In the issue statement for biological diversity, it is probably erroneous to too closely tie the success of National Forest management to RCW, black bear and neotropical migrants. Although these are not "special land allocations" [natural communities and old-growth], they are a significant way of capturing biological diversity not otherwise preserved through the indicator species approach.

COMMENT: The issue statement for biological diversity should include condensed discussions of the major ecosystems on the Croatan, with emphasis on longleaf pine savannas. The section most definitely needs a discussion of the biology/ecology of pine wiregrass and best management practices for retaining it under management and restoring it where it has been lost.

RESPONSE: The discussion on biological diversity has been broadened and organized into 8 categories specific to the Croatan. Issues related to biological diversity were developed from written communications and public meetings in 1996. These issues are addressed in the following categories:

(1) recovery of the red-cockaded (*Picoides borealis*) - RCW and restoration of its native habitat,

(2) designation and protection of Special Interest Areas (natural areas) as a means of managing multiple levels of biological diversity,
(3) recovering and sustaining rare plant communities and other rare species in addition to the RCW,
(4) identification and protection of old-growth ecosystems,
(5) maintenance of habitat suitable for the black bear (*Ursus americanus*),
(6) maintaining hardwood cypress wetlands to provide suitable habitat for a variety of species that use this ecosystem,
(7) restoring upland hardwood sites, and
(8) restoring hydrologic function and sustaining aquatic systems.

Goals and objectives related to biological diversity issues have been more clearly defined and outlined in Table 2.1. In addition, the standards developed to reach goals, objectives, and desired conditions have been aggregated into one chapter (Chapter 4) for better communication of the limitations on actions or thresholds not to be exceeded.

The Plan addresses biological diversity on the CNF, at different scales and allocates land use and limits management activities that correspond to these scales. These different levels of diversity include, landscape, community, and species. Landscapes are the broadest scale of diversity. They are evaluated by classifying ecological types (Appendix A) and are used to define management prescription boundaries (Chapter 3). Ecological types organize the CNF landscape into units having similar topography, geology, soil, climate, and natural disturbance regimes. Their extent and pattern have a major influence on finer levels of diversity on the CNF and they are incorporated in the Plan through management prescription boundaries.

Plant communities are used to address diversity at the stand-level or local scale. At this level of diversity, SIAs (natural areas) identified by the North Carolina Natural Heritage Program are recognized in the Plan for their value in providing important composition, structure, and function on the CNF and for providing habitat conditions suitable for a wide variety of species. Old growth stand conditions, and Wild and Scenic River attributes are also recognized in the Plan and contribute to community level diversity. Natural areas, old growth, and river corridors eligible for Wild and Scenic River status are included as primary and imbedded management prescriptions and goals, objectives, and standards to maintain their community level diversity are included in the Plan (Chapters 2 and 4). Species diversity is addressed through recognition of 120 rare species that occur or are likely to occur on the CNF (FEIS, Biological Assessment and Biological Evaluation). These species include 7 federally listed threatened or endangered species, 53 species identified by the Regional Forester as sensitive and 60 locally rare species. A standard requires evaluation of management impacts on these species [Standard 4.2.0.8], and numerous other standards protect habitats suitable for these species. Goals, objectives, and standards for rare species are tiered to requirements in the Endangered Species Act, National Forest Management Act and Forest Service policy.

KEY INTEREST: Biological diversity on lands outside of the RCW Habitat Management Area

COMMENT: The Draft Plan/DEIS is deficient in that it does not address biological diversity on lands suitable for timber production outside the RCW HMA. This should be done in the final Plan/EIS, i.e., develop a new section with the above heading.

RESPONSE: In the final Plan no management prescriptions are classified as suited for timber production outside the RCW Habitat Management Area (HMA). The Mixed-Pine management prescription has been included within the RCW HMA.

A. RCW

KEY INTEREST: Effects of proposed longleaf restoration on RCW recovery

COMMENT: The plan could actually be counterproductive to RCW recovery due to the immediate impact of proposed clearing of mature loblolly and pond pine stands to facilitate longleaf restoration. Mature loblolly and pond pine stands should not be ignored as potential nesting and foraging habitat.

RESPONSE: Under Alternative E, the methods used for restoring longleaf pine have been revised but still focus on establishing longleaf pine as the dominant canopy tree on appropriate soil types, and centering RCW recruitment stands in longleaf pine dominant forests. Mixed loblolly and pond pine stands may provide forage and nesting habitat for RCW, however, longleaf pine is the preferred nesting and roosting tree on the CNF.

A shelterwood with reserve trees method will be used as the primary silvicultural system for restoring longleaf pine (Appendix E). In this system, a minimum of 6 to 10 trees per acres will be maintained to provide RCW foraging structure and as a seed source for regeneration. Longleaf pine, if available, will be retained in the overstory and will be planted beneath the shelterwood in stands where this species is lacking. In addition, off-site loblolly pine plantations, most of which have a component of longleaf pine, will be restored to a longleaf pine forest type by cutting and leaving, prescribed burning, and supplemental planting of longleaf pine. Clear-cutting is retained as an option to restore longleaf pine on only 500-750 acres. This is approximately 70-80% less than proposed under Alternative C.

Forage requirements identified in the RCW FEIS (USFS 1995) will be maintained within all RCW territories regardless of restoration method. Many RCW territories currently exceed these forage requirements, and clear-cutting would not be an option in those RCW territories that are at minimum levels.

KEY INTEREST: Status of RCW population

COMMENT: The Plan presents an inaccurate picture of the current state of the RCW population on CNF.

RESPONSE: An updated summary report has been compiled by Forest Service personnel and provides the most up-to-date information on RCW reproduction and population dynamics on CNF (2001 RCW Summary Report). In general, the number of both active clusters and

potential breeding pairs began to increase in 1991 following implementation of a 1992 RCW management plan. These numbers continued to increase each year from 2 % to 8 % peaking in 1996. The population subsequently suffered a net loss of activity at two clusters per year (3 %) from 1997 through 1999. However, the population experienced a 6.5 % increase from 1999 to 2000 that included the formation of two entirely new clusters. The number of active clusters remained the same from 2000 to 2001, however, one recruitment cluster was occupied by a solitary bird post-breeding season. This cluster may be considered active if the bird remains through the 2002 breeding season. The CNF breeding population experienced a net increase of one breeding pair in 2001.

The proportion of solitary males on CNF has remained at or below 10% during each of the past eleven years except during 1997. Average group size has followed a trend similar to the other population measures. Even though the proportion of solitary males returned to acceptable levels in 1998, average group size continued to decrease through 1999 indicative of declining population health. However, group size rebounded in 2000 to an acceptable level of 2.54 birds per group and further increased to 2.62 birds per group in 2001.

Following guidelines set forth in the RCW FEIS for national forests in the southern region, the Croatan population falls within Management Intensity Level (MIL) 3. CNF currently supports 37% to 45% of the total population objective and has a stable and potentially increasing population trend.

KEY INTEREST: Deviation from the RCW EIS standards and guidelines

COMMENT: The FS must address how proposed deviations from Standards and Guidelines in the RCW EIS will potentially impact RCW on the Croatan National Forest.

RESPONSE: Alternative E now proposes only two deviations or additions to the standards in the RCW EIS (1995). One deviation exceeds these standards. The RCW EIS does not require that existing roads be closed. Instead, it states that "existing uses shall be modified or relocated if they are found to adversely affect the RCW". In Alternative E, all unauthorized roads in nest areas will be closed during the next 10 years [Standard 4.6.1.4].

The foraging habitat standard identified as a proposed deviation is a refinement of the RCW EIS Standard that states "foraging habitat should be maintained at 70-110 square feet of pine basal area depending on site and stand and condition". Ecological land units presented in Appendix A are an expression of site and stand condition on the CNF. RCW nest and forage habitat management will follow all other standards identified in the RCW EIS and RCW Recovery Plan.

KEY INTEREST: Size and composition of the RCW Habitat Management Area (HMA)

COMMENT: The LRMP reports approximately 30% of the CNF (53,000 acres) is currently included in the RCW HMA, but indicates elsewhere that acres of varying amounts not equaling the total RCW HMA will be maintained. These figures are confusing and should be organized for better interpretation.

RESPONSE: All figures referring to the size of management prescriptions, including the RCW Habitat Management Area, have been re-examined and corrected. The RCW Habitat Management Area is approximately 69,000 acres in size. This figure includes acres from two previously identified management prescriptions, Mixed-Pine and Small to Medium-Sized Pocosin Patches that have been combined with the RCW HMA.

KEY INTEREST: Logging Restrictions relative to RCW clusters

COMMENT: The policy of the USFS is inconsistent to not allow logging trucks to travel past a RCW nesting colony when some nesting birds reside next to train tracks and are not adversely affected by the loud noise.

RESPONSE: The RCW EIS does not specifically state that logging trucks cannot pass by RCW clusters during the nesting season but that "all potentially disturbing activities within clusters" should be scheduled outside the nesting season. The RCW EIS also states that "light maintenance of high standard roads, such as road grading or mowing of rights-of-way…" may be allowed during the nesting season suggesting that low level disturbance, such as occasional road traffic, may be allowed. Habitat improvement projects, such as stand thinning, would be considered as disturbing to a nesting group if the activity is within ½ mile of the cluster site. However, if logging activity is greater than ½ mile from a nesting group, then logging traffic on an authorized FS system road **may** be allowed to pass by the group. Each timber harvest unit would need to be assessed individually to determine the potential impact of logging traffic to nesting groups before making a decision.

KEY INTEREST: RCW population objectives and monitoring protocol

COMMENT: The short-term population goal of 50-63 clusters is too ambitious. However, the long-term population goal should be larger if RCW clusters are typically 200-300 acres and the RCW HMA is 53,000 acres.

RESPONSE: RCW expansion and recovery objectives will be lower to accommodate an overall less aggressive approach to longleaf restoration. The short-term population goal has been reduced by approximately 50% in alternative E to 20-26 clusters over 10 years. This revised short-term goal is realistic given that unoccupied suitable habitat currently exists. In addition, recruitment clusters will be established with artificial cavities, and a greater emphasis will be placed on using prescribed fire, including growing-season fire, for habitat management and restoration.

Current and potential RCW territories were delineated according to cluster and foraging habitat requirements set forth in the RCW EIS and on availability of all current and potential pine and pine-hardwood habitat on CNF. Territories vary in size (acres) due to variation in habitat types across the landscape. Pine savannas and flatwoods are often interspersed with hardwood-cypress wetlands, pocosins, small depression ponds, and streams with their associated hardwood drainage slopes. The number and extent of non-pine habitat types will affect territory size that can vary from 200 acres to 700 acres in size. Therefore, the long-term population goal of 137 to

169 clusters for CNF represents the maximum number of territories that may be supported given habitat requirements and availability.

COMMENT: We have special concerns about how concentrated RCW populations appear to be in Management Area 4, with only one cluster east of US 70. If Management Area 4 was impacted by a major hurricane, pine beetle outbreak, or disastrous wildfire, 70% or more of the RCW clusters could be affected. It is essential to greatly increase RCW numbers east of US 70 in order to decrease the vulnerability of RCW populations across the CNF.

RESPONSE: Based on existing and potential habitat available for the RCW, the Plan proposes to increase recruitment territories in Management Areas (MA) 5 and 6, which occur east of US 70. MA 6 currently has one active RCW territory, and the second largest proposed number of recruitment territories. Management Area 5, located to the south of MA 6, has potential for RCW expansion, but has less potential habitat than MA 6. For that reason, the long-term RCW population objective is much smaller. A maximum of 31 RCW territories could potentially be supported within these two management areas.

COMMENT: What steps will the Forest Service take to revise their management if the projected RCW population growth does not occur?

RESPONSE: First, after changing the approach to longleaf restoration (described in Alternative E), the RCW expansion and recovery objectives will be reduced by approximately 50% to 20-26 clusters over 10 years. With this modification, it is expected that if the management standards as outlined in the LRMP are fully implemented, population growth will occur on CNF. Monitoring will be used as an immediate feedback mechanism, such that if growth does not match projections, modifications of management can occur. Evaluation and consultation with staff biologists, other agencies, and specialists will also take place to analyze the obstacles to growth and to suggest changes.

Substantial growth has not occurred in the past few years for several reasons. New recruitment clusters have not been actively established and some of the existing recruitment clusters have not been properly maintained. In addition, translocations have not been used to facilitate expansion. Under the new LRMP, these activities will be emphasized to encourage growth, and translocations will be used should natural dispersion not take place. In addition, the new LRMP will place a greater emphasis on growing season prescribed burning.

COMMENT: How RCW pop size will be tracked, that is, whether by number of active clusters or number of breeding groups, is not clear (3.21). I doubt that the FS will be able to do complete monitoring (i.e., census adults, band adults and nestlings, monitor reproduction) of all the active sites on the forest. In what possible way could data on reproduction influence management practices? Given the inherent annual variability in reproduction and the lack of the influence of reproduction on pop dynamics, these data have little management value. Thus monitoring reproduction (3.22) wastes resources that could be better spent producing accurate censuses of a sample of groups.

RESPONSE: The RCW monitoring program on CNF exceeds the requirements set forth in the RCW EIS but is consistent with U.S. Fish and Wildlife Service's Revised Recovery Plan for RCW (2000, Draft). The Recovery Plan suggests Level IV monitoring for populations deemed essential to recovery and occurring on public lands. Level IV monitoring consists of color-banding nestling and adult birds, conducting nest checks at 7-11 day intervals, and conducting fledgling and adult checks to determine number and sex of birds. Level IV monitoring may be conducted on a sample of active clusters (IVa) or on all active clusters (IVb) as has been done on CNF for the past 10 years.

The RCW EIS requires that all clusters be surveyed annually for activity status and that only a sample of clusters be monitored annually for nesting success and group composition. However, the Recovery Plan states that monitoring methods should not be mixed from year to year and that color-banding translocated birds will be necessary when and if translocations are used as a management tool. Furthermore, the Recovery Plan states that due to sampling error, "…intensive monitoring of a sample of groups (Level IVa) can provide reliable estimates of productivity within a short period, but cannot estimate population trend until used for a longer period of time (e.g., 5 years)" and that "Accuracy of population trend assessment is also dependent on sample size…Thus, small samples cannot detect anything but large-scale changes in populations trends." Therefore, continued use of Level IVb monitoring on CNF will provide consistency and the most accurate population information. Identification of individuals will also be beneficial when and if within-population translocations are used to promote population growth. In addition, by continuing level IV monitoring, the CNF retains all options, including within population/subpopulation translocation of RCW, should the need arise. The Recovery Plan and RCW EIS require that all individuals be color-banded before translocation and the RCW EIS encourages translocation of RCW within populations/subpopulations rather than between populations. However, should the CNF population become too large for Forest Service staff to conduct 100% population monitoring, statistically sound sampling methods can be implemented to monitor a subset of the population.

KEY INTEREST: RCW foraging habitat management

COMMENT: Specific comments: (1) the last bullet on s.4 indicates tree age classes will be balanced on a per territory basis. RCWs do not require balanced age classes. They need old trees and enough regeneration to replace old trees. Balanced age classes are not necessary to provide the needed level of regeneration. (2) 70-90 ft/acre ba is too high to be good foraging habitat for RCWs (3.22) (3) rotations should be 80 years, not 60, in mixed pine forest (3.31).

RESPONSE: 1) We agree that RCW do not require balanced age classes. The objective to sustain RCW habitat by balancing tree age groups by territory has been eliminated.
2) RCW nest and forage habitat management follow standards identified in the RCW EIS and RCW Recovery Plan. Specific residual basal area targets for pine-dominated stands in the RCW HMA were developed from these standards and are included in Forestwide Standards for silviculture (Table 4.4.0, standard 4.4.0.5). The highest stocking objective (70-90 square feet/acre) is for ecological type 1022, a type that contains the highest natural longleaf and mixed pine stand density on the CNF. The target stocking level is within the 70-100 square feet/acre identified for RCW foraging habitat in the RCW EIS. 3) Land within the Mixed-Pine

management prescription is now included as part of the RCW HMA. The rotation age for forest types on lands suitable for timber production within the RCW HMA follow standards identified in the RCW EIS: 120 years for longleaf pine, and 80 years for loblolly pine and pond pine.

KEY INTEREST: Pine Savanna and Flatwoods description and standards

COMMENT: Add to the description of variation from reference condition, the fact that mixtures of pines, and in some cases, pond pines, historically dominated some pine savanna sites. Also make the point that depending on the soil, pine savannas will support different floras and vary from the northern Croatan to the southern Croatan.

RESPONSE: We have added to the description of variation from reference condition, the inclusion of pond pine woodlands and savanna as the primary landscape matrix in the northern and western portions of the CNF. In these areas, pond pine woodlands are interspersed with patches of longleaf pine savanna. This varies from the reference condition of longleaf pine savanna patches occurring in a pocosin matrix described for the southern portion of the CNF. The ecological classification, developed from the relationship between soil drainage and texture and potential natural vegetation, describes the different understory species 'floras' that occur in pine savannas (Appendix A). The mapped ecological units depict how the type, extent, and distribution of pine savannas varies from the northern CNF to the southern CNF.

COMMENT: All the standards for plant communities and rare species in the pine savanna and flatwoods prescription pertain to RCW. Although this species is important, it seems to overshadow the management needs of other plant and animal species within longleaf forests, or the ecosystem processes necessary to maintain longleaf forests in a condition which closely mimics nature. These standards need to be reworked to incorporate consideration for all the components of the pine savanna and flatwoods.

RESPONSE: Forest-wide standards for plant communities and rare species would also apply to the RCW management prescription. These include: [4.2.0.1] using the ecological classification and N.C. Natural Heritage Program site descriptions as a guide to identify suitable sites for restoration of native plant communities, [4.2.0.3] conserving and restoring a network of small and medium-sized areas of potential old growth for Upland Longleaf Pine Communities, and [4.2.0.6] restricting harvest of all stands dominated by longleaf pine using even-aged or two-aged regeneration methods, and [4.2.0.8] preparing biological evaluations for all vegetation management projects to determine effects on rare plant and animal species. In addition, longleaf pine and wiregrass is chosen as a management indicator species to evaluate the effectiveness of management actions, especially prescribed fire, to restore the composition and structure of longleaf pine forests to conditions more similar to pre-settlement forests.

COMMENT: How will the standards for Forest Products in this prescription mesh with the standards for Forest Products in any embedded natural area prescriptions that overlaps a pine savanna and flatwoods area? Timber harvesting is allowed within the pine savanna and flatwood prescription, but is not within the Natural Areas embedded prescription (at least the lands are not managed as unsuitable for timber production). The more restrictive standard normally takes precedence, but that will need to be clearly stated in both of these prescriptions.

RESPONSE: The discussion on embedded prescriptions has been expanded and more clearly defines the precedence of standards. In most cases, smaller scale prescriptions have more restrictive standards than those they are embedded within. For example, there are many areas on the CNF where SIA (natural areas) are imbedded in the RCW HMA. More restrictive standards would apply in these areas such as land adjustment [Standard 4.8.0.6] and road construction [Standard 4.6.1.10]. Natural areas are not suited for timber production [Standard 4.4.1.2], but active management is allowed where they occur within the RCW HMA. This may include timber harvest to meet RCW nest and forage standards outlined in the RCW EIS. However, it is unlikely that any timber harvest, including thinning, would occur in SIA (natural areas) on the CNF for a number of reasons. Most importantly, the plan sets objectives to restore and maintain forest composition and structure more similar to pre-settlement conditions and these conditions, and RCW nest and forage requirements, are already being met in natural areas.

COMMENT: In addition to the basal area restriction for thinning operations, please add that a stand should not be thinned more than once every 10 years.

COMMENT: Under the standards for Forest Products, pine restoration is proposed in existing hardwood stands in landtype phases 1022, 1124, and 1225. However, some specific sites classified as one of those landtype phases may not naturally support pine species. These sites include the Holston Creek Natural Area, and a small portion of the Island Creek Registered Natural Heritage Area. These areas because of their slope and aspect would naturally have been shielded from fire and remain as a hardwood site. These areas should not be converted.

RESPONSE: Site-specific analysis will be used to evaluate all pine restoration projects and thinning recommendations on the CNF. The ecological classification and N.C. Natural Heritage Program site descriptions will be used as a guide for identifying sites for restoration [Standard 4.2.0.1] and stocking level standards [Standard 4.4.0.5] will be used to determine the timing of thinning.

B. Special Interest Areas (Natural Areas)

B1. Identify and Protect SIAs (Natural Areas)

KEY INTEREST: Timber harvest or salvage within SIAs (Natural Areas)

COMMENT: No timber harvest should occur in natural areas, even where public safety is at risk or where large-scale natural disturbance occurs.

COMMENT: While it is good that natural heritage areas (NHAs) will be managed as "not suitable for timber production". Salvage for purposes of public safety should not be allowed. This language should be removed from the Plan as it could be interpreted to provide a huge loophole. Or change the standard to read, "Allow salvage of hazard trees adjacent to trails or access areas for the purpose of public safety. Hazard trees should be cut and left rather than salvaged to provide habitat for animal species that depend on downed wood for food and shelter."

COMMENT: Natural areas should be natural. Prescribed fire is compatible since it mimics natural conditions. We strongly oppose tree harvest and site modification after natural, even major, disturbances. Trees that must be felled for safety reasons should be left on the ground to function within the ecosystem.

COMMENT: Timber harvest should occur on sites not important for diversity or recreation. No harvesting should occur on registered natural areas such as Millis Road savanna or Patsy Pond.

RESPONSE: SIAs (Natural areas) are not-suited for timber production, however, trees may be cut to provide safety of forest users, to reduce the risk of disease or insect outbreaks, and to meet habitat objectives for threatened or endangered species. Standards have been modified to limit sanitation harvesting of trees or stands in SIAs (natural areas) (Standard 4.4.1.9). This standard reads, "Allow only cut and fell operations in SIAs (natural areas) to provide for safety of forest users, or where disease or insect infestations threaten adjacent private or public lands. Exceptions to this standard include allowing necessary removal of trees if the recovery of a threatened or endangered species is compromised, or if a hazard tree is in a developed area." The exceptions are included because natural areas overlap with developed areas (approximately 270 acres) and with the RCW HMA (approximately 4000 acres). Since a high number of users recreate within developed areas, removal of hazard trees may be necessary to facilitate use of the area. Within the RCW HMA, a small potential exists for an event to occur that may impact the ability of the area to regenerate naturally, or to be protected from catastrophic wildfire, if large amounts of woody debris is left onsite.

Tree cutting may occur in SIAs (natural areas) to meet habitat objectives for threatened or endangered animals or plants [Standard 4.4.0.14]. For example, in SIAs (natural areas) that are imbedded within the RCW HMA, prescribed burning and thinning may occur to maintain RCW forage standards outlined in the RCW EIS [Standard 4.2.1.9]. However, it is unlikely that any timber harvest, including thinning, would occur in SIAs (Natural areas) on the CNF for a number of reasons. The plan sets objectives to restore and maintain forest composition and structure more similar to pre-settlement conditions and these conditions are already being met in SIAs (natural areas). Also, RCW nest and forage requirements are, in almost all situations, already being met in SIAs (natural areas).

KEY INTEREST: Description of reference condition and core areas

COMMENT: Under Biological diversity in Chapter 2.0, subheading "Identify and protect natural areas", the goal/desired condition states that "core areas" will be provided. What is the definition of "core areas"? Will buffers be provided around these sites so as to minimize environmental changes within the core area and adjacent ecotones in the event of the nearby timber sales?

RESPONSE: On the CNF, over 70 percent of all rare species occurrences (threatened, endangered, sensitive, and locally rare) and rare communities are located within SIAs (natural areas), old-growth management areas, RCW nest sites, wilderness, and other ecosystem-based management prescriptions that are not suited for timber production (FEIS, Biological Evaluation and Biological Assessment). These areas are considered "core areas" for species conservation.

They provide a coarse-filter approach to managing biological diversity on the CNF because: (1) they represent the full range of environmental conditions on the forest and, (2) management objectives within the "core area" emphasize restoration and maintenance of habitats suitable for a wide-variety of species. The "core area" occupies approximately 90,000 acres on the CNF. The boundary of the core area is based primarily ecological types, which are derived from topography, soil drainage, soil texture, and potential natural vegetation. Buffer areas are included within many SIAs (natural areas), and one standard [4.5.0.15] prohibits plowed fire lines in pocosin-upland ecotones that often separate the "core area" from nearby lands suited for timber production.

COMMENT: Use a more recent reference condition description for the Patsy Pond Natural Area (NHP proposal June 1996). Use two sites for the reference condition that are markedly different in habitat type. Island Creek should be used as the second site. Omit any reference to OHV trails within these descriptions, since OHV use is far from an ideal condition.

RESPONSE: The reference to OHV trails as part of the description for Patsy Pond Registered Natural Heritage Area has been eliminated. This description adequately describes the desired condition for the area. Additional descriptions of all other SIAs (natural areas) on the CNF, including Island Creek, are intended to briefly describe their reference condition.

KEY INTEREST: Management of Natural Areas

COMMENT: Coordinate with the Natural Heritage Program on future management of Hancock Cr Forest, Flanners Beach, and Island Creek, which are SIAs, Registered Natural Heritage Areas and Heritage Resource Areas.

RESPONSE: The CNF will continue to coordinate with the Natural Heritage Program on future management of these areas and will provide, through the NEPA process, environmental analyses and biological evaluations of project proposals for their review.

COMMENT: Access to natural areas should be limited to foot trails. Allowing road construction for the purpose of providing access, for any reason, to or within a natural area should be prohibited. Maintain existing roads and road rights-of-way to a minimum width. Also prohibit OHVs, mountain bikes, and horses by legal means and use law enforcement program as necessary.

RESPONSE: The Plan includes an objective [2.6.1.2] to close and restore unauthorized routes over the next 10 years. This includes many illegal trails that currently access SIAs (natural areas) and should reduce use by OHVs, mountain bikes, and horses in these areas. The Plan also includes a standard [4.6.1.10] that prohibits the construction of roads in SIAs (natural areas) except for the purpose of research. The road and right-of-way width of existing system roads (legal roads) are based on the traffic level of the road. Right-of-way widths may be reduced based on a site-specific analysis.

COMMENT: Under probable management practices, what other fuel treatments may be used other than prescribed fire? If none, then reword the sentence. If others, then list them.

RESPONSE: Reference to "other fuel treatments" has been eliminated. The intent is to identify prescribed burning as a probable management practice.

COMMENT: Under probable management practices, the reason thinning would be used should be described more fully. Thinning should only take place to restore natural community structure where needed.

RESPONSE: The reason for thinning has been more clearly stated as "to restore natural community structure where needed".

COMMENT: The Plan should state as a standard that natural areas, and land acting as a buffer to the natural area, will not be included as part of sales or land exchanges, and that if a natural area is included in any land management proposal, the Natural Heritage Program will be consulted. However, the acquisition of portions of natural areas, or lands that buffer natural areas, on private land should be given high priority.

RESPONSE: Federal policy prohibits the sale but not the exchange of public land. A standard [4.8.0.6] has been added that would "consider only those land exchange proposals that would result in no net loss of values for which the SIA (natural area) was established." Although natural areas on private land are not specifically identified in the list of "highest priority lands for acquisition" [Table 4.8a], this list includes many of the characteristics that natural areas incorporate such as riparian ecosystems, critical habitats for federally-listed species, environmentally-sensitive areas, and also land needed to buffer for these specific habitats.

COMMENT: In natural areas, scenery management should not take precedence over natural area objectives.

RESPONSE: The scenery objectives for SIAs (natural areas) are not in conflict with the ecological objectives. SIA (Natural area) ecological/biological objectives are, by default, equivalent to scenery management objectives. We expect little management needed to meet the scenic objectives in the natural areas.

COMMENT: Under the standards for water/hydrology/soils, modify the second standard to read, "Stop water flow of existing canals and ditches if it appears that doing so will restore natural hydrology. Retain canals and ditches where necessary along forest roads. If blocked ditches create an impassable barrier, it may be necessary to create crossing opportunities for animal movement."

RESPONSE: The standard [4.1.1.1] was modified to "Stop water flow in existing canals and ditches if it will restore natural hydrology. Retrofit with water control structures. Maintain ditches and canals where necessary for forest roads. Where canals and ditches occur in Wilderness, stop water flow outside of the Wilderness boundary in such a way as to restore natural hydrology within the Wilderness area." Risks to animal movements will be evaluated as ditch-blocking projects are proposed.

COMMENT: Under standards for plant communities, ensure that all active management contributes to the perpetuation of rare and high quality natural communities by adding this as a standard. Natural community descriptions are provided in the site descriptions from the NC Natural Heritage Program.

RESPONSE: Standards are limitations on actions or thresholds not to be exceeded, and were developed in the Plan to reach goals, objectives, and desired conditions for the CNF. "Perpetuating rare and high quality natural communities" is a primary emphasis of the Plan and includes both restoring and maintaining natural community composition, structure, and function. High priority is given to maintaining biological diversity and the appearance of natural forests. This priority is expressed in goal/desired condition statements and in objectives. They include: [Goal 2.5.2.b] - expanding the role of fire to recover and sustain short interval fire-adapted systems, [Objective 2.5.2.3] - restoring natural communities using prescribed natural fires that occur during the times of year when natural fire historically occurred, [Goal 2.1.2] - providing core areas for rare species and unique communities that represent the range of ecological conditions found on the Croatan, and [Objective 2.1.2.1] – maintaining habitat quality in these core natural areas.

Various standards were developed to "ensure that all active management contributes to the perpetuation of rare and high quality natural communities". These include:
[4.1.1.5] – prohibiting all direct and indirect alteration of natural hydrology;
[4.2.0.1] – using the terrestrial and aquatic ecological classification and the NC Natural Heritage Program site descriptions, as a guide to identify suitable sites for restoration of native plant communities;
[4.2.0.2] – prohibiting ground disturbance in marl outcrops or limesink ponds except where restoring natural community structure or function;
[4.2.0.3] – conserving and restoring old growth longleaf pine;
[4.2.0.4] – retaining in old growth condition 1/3 of the suitable sites for Southern Wet Pine Forests, Woodlands and Savannas, Cypress-Tupelo Swamps, and Upland Mesic Hardwoods;
[4.2.0.6] – prohibiting harvest of longleaf pine dominated stands using even-aged or two-aged systems;
[4.2.1.1] – managing RCW HMA in accordance with standards identified in the RCW Management Standards and Guidelines and Recovery Plans;
[4.3.1.11] – prohibiting camping within 100 feet of limesink ponds in the Patsy Pond Limesink complex and Nine Foot Road/Roberts Road Limesink Ponds Natural Areas;
[4.4.0.6] – using the clearcut regeneration method only where it is essential to meet specific forest plan objectives;
[4.4.1.2] – managing Pocosin Lakes, Wilderness, River Corridors Eligible for Wild and Scenic River Status, Hardwood-Cypress wetlands, Upland hardwoods, Black Bear Habitat, SIAs (Natural Areas), and Old Growth as not-suited for timber production; and
[4.6.1.4] – closing all unauthorized roads in RCW nest areas.

COMMENT: Under standards for rare species, any active RCW management should be limited to what is essential and required according to the RCW Management Standards and Guidelines, and should be coordinated with the US Fish and Wildlife Service and the NC NHP. The standard should also emphasize that RCW management will also take into consideration the

management needs of other rare species, and communities. Any trees harvested should be cut and left in place.

COMMENT: Add a standard to the rare species standards that ensures that all active management, including prescribed fire and restoration management in adjoining areas, provides for the perpetuation of all rare plant and animal species within the natural area. Additionally, that all rare species management proposals require the review and approval of the Natural Heritage Program.

RESPONSE: Active RCW management in SIAs (natural areas) will follow all nest and forage standards identified in the RCW EIS. These management actions are considered essential for the recovery of the species. All management actions that may impact threatened and endangered species, including the RCW, will be coordinated with the U.S. Fish and Wildlife Service following the required consultation process.

The National Forest Management Act (NFMA) requires that biological diversity be maintained within a planning area (the CNF). NFMA and the Endangered Species Act ensure that all activities, including RCW management, that may impact rare species or reduce our ability to perpetuate these species, be evaluated and mitigation measures implemented. Goals, objectives, and desired conditions for rare natural communities are discussed in the previous response.

Tree harvest in SIAs (natural areas) may occur where SIAs (natural areas) overlap the RCW HMA and only when it is considered essential management for the recovery of the RCW. In these areas, trees may be cut and left in place or sold and removed through commercial timber sales. This decision will be made on a site-specific basis and all timber sale proposals will be reviewed by the U.S. Fish and Wildlife Service, N.C. Natural Heritage Program, N.C. Wildlife Commission, N.C. Plant Protection Agency, other interested agencies, and the public.

COMMENT: The standard for rare species that allows for site modification or translocation in response to major disturbances should be limited to RCW. Any site modification or species translocation proposals should be reviewed and approved by the NC NHP.

RESPONSE: Standard [4.2.1.10] is intended to allow for site modification or translocation of species from SIAs (natural areas) if the species continued existence on the CNF is threatened by habitat loss resulting from an intense and widespread natural disturbance. It would only apply in extraordinary cases where this disturbance results in the destruction of a significant amount (25 percent) of habitat on the CNF that supports a rare species. It is not limited to RCW but would apply to any species whose continued existence on the CNF is threatened by such an event. Various federal laws, including the Endangered Species Act and the National Forest Management Act would likely supercede this standard.

COMMENT: Documenting the effects to vegetation composition and structure from hurricane blow down is a good idea. However, it's unlikely that any subsequent changes in vegetation or ground disturbance would result in changes in natural area status. The goal of the study should be clearly stated.

RESPONSE: This standard has been restated as objective 2.1.2.3 – "Evaluate the effects of natural disturbance on native plant communities and rare species in SIAs (natural areas)". The intent of this objective is to better understand the role of natural disturbances in Coastal Plain ecosystems. The most appropriate areas to conduct this investigation are in SIAs (natural areas). These areas have forest structure and composition most similar to the "natural conditions" that may have occurred in pre-settlement forests.

COMMENT: Any special use proposals that are not compatible with natural area protection should be prohibited within natural area boundaries. This includes, but is not limited to, solid waste disposal, liquid waste disposal, landfills, and powerline rights-of-way.

RESPONSE: Standard 4.7.0.1 would prohibit any special use "when the proposed uses are inconsistent with the CNF Plan, are in conflict with other forest management objectives or applicable Federal statutes and regulations…". Solid waste disposal, liquid waste disposal, landfills, and powerline rights-of-way in SIAs (natural areas) are inconsistent with the CNF Plan.

COMMENT: The Millis Road Savanna natural area as mapped does not adequately incorporate rare species population concentrations or high quality habitat. The boundary needs to be expanded to the south and east.

RESPONSE: We disagree. The Millis Road Savanna SIA (natural area) adequately captures rare species concentrations and high quality habitat in this area. To include all rare species and community element occurrences south and east of the SIA (natural area) would increase the SIA (natural area) size by 300% but would only increase the number of rare element occurrences by 70%. Furthermore, Millis Road Savanna SIA (natural area) includes all five of the element occurrences for rare insects in this area, over half of the rare plant species and 75% of the rare bird species element occurrences in the area.

B2. Recover and sustain rare species and natural communities

KEY INTEREST: Protected species

COMMENT: The division of "rare" species into "Sensitive" species and "locally rare" species appears to be arbitrary. What are the actual criteria that the Forest Service uses to divide species into one category or the other?

COMMENT: Why is the Eastern Painted Bunting not on either list?

COMMENT: At Island Creek and a few other rich mesic sites along the northern edge of the Croatan, there are numerous species that are absent from most of the Croatan. Most if the species are common in the Piedmont of the state, but are rare/very local in the outer Coastal Plain. They are not found on any State rare lists, because they are not rare for the state as a whole. Why don't these species qualify for locally rare status? They are native plants and add to the diversity of the Croatan.

RESPONSE: Sensitive species are considered rare on a range-wide basis. They are designated by the Regional Forester and have a global rank of G1, G2, or G3 and are considered at risk of extinction in a portion of their range as evidenced by downward trends in population numbers or density, or downward trends in habitat capability. The Forest Supervisor designates locally rare species and these species usually have a state rank of S1, S2, or S3. They are not at risk of extinction, even in a portion of their range, and do not show a downward population trend over their range as a whole. However, they are uncommon within North Carolina and on the CNF and add to the locally biological diversity on the CNF. For the sake of brevity, both sensitive and locally rare species have been referred to as "rare species" in the Biological Evaluation (FEIS). Management of sensitive species focuses on maintaining species viability across USFS administered lands. Management of locally rare species focuses on maintaining representation within a Forest to provide for diversity of plant and animal communities as required by the National Forest Management Act (NFMA).

Rare species lists are maintained to highlight those species that are at the greatest risk of extirpation. These lists are not static. Species on the list are 'red flags' to land managers, alerting them to use caution with management actions that may impact habitat suitability. Rare species lists may not include all species that occur in isolated habitats, especially those that are disjunct from their central range. Disjunct species, like those found at Island Creek, and species like the Eastern Painted Bunting, are rare on the CNF but do not qualify as locally rare because they do not meet the S1, S2, or S3 criteria (they are abundant in the State). We agree, this distinction may seem arbitrary. However, a species does not have to be 'listed' to be given protection if site-specific analysis reveals that a population is important for maintaining diversity within a planning unit (CNF boundary). The NFMA and USFS policy requires that the diversity of all native species be maintained within the CNF boundary.

One hundred and thirteen sensitive or locally rare species either occur now or could potentially occur in the future within the administrative boundaries of the CNF (CNF Plan, Appendix C). Fifty-three of these species are defined by the USFS as sensitive and 60 are defined as locally rare.

COMMENT: The language concerning surveys for PETS species (2.55) violates the decision in Sierra Club v. Martin 168 F3d 1, and mirrors that of the contested forest plan amendments in Georgia and Alabama. PETS species require extra attention, due to their imperiled status. Ignoring their presence by making surveys optional will lead to more habitat loss and lead to more ESA listing. Further, it violates the Vegetation Management EIS. Surveys for PETS species must occur prior to any disturbance of ecosystems.

RESPONSE: This language has been removed from the Plan; the need for PETS surveys for project analysis will now follow direction contained in the Regional Supplement for Forest Service Manual 2670.

KEY INTEREST: Habitat for protected species

COMMENT: Areas around existing habitat for the Argos skipper and Venus flytrap cutworm moth be restored, allowing populations to expand.

RESPONSE: Prescribed fire will continue to be the primary tool used at Millis Road Savanna to restore habitat conditions for the Argos Skipper and Venus Flytrap Cutworm Moth. Fire will be allowed to burn in a natural mosaic pattern [Objective 2.5.2.2] and adjacent fire compartments will not be burned in consecutive years [Objective 2.5 2.2]. These precautions will significantly reduce the likelihood that all preferred habitat for these species (the ecotone between pine uplands and pocosin wetlands) would be impacted during the same year. The continued use of prescribed fire, within these limits, should allow the Argos Skipper and Venus Flytrap Cutworm Moth populations to expand on the CNF.

COMMENT: The Plan proposes to maintain 25 acres of existing maritime habitat in a younger than 40 year old successional stage and to restore 10 acres of maritime forest. Where is this habitat, and what is the purpose of artificially maintaining the existing forest in a variety of successional stages, when the natural processes that accomplish this are still occurring?

RESPONSE: This was an error in the draft Plan. The final Plan proposes to maintain 25 acres of existing maritime forest and allow it to progress to an older stand condition [Objective 2.1.3.5) and restore 10 acres of maritime forest [Objective 2.1.3.4]. Most of the existing and potential habitat for maritime forest occurs near Cedar Point and at Oyster Point.

COMMENT: Are there efforts to re-establish Atlantic White Cedar in its natural range?

RESPONSE: Alternative E, includes an objective [Objective 2.1.3.4] to restore 25 acres of Atlantic White Cedar on suitable sites on the CNF, considered within it natural range.

KEY INTEREST: American woodcock

COMMENT: An important omission in the plan is the failure to mention the importance of the Croatan as a wintering area for American woodcock or to provide for proper habitat for this diminishing species. The importance of the Croatan to woodcock should be delineated and described in the plan.

RESPONSE: In a recent species profile of American woodcock (McAuley & Clugston, 2001), winter habitat is identified as primarily bottomland hardwoods, upland mixed pine-hardwoods, and recently burned longleaf pine stands but includes a variety of other habitats. Habitat requirements include dense understory vegetation for cover and nearby open areas for roosting and foraging. Open areas used by woodcocks include forest openings, recent clearcuts, and open fields.

The American woodcock is not listed in the 2001 NC Natural Heritage Program list of rare animals of North Carolina. The Plan, however, provides management direction that would maintain wintering habitat for this species. The Plan proposes to maintain or restore 6,200 acres of forested wetlands [Objective 2.1.6.1], to maintain and restore longleaf pine savannas/flatwoods on appropriate soils [Objectives 2.1.1.6 and 2.4.1.1], and to expand the role of prescribed fire primarily in pine savannas and flatwoods. Existing mixed pine-hardwood forests will be maintained on appropriate soils. Furthermore, CNF maintains a system of wildlife

openings with forested habitats and provides additional open areas in naturally occurring forest gaps, existing rights-of-way, and recent forest clearings (i.e. salvage cuts and proposed clearcuts).

KEY INTEREST: Bald Eagles

COMMENT: The Croatan could help the recovery of the Bald Eagle by defining strictly what "older large diameter trees near open water" would be protected.

COMMENT: If trees suitable as potential bald eagle nest trees are protected and allowed to grow and develop on sites close to water the CNF has an excellent chance to establish a viable breeding population of at least 5 nesting pairs. Important potential CNF areas may be developed along (1) the Neuse River between road 1112 and Temple, (2) the Mill Creek drainage into Newport River bay, (3) Bogue Sound between Mansfield and Cedar Point, (4) White Oak below Haywood landing, and (5) Great Lake.

COMMENT: Under the "Recover and Sustain Rare Species and Communities" section in Chapter 2, no provisions are made for protecting potential nest sites for the bald eagle – a federally listed (T) species that nests along coastal waters from Florida to Chesapeake Bay. The Biological Assessment mentions that implementation of the CNF Plan would result in a considerable amount of habitat for the bald eagle. It also specifies that all acres of older, large diameter trees near open water would be retained and managed to protect this condition (BA p.E-6). If such a statement is in the plan exists, or is added, it serves only as a "course filter" which is inadequate for the species. The coarse filter is inadequate because the possibility exists that timber harvest may destroy the trees on one, or more, of the best potential nest sites. The final Plan should (1) include adequate protective language in this section, and (2) commit the CNF to timely implementation of a bald eagle habitat inventory and a bald eagle habitat management policy.

RESPONSE: Bald eagles can be found on CNF and the surrounding waterways year-round. A nest was recently confirmed on CNF land and successfully produced one fledgling. Bald eagles have been observed regularly along both the Neuse and White Oak Rivers but no nests have yet been confirmed in these areas. USFS personnel have searched parts of the White Oak River and its' tributaries for nests.

Bald eagles most often nest in the ecotone of forest and marsh or water, and nests are constructed in older, dominant or codominant living pines or bald cypress that are four kilometers or less from open water providing a food source. Nest trees are often supra canopy trees that stand taller than other trees in the forest providing a clear view and easy access. A standard has been added to the Plan (4.2.0.10) that will provide protection of supra canopy trees within 300 feet of lakes and rivers. These trees may be cut only when they pose a health or safety hazard to forest users.

Protection for bald eagle nesting and foraging habitat can be found within the following sections:

- Section 2.1.3 - Recover and sustain rare species and communities [Objectives 2.1.3.1 and 2.1.3.2];
- Section 2.1.4 – Restore old growth forests [Objectives 2.1.4.1 and 2.1.4.2];

- Section 2.1.6 – Maintain hardwood cypress wetlands [Objective 2.1.5.1];
- Section 2.1.8 – Restore hydrologic function and sustain aquatic systems [Objectives 2.1.8.4 and 2.1.8.5];
- Section 2.3.1 – Wilderness [Goals 2.3.1.a and 2.3.1.d];
- Section 2.3.2 – River Corridors Eligible for Wild and Scenic River Status [Objectives 2.3.2.1 to 2.3.2.5]; and
- Section 2.6.1 – Providing access while protecting natural resources.

In addition, only one management prescriptions is suited for timber production, the RCW HMA [Standard 4.4.1.1], and this area is less likely to support habitats suitable for the bald eagle than other management prescriptions.

Site-specific biological evaluations will be conducted for all projects to determine effects to PETS species [Standard 4.2.0.8]. This should provide an additional level of protection for the bald eagle. The bald eagle is currently federally listed as a threatened species and therefore, will be considered in all biological evaluations. If any project is proposed in an area containing suitable habitat for this species, a biologist will visit the site, search for eagles and nests, review occurrence records, and speak with others familiar with the area to see if eagles occur or have occurred within the area. At that time, it will be determined whether the bald eagle nests in the area. If it is found there are bald eagles in the area, consultation will begin with the U.S. Fish and Wildlife Service to determine which actions, if any, would be allowed in the project area.

B3. Old Growth

KEY INTEREST: Definition of old growth

COMMENT: The definition of old growth seems to indicate that only trees about to die are old growth. The appendices do not give a definition and the one in the DEIS glossary is vague and open to a wide range of interpretations. Define old growth for long leaf pine stands as stands that are characterized by widely spaced dominant trees that have rounded to nearly flat tops, a high decadence and rough-plated bark. Such trees range between 150 and 300 or more years of age.

COMMENT: The definition of "old growth" is illogical and unworkable. It indicates old growth begins when the tree/stand is expected to die of old age. That essentially eliminates old growth as a significant period in the life span of a tree or stand of trees. The term old growth represents a period of time, at least several decades in length, that is the last stage of life of a tree/stand.

RESPONSE: The characteristic of "rough-plated bark" has been added to the description of old growth longleaf pine in Chapter 3.13.1. All other characteristics of old growth identified in these comments are included in this description.

The description of old growth in Chapter 2.1.4 is intended to portray, in general, the old growth stage of succession for a variety of tree species and plant communities. It is not meant to imply that "old growth begins when the tree/stand is expected to die of old age". Many trees, roughly half, would be expected to be alive beyond their average life expectancy in an old growth stand.

Old growth is not the last stage of the life of a stand. Old growth is a stand condition and a point on a continuum. The old growth condition will persist until a major disturbance eliminates all components important to old growth function such as large trees, numerous large snags, and downed logs in various stages of decay. As pointed out in Chapter 3.13, the age at which old growth conditions occur and the length of time that they are retained, depends upon the plant community type, life expectancy of a tree species, and the severity and intensity of disturbance.

KEY INTEREST: Designation and management of old growth

COMMENT: The designated old growth longleaf pine stands will not provide adequate old growth function over time because they are too small in size and are surrounded by younger forests managed using even aged silvicultural systems.

COMMENT: All of the natural longleaf stands on the Croatan should be allocated to old growth. Delineate one or more large (greater than 2500 acres) patch contiguous or proximate areas of existing longleaf forests and longleaf savanna landtype and allocate these areas to old growth. The most logical areas to allocate a large old growth longleaf patch is within Management Area 4, which also contains several natural areas and about half of the existing RCW clusters on the Forest.

COMMENT: The Forest Plan allocates "small" old growth patches, but no large or medium patches. Without large, undisturbed patches of old growth, recovery of many wide-ranging species (such as cougar and red wolf) will be precluded. The Forest Service must provide large patches of undisturbed forest to recover as old growth, or it will be in violation of the Endangered Species Act, Section 7(a)(1), 16 USC 1536(a)(1).

COMMENT: Restore old growth by leaving areas undisturbed such as upland hardwoods and cypress swamps.

COMMENT: Leaving small patches of old growth in a matrix of early to mid successional stands risks declining functionality during their lifetime by forcing them to function over the long term as islands, which means lower species diversity than larger tracts of habitat.

RESPONSE: The intent of habitat management on the CNF is to provide forest composition and stand conditions, including old growth, similar to those found in pre-settlement forests. Historical accounts and more recent observations of population declines of native species in the Eastern Coastal Plain indicate that pre-settlement forests provided the composition and structure necessary to support a wide variety of rare as well as common species in this area. Old growth forests were a component of pre-settlement forests in the Coastal Plain, but their extent is speculative given the lack of historical documentation and the frequency and intensity of natural disturbance (hurricane and wildfire) that could 'set back' forest stand development to earlier successional stages. Within this background of uncertainty and the need to provide conditions to maintain species diversity, the CNF Plan attempts to set realistic objectives for the extent of old growth on the landscape. A classification of ecological types was developed (Appendix A) to address the issue of potential natural communities, and the structure of landscapes on the CNF

was analyzed to assess the distribution and configuration of natural landscape components, namely the matrix, corridors, and patches.

The CNF is primarily a matrix of pocosin and pond pine with small patches of upland mixed pine and longleaf pine forests. Pocosin habitat totals 74,000 acres and occurs in 155 mapped polygons with 480 acres average polygon size. Pond pine forest habitat totals 32,000 acres and occurs in 185 mapped polygons with 172 acres average polygon size. These two ecological types account for over two-thirds of the land on the CNF. Within this matrix are corridors of hardwood-cypress swamps (7,800 acres total; 126 polygons; 62 acres average polygon size), and patches of upland, mixed-pine forests (8,000 acres total; 145 mapped polygons; 55 acres average polygon size), and upland, potential longleaf pine forests (16,000 acres total; 843 polygons; 30 acres average polygon size). Regardless of the potential natural vegetation that can occur on the CNF, the natural topography controls the patch sizes of communities, including those in old growth condition, and their distribution on the Forest. Upland plant communities such as mixed pine and longleaf pine, within this Coastal Plain landscape composition, will always be relegated to relatively small to medium-sized patches on the CNF.

The Plan directs that old growth forests will be identified and maintained on the CNF within portions of three broad plant community groups: "Retain at least 1/3 of ecologically suitable landtypes in old growth Southern Wet Pine Forests, Woodlands and Savannas (10,000 of 30,000 acres), Cypress-Tupelo Swamp (2,300 of 7,000 acres), and Upland Mesic Hardwoods (300 of 1,000 acres)" [Standard 4.2.0.4]. These community groups occur in management prescriptions that are not suited for timber production [Standard 4.4.1.2]. Therefore, all forests in these prescriptions, except approximately 2,000 acres of 'offsite' pine which will be restored to hardwood, will be left undisturbed and allowed to develop without direct management actions. Furthermore, where old growth stands are identified in these areas, no tree harvest will occur unless it enhances old growth structure [Standard 4.4.1.5]. These standards should ensure that small, medium, and medium-large patches of old growth, relative to the natural landscape configuration, exist across the CNF on sites that support these communities groups.

The Plan also identifies approximately 1,800 acres of potential old growth longleaf pine forest (Appendix M) in small (5 to 25 acres), and medium-sized (100 to 200 acres) areas across the CNF and provides the direction to "Conserve and restore 'this' network of small and medium-sized areas of potential old growth for Upland Longleaf Pine communities" [Standard 4.2.0.3] and to manage these areas as not suited for timber production [Standard 4.4.1.2]. These areas of potential old growth forest were identified from Continuous Forest and Stand Condition (CISC) data, descriptions of SIAs (natural areas), and local knowledge. Many of these stands occur in RCW nest clusters and in SIAs (natural areas) in the southern portion of the CNF, identified as Management Area 4.

One of the primary goals in the Plan is to restore longleaf pine in stands that are currently occupied by 'off site' species. By design, forests that are currently longleaf pine will not be converted to other forest types, will be maintained as savanna [Objective 2.1.1.6], and will be allowed to develop into older forest condition. Nearly all of the approximately 12,000 acres of stands on the CNF classified as longleaf pine forest type occur in the RCW HMA and are well below the required rotation age of 120 years for the species. All longleaf pine stands, except

those designated as old growth, are below 80 years in age and therefore no regeneration harvests can occur in this forest type during implementation of the Plan. Thinning of these stands [Standard 4.4.0.5] may occur to meet RCW nest and forage standards in the RCW EIS and Recovery Plans [Standard 4.2.1.1]. Thinning will create a more open stand structure and will stimulate growth in residuals trees by reducing root and crown competition. The intent of these standards is to provide conditions more similar to those found in old growth stands.

Large areas of old growth longleaf pine are not likely to develop during the next decade because of the current age of stands, the extent of 'off-site' species on longleaf pine sites, and the natural landscape composition on the CNF. There are approximately 500 longleaf pine stands on the CNF and they vary from 2 to 225 acres in size. The average stand size is only 27 acres and this is due primarily to the dissected nature of the CNF landscape. There are few contiguous upland sites that are considered 'large' (greater than 400 acres in size) that could support longleaf pine forests; most are divided by pocosin or drainages dominated by hardwoods. The creation of large areas of old growth longleaf pine forests on the CNF is possible only through restoration of longleaf pine forests in these few large upland forest areas and by maintaining stands that are currently at or near old growth condition.

The amount of old growth on the CNF and its configuration with other forest conditions is dependent upon current conditions, natural disturbance events, and the planned creation of early successional habitats. Currently, 16,000 acres or 10 percent of the CNF forests are less than 20 years in age and over 120,000 acres or 70 percent of forests are between 60 to 80 years in age. During Plan implementation, an objective is identified for only 500 to 750 acres of clearcutting [Objective 2.4.1.1], which will increase the amount of younger forests by approximately 3 to 5 percent. Longleaf pine restoration using a shelterwood with reserve trees method is planned for an additional 1,250-1,750 acres [Objective 2.4.1.1], which will maintain older forest structure in these areas. If all vegetation management Plan objectives are met, approximately 14,400 acres of old growth management areas will be surrounded by over 100,000 acres of mid to late successional, 60-80 year old stands not managed by even-aged silvicultural systems, and 7,500 acres of early successional pocosin habitat [Objective 2.1.5.1] managed by prescribed fire.

COMMENT: Use several examples for reference conditions. Since much of the acreage of old growth-other is pond pine woodland, it would be good to include a pond pine woodland reference condition description.

RESPONSE: A description of the reference condition for old growth pond pine woodlands is included with Southern Wet Pine Forests, Woodlands, and Savannas [Chapter 3.13.1]. Less is known about the structure of these communities in old growth condition, e.g. number of large trees per acre, snags, or downed wood, than is known about longleaf pine forests. The description of old growth pond pine woodland composition, is therefore, emphasized over structure and is not used as the primary example of reference condition.

COMMENT: In the description of probable management practices, occasional timber harvesting should be more specifically stated as being used for restoring old growth structure through gap creation, thinning and provisioning of large woody debris.

RESPONSE: This refinement has been added. The description of probable management practices includes "occasional timber harvesting for restoring old growth structure through gap creation, thinning, and providing large woody debris" [Chapter 3.13].

COMMENT: When an old growth designation overlays another designation, which prescription takes precedence and what management activities are allowed?

RESPONSE: Whenever management prescriptions overlap, the more restrictive standards take precedence. For example, when old growth occurs in the RCW HMA, the area is not suited for timber production but trees may be cut to restore old growth structure. When old growth occurs in a natural area, the more restrictive standards in SIAs (natural areas) that limit land exchanges would apply. Similarly, no mechanized equipment could be used to manage old growth that overlaps a wilderness area.

COMMENT: The mapping of old growth around Holston Creek needs to be expanded. Hunter Creek is incorrectly mapped as pine savanna and flatwoods, and needs to be designated as old growth.

RESPONSE: Old growth at Holston Creek has been expanded from 26 to 49 acres and now includes all of stand 29 within compartment 42 (Appendix M). At Hunter Creek, the error has been corrected; stand 6 (a longleaf pine type) has been designated as old growth instead of stand 8 (a hardwood type). There is approximately 140 acres of old growth longleaf pine designated in this area including stands 6, 18, 19, 20, and 21 in compartment 55 (Appendix M).

COMMENT: No acreage for old growth protection is given, despite acreages for other areas, such as oak, wetlands, lakes, longleaf pine, pinestraw production, etc. Lack of old growth (less than 400 acres – 2.10) means that no cutting or removal should occur.

RESPONSE: Forestwide standards provide acreage figures for three categories of old growth: Southern Wet Pine Forests, Woodlands and Savannas (10,000 of the 30,000 acres), Cypress-Tupelo Swamp (2,300 of the 7,000 acres), and Upland Mesic Hardwood (300 acres of the 1,000) [Standard 4.2.0.4]. Appendix M includes acreage figures for longleaf pine old growth.

KEY INTEREST: Timber management of old growth

COMMENT: Use of uneven-aged management and the group selection method of regeneration across the entire timber production land base to conserve older age trees with old growth characteristics (as we recommend for lands suitable for timber production) would minimize the risk of declining function.

COMMENT: Extensive cutting of mature loblolly may leave stands of old growth longleaf more vulnerable to hurricane winds.

RESPONSE: Alternative E refines the purpose, reduces the extent, and alters the mix of timber harvest methods on the CNF. The primary purpose of timber harvest is to restore longleaf pine or to thin longleaf, loblolly, or mixed pine stands [Objectives 2.4.1.1 and 2.4.1.2]. The objective

for using clearcutting as a restoration method has been reduced from 2,500 acres during a ten-year period to 500 to 700 acres. The objective for using a two-age system as a restoration method has remained the same, and the objective of regenerating mixed pines on 2,000 acres in a ten-year period has been eliminated. The use of prescribed fire and supplemental artificial planting has been added as an objective on 900 to 1,100 acres to restore longleaf pine in off-site loblolly pine plantations.

The overall reduction in cutting of mature loblolly pine stands and the retention of significant forest structure in shelterwood with reserve trees harvest areas will reduce forest stand and landscape level impacts on the CNF including the vulnerability of old growth longleaf pine stands to hurricane winds. The shelterwood with reserve trees method retains 6 to 10 overstory trees per acre, leaving older trees in the canopy that can develop old growth characteristics. These harvest areas, along with the extensive number of mid to late seral forests (EIS Table 3.20), where no timber harvest occurs, will reduce the risk that old growth function will decline during implementation of the Plan because a large amount of structure is being maintained across the landscape.

COMMENT: Old growth areas should not be logged.

COMMENT: Old growth longleaf, cypress/tupelo and upland mesic hardwoods should be removed from the timber base and the exact reasons why stated in the text. If there are any limited circumstances under which trees could be selectively removed from these old growth types, these should be clearly described within the prescription.

RESPONSE: In the Plan, old growth forests are not suited for timber production [Standard 4.4.1.2] but occasional tree cutting may occur for restoring old growth structure through gap creation, thinning, and to provide large woody debris [Chapter 3.1.3]. Although tree cutting is allowed [Standards 4.4.1.5, 4.4.1.6], the Plan prohibits "removal of old trees, snags, or downed logs if they will alter old growth structure" [Standard 4.4.1.7]. These standards take precedence over forest-wide standards that define the limits of tree cutting on land classed as not suited for timber production [Standard 4.4.0.14].

COMMENT: The standards for Forest Products should be modified as follows:

1. Timber will not be harvested in the upland pine communities, since they have already achieved old growth structure. If the midstory becomes too dense or too mature to be controlled by fire, cutting and application of herbicides may be used.
2. Timber may be harvested in old growth community types other than upland pine communities if the structural characteristics of the forest clearly indicate a need for restoration forestry. If multi-ages structure is present, no timber harvest is needed. If the forest is too dense, overstory trees may be removed in groups of 1/10 acres or less to create gaps, or midcanopy trees may be thinned.
3. For any old growth forest type, timber harvest may occur to reduce risks to adjacent stands from insect attacks or disease conditions.
4. In a multi-age old growth stand, natural treefall should be sufficient to provide woody debris to support aquatic habitat structure. In stands which have not yet achieved old

growth structure, and woody material is insufficient in streams, individual overstory trees may be felled into the stream.
5. Leave scattered large woody debris on the ground when forests are thinned, or have gaps created, to provide food and shelter for animal species.
6. Leave as it is currently written.

RESPONSE: The standards for the old growth management prescription include all of these suggestions.

Suggestions 1 and 2: Trees may not be cut in any old growth management prescription, including upland pine communities, if they have already achieved old growth structure, except for the purposes of human safety [Standard 4.4.1.5]. If the midstory become too dense or too mature to be controlled by fire, thinning of mid-canopy and low thinning of canopy codominates is allowed if it will enhance old growth structure [Standard 4.4.1.5]. Overstory trees may be felled in 1/10 acre or less groups in all old growth management prescriptions to create gaps [Standard 4.4.1.5]. However, no timber will be removed (harvested) if this will alter old-growth structure [Standard 4.4.1.7].

Suggestion 3: Timber felling may occur in old growth management prescriptions to reduce risks to adjacent stands from insect attacks or disease condition [Standard 4.4.1.5].

Suggestion 4: Overstory trees may be felled if there is a need for large downed material to improve habitat structure for fish in streams [Standard 4.4.1.6]. If natural tree fall is sufficient to provide woody debris to support aquatic habitat structure, there is no need to apply this standard.

Suggestion 5: Standard 4.4.1.7 prohibits "removal of old trees, snags, or downed logs if they will alter old-growth structure". This standard will ensure that large scattered woody debris will provide food and shelter for animal species.

C. Wildlife and Fish Habitats

C1. Maintain Black bear habitat

KEY INTEREST: Early successional habitat for black bear

COMMENT: Sections of the Plan are less than clear about the methodology to be used for creating early and mid-successional habitat for black bears, based on the research available. The potential methods of drum chopping and small clearcuts to create this habitat, especially within the boundaries of the proposed natural areas, Masontown Pocosin and Union Point Pocosin should not occur.

COMMENT: An historic basis for your early successional habitat targets needs to be established. Evaluate the current availability and distribution of early successional habitat before artificially creating new habitat.

RESPONSE: There are no acre objectives set for drum chopping and small clearcuts to enhance black bear habitat, however, objectives for habitat conditions are identified [Objective 2.1.5.1 through 2.1.5.4]. Although clearcutting and drum chopping are not prohibited in black bear habitat [Standard 4.4.0.6] their use will be limited by funding and access (they would occur adjacent to existing roads). Prescribed fire is the primary tool that will be used to create early successional habitat in pocosins. As more research becomes available on the proper season and condition for burning pocosins, prescribed fire will be used on a 5 to 12 year rotation to reduce risks of wildfire [Objective 2.5.1.3] and create habitat conditions suitable for black bear. An evaluation of the needs for habitat enhancement will be made on a site-specific basis before any vegetation management projects in black bear habitat will be implemented.

COMMENT: Why is active management described under the background discussion for enhancing black bear habitat (prescribed burns, small clearcuts, drum-chopped areas), while part of the goal is to minimize human disturbance and habitat modification? The information is contradictory.

RESPONSE: Black bears need a variety of habitat conditions to provide food, hiding cover, and denning areas (Chapter 2.1.5). They also prefer large blocks of habitat free from frequent human disturbances such as hunting. Active vegetation management may be needed to provide these conditions because natural disturbance events such as wildfires, that once created a mosaic of habitat conditions, are now suppressed for human safety reasons. Both wildfire and vegetation management are forms of disturbance that could directly impact black bears. However, when they occur on an infrequent basis, such as the 5 to 12 year rotation suggested for pocosin burning [Objective 2.5.1.3], they can enhance long-term habitat conditions.

KEY INTEREST: Description and management of Black Bear Habitat Management Area

COMMENT: Restrict construction of new roads within the Black Bear HMA, especially the Union Point and Masontown pocosins, by adding this as a standard under Access.

RESPONSE: One of the primary goals in managing black bear habitat is to minimize human disturbance. To help meet this goal, objectives are set for closing all existing unauthorized routes [Objective 2.6.1.2] as well as 15 to 20 miles of existing authorized roads [Objective 2.6.1.1]. Standards further restrict disturbance from roads in black bear habitat by prohibiting public access on existing closed roads in these areas [Standard 4.6.1.7] and prohibiting new recreation uses from the central core of black bear habitat [Standard 4.6.1.8]. It is very unlikely that any new roads would be constructed in black bear habitat, especially in significant wetlands such as the Union Point and Masontown pocosins.

COMMENT: Atlantic white cedar seems unlikely to be found in MA 5, southeast of Havelock, as described in the reference condition for black bear habitat.

RESPONSE: We agree that Atlantic white cedar is unlikely to be found in the large pocosins southeast of Havelock. The reference to this species has been removed.

COMMENT: Emphasis should be made that where the Black bear HMA designation overlaps with a management or embedded prescription designation, the other designation takes precedence.

RESPONSE: The discussion on embedded prescriptions has been expanded and more clearly defines the precedence of standards (Chapter 3.1). In most cases, smaller scale prescriptions have more restrictive standards than those they are embedded within. The same logic applies when two primary prescriptions overlap. For example, there are areas on the CNF where SIAs (natural areas) are embedded in black bear habitat. The more restrictive standards for SIAs (natural areas) would apply in these black bear habitat areas.

KEY INTEREST: Military training within the Black Bear Habitat Management Area

COMMENT: Within the Black Bear Habitat Management Area, why are military training operations considered "probable management practices?" What does this involve? What is the potential for military operations disturbing bears and driving them into areas where they are likely to be injured or killed – by poachers or collisions with automobiles? The DEIS does not address this potential impact.

COMMENT: Intense or high use military training within the Black bear HMA should *only* be permitted to occur in January and February.

RESPONSE: Military training operations are permitted on the Croatan National Forest. The operations include foot travel by infantry Marines, bivouacking, individual/small group parachuting, and low level helicopter flights. Many times the foot travel training exercises take place within pocosin habitat to simulate rough conditions found elsewhere in the world. Since the black bear management prescription is predominantly pocosin, military training operations is included as a probable management practice. Ground military training exercises are not permitted in specially designated areas including wilderness areas and special interest areas. Military vehicles are prohibited from going "off-road".

For the last several years an average of five permits per year were issued for military ground training exercises. Each ground exercise lasted an average of two days. Due to the limited use of open roads and administrative sites for military operations it is unlikely these operations would increase the chances of black bears being injured or killed by poachers or automobiles. In addition, military ground operations, along with other types of activities proposed in the black bear habitat management prescription are evaluated and mitigated if the action would substantially alter natural movement patterns of bear [Standard 4.2.0.15].

The black bears living within and around the Croatan National Forests are adapted to military disturbance due to the close proximity of MCAS Cherry Point Naval Base. According to a Report to Congress on the "Potential Impacts of Aircraft Overflights of National Forest System Wildernesses (July 1992)", the effects on large carnivores from overflights are "weak or subtle because animals adapt by habituating behaviorally and physiologically to the challenge (p.4-5)." The report discussed that animals initially are startled by overflights, but generally adapt very well.

C2. Maintain hardwood cypress wetlands

KEY INTEREST: Neotropical bird species

COMMENT: Of approximately 38 species of neotropical migrants that breed in the Croatan, it has been indicated based on census work on the Croatan that no more than 14 occur primarily in riverine hardwood systems (including the slopes). Species to consider adding to the list of birds benefiting from riparian habitat are yellow-billed cuckoo, Acadian flycatcher, wood thrush, red-eyed vireo, northern parula, and prothonotary warbler. The plan revision should specify what neotropical migrant species benefit from the proposed riparian management and how the needs of neotropical migrants in areas other than riverine hardwood systems will benefit.

COMMENT: The black-throated green warbler shuns riverine swamps.

RESPONSE: The yellow-billed cuckoo, Acadian flycatcher, wood thrush, red-eyed vireo, northern parula, and prothonotary warbler have been added as species benefiting from the proposed hardwood-cypress wetland management prescription. The black-throated green warbler has been removed from this discussion.

Allocating land use in the hardwood-cypress wetlands as habitat for neotropical migrants was not intended to fulfill the needs of all neotropical migrants that breed on the CNF. However, these wetlands do support a disproportionately large number of these species and therefore warrant special attention. The Plan does not specify how the needs of neotropical migrants in areas other than riverine hardwood systems will benefit. It is likely that suitable habitat conditions for other neotropical migrants will occur in the extensive network of SIAs (natural areas), old growth, wilderness, and pine savannas on the CNF.

KEY INTEREST: Description and designation of hardwood cypress wetlands

COMMENT: Why is Black Creek swamp used as the reference condition when it does not show up on the map as being a hardwood cypress wetland?

RESPONSE: The scale of the management prescription map is too coarse to clearly see Black Swamp Creek. In addition, not all of Black Swamp creek shows up on the map because a part of the creek is included within the more restrictive Catfish Lake South Wilderness prescription. This map has been improved and enlarged in the final Plan.

COMMENT: Areas along Holston Creek, in addition to other sites, could qualify as hardwood cypress wetlands based on natural canopy cover. Why were these not included? Were they designated as No Prescription or Old Growth II to provide increased protection due to the management prescription standards? If this is the case, please also designate the Hadnot Road Ponds SIA/RNHA as such to ensure a greater degree of protection for it since it was not accepted as a Natural Area for the Plan.

RESPONSE: The hardwood-cypress wetland management prescription boundary was based primarily on maps of presettlement riverine swamp communities on the CNF (Frost 1996). There are about 7,900 acres of riverine swamp communities on the CNF (Appendix A). Approximately 1,500 acres are included in Wilderness and river corridors eligible for Wild and Scenic River status management prescriptions and 6,200 acres are included within the hardwood-cypress wetland prescription. The hardwood-cypress wetlands prescription also includes about 2,000 acres of types that are more upland adjacent to the true riverine hardwood system. Areas along Holston Creek are included within the hardwood-cypress wetland prescription and the Hadnot Creek Ponds and Longleaf Pine Woods natural area (410 acres) has been identified in the Plan in the SIAs (natural areas) management prescription (Chapter 3.12.1).

KEY INTEREST: Herbicide use

COMMENT: Under the Water/Hydrology/Soils standards, in the hardwood and cypress wetlands prescription, and the hardwood restoration prescription, herbicide use is allowed if the herbicides are labeled for use over water when within 150 feet of perennial streams or water bodies. For what management purpose would herbicides be applied in these two prescription areas? Roadside ditches should be added to protected aquatic habitats and specify that broadcast application of herbicides should not occur at all.

RESPONSE: Wildlife openings exist within the upland hardwood prescription and in the upland portions of the hardwood-cypress wetlands. It may be necessary to use herbicides to maintain the plants beneficial to wildlife in these openings and to convert non-native vegetation to native vegetation (Standard 4.2.1.12). When applying herbicides in wildlife openings, it is usually broadcast sprayed with a tractor. It is applied on days with low wind speed. The intention is not to apply herbicides within or directly adjacent to streams or other bodies of water. The requirement to use only those herbicides labeled for use over water [Standard 4.1.1.6] is an added protection to ensure that if spray drift occurs, it will not adversely affect aquatic species.

KEY INTEREST: Context of objectives

COMMENT: The stated objective, to maintain or restore 6,200 acres of oak-gum-cypress habitat is nebulous in the absence of knowledge about the total amount available. Also, because of the wide range of life spans among the various species of trees in this ecosystem, what constitutes the "mature successional stage" is uncertain. The term "few canopy gaps" is open to a wide range of interpretations.

RESPONSE: Approximately 6,200 acres of riverine plant communities identified in Cecil Frost's (1996) map of presettlement vegetation on the CNF are included within the hardwood-cypress wetlands prescription. The Plan objective is to maintain all existing oak-gum-cypress forests in these areas and restore this composition in areas that were damaged by hurricanes in the mid 90s (Objective 2.1.6.1). Restoration may include planting hardwoods or allowing natural succession to recover this species composition. The desired stand condition for this prescription is a predominantly "mature" forest with one-third of the area in old growth condition (Objective 2.1.4.1 and Standard 4.2.0.4). Because of the frequency of hurricanes in the Eastern Coastal Plain, that tend to set back succession, and the lack of historic records of stand dynamics on the

CNF, the term "mature" in these systems can easily be debated. In the Plan, oak-gum-cypress forests over 60 years old are considered mature and currently over 80% of these forests exceed this age limit. These forests are not suited for timber production (Standard 4.4.1.2) and are currently meeting their desired condition as landscape corridors (Goal 2.1.6). Therefore little active management is necessary in these areas. Although the objective is to have "few canopy gaps" in the hardwood-cypress wetlands prescription, their creation will be dictated more by natural processes than by active management.

KEY INTEREST: Timber harvest for salvage and associated site preparation

COMMENT: Due to the fact that dead and dying hardwoods present little or no insect or disease threats to adjacent commercial forests, salvage of hardwoods should be very limited. Timber harvest should be limited in this ecosystem to thinning and small group selection cuts. Limit the small group selection area to an acreage equivalent of an old growth rotation for bald cypress, e.g., 1/250th of the total ecosystem area. Also, give full protection to relict cypress. Change the last paragraph in the Hardwood Wetlands for Neotrops Goal to read, "The hardwood-wetland ecosystem will be managed on an old growth rotation of 250 years with timber harvest limited to no more than ____(calculate) acres per year. No relict cypress will be cut."

RESPONSE: The predominant goal of hardwood-cypress wetlands is to maintain these systems as important contiguous forest, landscape corridors (Goal 2.1.6). These areas are not suited for timber production (Standard 4.4.1.2). Tree may be cut on land classed as not suited for timber production for "salvaging or sanitation harvesting of trees or stands that are substantially damaged by fire, windthrow, insect or disease attack, or other catastrophes (Standard 4.4.0.14). The clearcut regeneration method is allowed in these areas to "rehabilitate lands adversely impacted by events, such as fires, windstorms, or insect or disease attacks" (Standard 4.4.0.6). However, salvage operations are driven mostly by the desire to maintain scenic integrity objectives (Table 4.3a) and will not occur if they interfere with the predominate goal of the management prescription to provide intact landscape corridors.

COMMENT: Under the forest products standards, it is indicated that when salvage occurs, regeneration efforts will include site preparation for natural regeneration. Is site preparation necessary? Specify what activities would be included as site prep. By conducting management activities in these areas, the likelihood of introducing invasive exotics is increased.

RESPONSE: Site preparation may be used in the hardwood-cypress wetlands management prescription to regenerate native species (Standard 4.4.1.4) but only if stands are "substantially damaged by fire, windthrow, insect or disease attach, or other catastrophes" (Standard 4.4.0.14). Site preparation in the riverine hardwoods communities would likely include thinning or herbicide treatment if it is necessary to control invasive exotic species or highly competitive native species (such as red maple) to favor oak, gum, and cypress species.

C3. Restore Hardwoods on Suitable Sites

KEY INTEREST: Description and management of hardwood sites

COMMENT: In the Hardwood Restoration section of the Plan under Probable Management Activities, the creation and maintenance of long, narrow wildlife openings, and permanent grass and forb openings, are likely to occur. However, under the Wildlife and Fish standards it states that the construction of new wildlife openings is prohibited. Which is going to be followed? Adherence to the standard should occur as indicated, and the actions under probable management activities should be changed.

RESPONSE: This was an error in the draft Plan. The standards developed to reach goals, objectives, and desired conditions have been aggregated into one chapter [Chapter 4] for better communication. New wildlife openings are prohibited in the hardwood-cypress wetlands prescription (Standard 4.2.1.11) but they are not prohibited in the Upland Hardwoods Management prescription. One of the primary species favored in the Upland Hardwood prescription is wild turkey and it requires not only hardmast producing forests but permanent grass-forb openings especially during brood-rearing periods.

COMMENT: To classify an oak-beech-hickory as mature at 40 years seems too young (as indicated under first objective). Since white oak can live to be 600 years old, age 40 is not ecologically mature under any management regime. Define mature with an age greater than 40 years.

RESPONSE: We agree. In the Plan, mature forests on the CNF dominated by oak, beech, and hickory are considered to be greater than 60 years in age (Objective 2.1.7.1).

COMMENT: The second objective is vague. What percent of maximum potential is represented by the 2000 acres of loblolly pine that are to be restored to hardwood – and what is the rational for deciding on this treatment acreage.

RESPONSE: Based on Cecil Frost's (1996) map of presettlement vegetation and the ecological classification (Appendix A), there are approximately 2,000 acres of potential hardwood and hardwood-pine ecological types (LTPs 306, 307, 408, 409, 510) that are currently classified by the USFS continuous inventory of stand conditions database (CISC) as loblolly pine forests. Forests classified in CISC as loblolly pine have at least 70% of the overstory dominated by loblolly pine. About one-half of these forests (1,000 acres), occur in the Upland Hardwood management prescription. The other approximately 1,000 acres are embedded in the RCW HMA, hardwood-cypress wetlands, and river corridors eligible for wild and scenic river status management prescriptions. The rationale for deciding to restore some landscapes to presettlement conditions is described in Chapter 1 and 2 and is listed as a goal under Issue 2 "Restore and Protect SIAs (Natural Areas)".

COMMENT: The Plan proposes fire prescriptions in hardwood stands, specifically in MA 6 with an objective to burn 500 acres of hard mast-producing hardwoods. With the intensity of burns

normally conducted on the Croatan, mast production and tree survival would be severely impacted following the burns, unless implemented with different methods than used currently.

RESPONSE: Prescribed burning in the Upland Hardwoods management prescription is limited to the dormant season and would occur only in stands where the majority of hardmast producing trees, including regeneration, are at least 4-6 inches average diameter (Standard 4.5.1.3). In addition, prescribed fire is restricted in the riverine swamp communities in the hardwood-cypress wetlands management prescription. These precautions will reduce the risk of prescribed fire damage to hardmast producing trees. The discussion of Management Areas (Chapter 4.0 in 1999 draft) is abbreviated and is included in Appendix A of the Final CNF Plan. Because of this, the objective to burn 500 acres of forest types dominated by hardwoods is not included.

COMMENT: In the reference condition description of hardwood restoration, swamp white oak must actually be swamp chestnut oak, and the black-throated green warbler would not occur in the upland hardwood habitat described here. Some of the birds listed are not likely to increase as a result of the proposed restoration. Additional birds that would increase eventually are the yellow-billed cuckoo, Acadian flycatcher, blue-gray gnatcatcher, wood thrush, red-eyed vireo, northern parula, ovenbird and hooded warbler.

RESPONSE: Swamp white oak has been changed to swamp chestnut oak and yellow-billed cuckoo, red-eyed vireo, and northern parula have been added to the description of birds found in these habitats. Flycatchers, blue-gray gnatcatcher, wood thrush, ovenbird, and hooded warbler were already included in this description.

COMMENT: Some of these areas would naturally have some pines within them and these should be retained during restoration. A greater diversity of nesting birds often occurs in areas with a few pines rather than pure hardwood. Restoring natural stand composition, rather than removing all pines, should be the objective of hardwood restoration.

RESPONSE: The intent is to restore natural stand composition in the upland hardwood management prescription areas that are currently dominated by pines. This composition would include a component of pine as stated in the 2nd paragraph of the reference condition (Chapter 3.8).

KEY INTEREST: Fox squirrels

COMMENT: Species assumptions directing some management actions may not be based on reliable information. While ambitious, the plan also needs to be realistic, for instance, one plan objective in MA3 is to increase the suitable habitat for southern fox squirrel by 25 percent over the next 10 years. This is not seen as a realistic goal if suitable habitat is classed as seed producing age longleaf pine with an open understory.

COMMENT: Why the emphasis on fox squirrels? Appendix J states that there are viability concerns about it, but there are viability concerns about a lot of species. Some rationale should be provided to explain the emphasis. Does the objective of increasing fox squirrel populations by 25% require more work than that identified for increasing pine savanna?

RESPONSE: The objective to increase suitable habitat for southern fox squirrel has been eliminated. The southern fox squirrel was originally chosen as a species representing mature longleaf habitat, hard mast, and live den trees because its population can be monitored through the use of nest boxes. However, the species was not found in the 30 boxes erected on the Croatan. For this reason in combination with the knowledge that habitat is available to support the species, fox squirrel will be removed from the MIS list. Its presence in a particular area would demonstrate that forest management is providing suitable habitat for other species requiring similar habitat, such as the Bachman's sparrow, bluebirds, great-crested flycatchers, various reptiles, red-cockaded woodpeckers, etc. With implementation of growing-season prescribed burning in longleaf habitat types, suitable habitat for this species will be increased.

KEY INTEREST: Standards for the retention and distribution of snags and hardwood, including effect of issuing firewood permits.

COMMENT: Retaining only 36-inch dbh and larger hollow trees will waste smaller trees that are useful to many small species of wildlife. Change the standard to 16 inches dbh and larger (as provided for in at least one management area) and dropping the requirement for den trees – as they would be covered by the hollow tree standard.

COMMENT: Retention of 2 snags per acre should be regarded as a bare minimum. The standard guideline should read "Retain all snags 12 inches dbh and larger and at least 10 feet tall as safety permits. If the situation is such that a choice must be made among 2 or more snags the largest is highest priority. If during timber sale layout it is obvious that the number of suitable snags that can be saved is less than 2 per acre, designate live decadent trees to be left in lieu of snags sufficient to at least meet the 2 per acre standard."

RESPONSE: Although the den, snag, and hollow tree/hardwood standards apply forest-wide, there is only a concern about retaining these components where active vegetation management has the potential to reduce their abundance. The amount of clearcutting proposed in the Plan has been reduced from 2,500 acres to 500 to 750 during a ten-year period and therefore decreases this concern even further. The most active vegetation management is proposed in the RCW HMA. In this area, standards in the RCW EIS will apply. These standards include the direction to "retain all snags". To ensure that snags, den trees, and large hardwoods will be retained in areas that have experienced extensive hurricane damage, standard 4.4.1.4 limits salvage to only trees that are down.

COMMENT: The proposal to limit retention of hardmast producing hardwoods to 10% of regeneration units should be changed to leaving them in all areas where available, but limiting the number retained, e.g., three per acre of available species that are most valuable for hardmast.

RESPONSE: The preferred method for retaining hardmast-producing trees in regeneration units is to leave clumps of trees instead of individual trees. Trees left in clumps are better able to withstand high winds than single individuals left in openings. Ultimately, the number of hardmast-producing trees that will be retained is dependent upon their availability.

COMMENT: The Plan lacks discussion of firewood management on the Croatan National Forest. Is there no demand for firewood from CNF lands? If there is a demand, it should be quantified. What mitigative measures does the CNF use to protect den trees, snags, and large fallen trees for wildlife?

RESPONSE: The CNF has not recently issued permits for firewood cutting. However, if there is a demand in the future, permits may be issued and they must follow all Plan standards. A forest-wide standard has been added (Standard 4.2.1.18) that prohibits the cutting of snags for firewood.

D. Hydrological Function and Aquatic Systems

KEY INTEREST: Ecological value of lakes and ponds

COMMENT: Excessive emphasis is given to the value of recreational fishing in the background discussion in the section for hydrologic function and aquatic systems goals and objectives. Specifically, Great Lake and Catfish Lake are discussed as having "very limited potential as sport fisheries." Emphasize the other values of lakes and ponds by adding the following statement, "While lakes and small ponds have limited value for recreational fishing, they may contain rare species and, due to their limited distribution and variability across the landscape, can be considered rare natural community types."

RESPONSE: Additional information was added to the background of the section "Restore Hydrologic Function and Sustain Aquatic Systems" to emphasize a broader range of values of lakes and ponds. The language suggested in comment was used.

COMMENT: The standards for Water/Hydrology/Soils under the Lakes prescription should indicate that the natural hydrology of the lake should not be altered by pumping, dams, etc. except when unavoidable in an emergency. The natural chemistry of the lake should be altered by liming or other methods.

RESPONSE: A standard (4.1.1.5) was added to the Soil, Water and Air management prescription standards for pocosin lakes and natural areas to "Prohibit all direct and indirect alteration of natural hydrology."

KEY INTEREST: Maritime forests and improved watersheds

COMMENT: The maritime forest at Cedar Point that lost many loblolly pines after hurricanes should be left to develop naturally with the dominant live oaks and maritime forest species. To restore the natural hydrology improves watersheds into estuaries and as a source for drinking water.

RESPONSE: Only hazardous trees have been removed in this area. The maritime forest at Cedar Point that was damaged by hurricanes is currently developing naturally. The terrestrial

classification and the NC Natural Heritage Program site descriptions will be used as a guide to identify suitable sites for restoration of native plant communities (Standard 4.2.0.1).

A.2. RECREATION OPPORTUNITIES

A. Increase Recreation Opportunities

KEY INTEREST: Expansion of recreation facilities.

COMMENT: Additional good wildlife viewing opportunities are located at the lower Newport River at Oyster Point and Catfish Lake. By adding piers, waterfowl improvements, and making it easier for canoeing, these areas would greatly enhance wildlife viewing.

COMMENT: The area located off of the Newport-White Oak Road was a gift given to the Forest Service, and has excellent potential for recreation. This area needs to be included in the LMP.

RESPONSE: The Plan identifies a need for increased recreation opportunities, and sets objectives for accomplishing this increase (Objectives 2.2.1.2, 2.2.1.3, and 2.2.2.4). The Plan identifies Catfish Lake and other water based areas as sites for adding wildlife viewing opportunities (Objectives 2.2.2.1 and 2.2.2.2). The developed areas management prescription includes several subsections that discuss recreation in certain environments, specifically water based recreation (Sections 3.1.0.1, 3.1.0.2, 3.1.0.3 and 3.1.0.4). Future recreation improvements or facilities for these recommended areas would be considered through Plan implementation and project-level analysis.

COMMENT: When new recreation facilities/sites are proposed, consideration should be given to the value of the recreational activity in comparison to the resources that may be impacted. High quality resources, such as limesink ponds or longleaf pine ecosystems, are irreplaceable, but recreational activities can be located in a variety of areas.

COMMENT: More specifics are needed for the development of other trails, as suggested in the Plan, as well as what is proposed for the north shore of Catfish Lake. The Long Point-Haywood Landing area would be an excellent site for a new trail that would serve residents in the western forest areas well.

COMMENT: Is there a large enough land base at Cedar Point to increase visitor facilities without impacting the maritime forest there?

RESPONSE: Trail and recreation facility location and design specifics are completed at the project level. Environmental analysis will be conducted to ensure that unique and protected resources are considered when designing facilities, and that the balance between site locations and potential resource impacts are taken into consideration. Project level design and analysis also facilitates dialogue with the community and users groups, and time for on-the-ground reconnaissance. Decisions made at the project level are more flexible over time, and can be more responsive to changes in conditions or user needs.

COMMENT: The proposed expansion of Brice Creek parking area to accommodate 150 people as described in objectives for MA 1 is well beyond the capacity of the area and would change the quality of the recreational experience. It would also contribute to environmental degradation and be outside the intent of a Wild and Scenic designation.

COMMENT: We would like to review plans for all proposed recreational improvements including the parking lot at Brice Creek, visitor facility improvement plans at Cedar Point, and location of 1-3 fishing ponds.

RESPONSE: All proposed projects would remain within the guidelines and Recreation Opportunity Spectrum designation for the area, including the capacity limits. The parameters for river corridors eligible for Wild and Scenic River designation, which is Recreational at this point on Brice Creek, would allow for more development than is already currently in place. We will coordinate with the public, other resource management groups, and agencies as trail and other recreation projects and proposals are evaluated.

COMMENT: Recreation can be improved with more hiking trails and primitive campsites for people to experience the wilderness. Designating several old roads for OHVs, horses, and bikes may lessen impacts on sensitive areas.

RESPONSE: The following objectives are included to further consider this type of recreation expansion.
Objective 2.2.1.4: Over the next 3 years, sign and mark trail systems utilizing input from user groups. Trails may be shared among several activity-user groups, and other trails will be designated for a single activity use. Develop a horse system of 10 - 20 miles using existing roads and new trail construction. Develop a mountain bike system of 20 - 40 miles using existing roads and trails. Develop with partners a scenic byway and historic driving tour on the forest.
Objective 2.3.1.2. In cooperation with user groups, construct hiking and horse trails in some portions of established wildernesses where practical and wilderness values can be sustained.

KEY INTEREST: Limitations on recreation development, use, and water based recreation activities.

COMMENT: Imposing a motor horsepower restriction at Great Lake appears contradictory to the theme of increased recreational opportunity, especially since the character of the lake and launch facilities already limits boat size and engine horsepower.

RESPONSE: Most of the national forest land surrounding Great Lake is designated Wilderness, an area offering primitive experiences, solitude, and non-motorized use. Lowering the allowable horsepower for motors on the lake moves closer to consistency with the Wilderness management.

COMMENT: Water recreational activities in the CNF should be limited to “swimming, canoeing, fishing, and camping along rivers” (p S-2) as opposed to inclusion of motorized vehicles such as powerboats and jet skis.

RESPONSE: Motorized watercraft is allowed on national forest land, although informal documentation shows very little use by jet skis on the Croatan. Sites allowing motorized watercraft are determined by the ROS class and other congressional designations that may put limitations on use. For instance, river corridors eligible for Wild and Scenic River status determined to be Wild, and Wilderness do not permit motorized craft.

COMMENT: The surfacing of access points, dispersed recreation sites, or pedestrian access in recreational areas should only occur if the area is heavily used or if erosion appears to be a problem. Only access points on National Forest should be surfaced, and only materials that do not create an impermeable ground surface should be used.

RESPONSE: Surfacing would only occur on National Forest land and where a need exists to control erosion. The Forestwide standard 4.1.0.4 requires that "New ground disturbing projects must be designed, implemented, and maintained to prevent visible sediment from entering perennial and intermittent stream channels in accordance with the same performance standards established for silviculture by the NC Forest Practice Guidelines Related to Water Quality (NC 1989). Existing sites, including dispersed and developed recreation, must be maintained to the same performance standards, through restoration and/or rehabilitation."

COMMENT: Change the third recreation standard under the Water-based recreation prescription to read, "Interpret sites through signing and limited development, while protecting the natural resources, which may be associated with the site."

RESPONSE: The goals and objectives for Local Communities (2.7.3 and 2.7.3.3) now include Heritage Resources, including the interpretation of sites. There is no longer a standard for this action.

COMMENT: In areas with moderate or heavy recreation use, or moderate to high intensity use, a restrictive permit system, and consistent law enforcement may control excessive and improper use of the resources.

RESPONSE: Effective user information and education efforts are the first priorities in controlling impacts from improper use. A consistent law enforcement presence generally reinforces these efforts. Restrictive permit systems are expensive and difficult to administer and are a last resort in controlling impacts.

COMMENT: The Forest Service must fully consider the likely continued growth in recreational use on the forests. Credible growth estimates must be established and these estimates must be keyed to the assessment of potential impacts of various management strategies.

RESPONSE: Growth estimates used in the DLRMP were determined through site specific use data from the Forest, informal observations of use by FS employees, use information from local tourism and chambers of commerce, and trend data from SCORP (Statewide Comprehensive Outdoor Recreation Projections) and FS social researchers from the Southern Research Station.

KEY INTEREST: Recreation management within Natural Areas.

COMMENT: Recreation activities within natural areas should be confined to passive activities, such as hiking, bird watching, and appreciation of natural areas. Dispersed camping should be allowed within natural areas, but only with careful monitoring for impacts and rapid closure of the natural area if impacts begin to occur. We agree with the camping prohibition within 100 feet of limesink ponds in the Patsy Pond complex and Nine Foot Road/Roberts Road Natural Area. Any active management proposed to support passive recreation should be reviewed and approved by the North Carolina Natural Heritage Program.

RESPONSE: Recreation activities proposed for natural areas would meet criteria that conform to the appropriate recreation opportunity spectrum, landscape character theme, and scenic integrity objectives for natural areas. Proposals would not impact the values for which the natural area was established, but would provide some opportunity for the public to experience and appreciate those values. Project proposals would undergo an environmental analysis process, including solicitation of comments from State and Federal agencies, as well as the public.

KEY INTEREST: Management of the existing and proposed OHV trail system

COMMENT: Designating illegally used OHV routes as part of an overall legitimate OHV trail system will encourage users to create new illegal routes as a means to expand beyond the trail system that is designated. All unauthorized roads need to be eliminated and new ones not developed for OHV use.

COMMENT: Eliminate illegal OHV access to natural areas and old growth patches by signage, gating and strict enforcement.

COMMENT: Monitoring of OHV use in unauthorized areas must be part of a vigorous enforcement approach. Lack of law enforcement should not be used as an excuse for improper OHV use.

COMMENT: We have strong concerns about locating an OHV area between Pringle Road Bay Rims and None Foot Road-Broad Creek Pine Woods, and encouraging OHV use of Pringle Road, which transects a natural area. From the GIS layers, it appears that the OHV area may actually overlap one of the natural areas. If possible, keep designated OHV areas to locations more peripheral to this natural area cluster.

COMMENT: OHV use should be limited to 8-10 miles of trail and shifted to areas of less sensitive plant and animal species.

COMMENT: OHV use can cause existing roads and trails to degrade. OHV use often leads to the creation of illegal, and destructive trails and roads.

COMMENT: A comprehensive strategy to implement and enforce the new OHV trail system should be instituted. This would include an effective educational and interpretive program to convey the new policies; an incentive program to reduce or mitigate impacts; and the

development of user groups or clubs to assist with the dissemination of information, trail maintenance, and to provide self-policing.

COMMENT: Management should be based on the evaluation of past OHV caused impacts, effective and ineffective mitigations, monitoring species and ecosystems, and collecting baseline inventory data on species and ecosystems. Results of the evaluation should be used to adjust management practices. Until the evaluation results are analyzed, no management decisions should be made that would negatively impact species and ecosystems.

COMMENT: Standards, based on the best available scientific information, should be incorporated into OHV use areas. The following are standards to be included – seasonal use based on precipitation and forest conditions; site-specific closure criteria such as for wildlife's sensitive life cycle periods; prohibitions on use based on physical and ecological conditions such as steep slopes or proximity to riparian areas; enforceable speed limits; restrictions on party size and length of stay; anti-harassment of wildlife; controlled amount of use in an area; no night use; no weapons; and restriction of use to designated trails and roads.

RESPONSE: In response to the public comments received on the proposed Croatan Plan, the final version of the Plan outlines a modified approach to OHV recreational use of the Croatan National Forest. OHV use will be focused in one area, adjacent to and east of, the Black Swamp Road. The Forest Supervisor will close all other National Forest land on the Croatan to OHVs via a signed closure order.

The Black Swamp Road area is currently being used by OHVs. This area also provides access for fire protection, and for other forest users, especially hunters. A user fee system would be established to assist with maintenance of the trail system. Ideally, a user group would form and assist with the required maintenance and will help educate other users. Currently the Black Swamp Road OHV area consists of approximately 8 miles of loop routes. Other routes (approximately ten miles) are short but help disperse travelers and hunters.

Objective 2.2.1.5 and Management Prescription 3.11 OHV System Management describe the intent of the designated area and design. The objective states, "Continue OHV use in the designated Black Swamp OHV area. Work with user groups, such as hunters and OHV-riders, to monitor and evaluate the Black Swamp Area for opportunities to enhance or improve existing routes, re-designate routes, expand routes, close routes, or a combination of these actions."

The ideal OHV system would consist of challenging routes that are maintained to a level that prevents resource damage. This combination is difficult to attain since a challenging and enjoyable ride often requires conditions such as wet, steep, or difficult terrain that may be considered less than ideal for preventing resource damage. The system would consist of loop travel ways, with a designated parking area, and specific ingress and egress points. Access for hunting would continue to be provided, considering the extensive historical use in this area. Because of the way in which the existing routes are arranged, between a well-traveled road (Black Swamp Road) and the pocosin, expansion of the system through unauthorized means would not be possible.

The design criteria for an OHV system would be based on providing an enjoyable user experience while providing for the long-term sustainability of natural resources and the OHV routes. Impacts on all resources such as vegetation, wildlife, water, soils, scenery, and other forest users and adjacent lands must be mitigated to an acceptable level.

Monitoring of the designated area and routes will be conducted as part of the forest plan monitoring program. Chapter 5.0 of the Plan outlines the approach to monitoring. Monitoring question 3b will help to gauge the effectiveness of the approach.

COMMENT: Developing an OHV trail system should also consider where best to place non-motorized recreational use. The following are some considerations for deciding where non-motorized use, and thus not OHV traffic, should be established – areas with habitat sensitivities; buffer zones around wilderness, proposed or recommended wilderness, Class I air quality areas on and off Forest; areas of high non-motorized use value; and all biologically and ecologically important areas.

RESPONSE: Part of the planning process included where to concentrate certain motorized use on the National Forest. In conjunction with analysis of motorized use, non-motorized use was also analyzed. Objectives relating to non-motorized use include 2.2.1.4, 2.2.2.1, 2.2.2.2, and 2.3.1.2. The parameters of the Recreation Opportunity Spectrum (ROS) help to define the desired conditions for non-motorized use. In some areas of the Forest, such as Wilderness, semi-primitive areas, or other sensitive areas, solitude and remoteness will be emphasized. Other areas may offer more opportunities for a variety of non-motorized uses consistent with the capabilities of the land.

B. Hunting, Fishing, and Wildlife-Related Recreation Opportunities

KEY INTEREST: Fishing on the Croatan National Forest.

COMMENT: Fishing ponds are not necessary on the Croatan with all the existing water within and outside the National Forest boundary. If ponds are established, they should be built outside natural areas, in previously disturbed sites, and with the assistance of the NC Wildlife Resources Commission and Natural Heritage Program.

RESPONSE: Proposed new ponds are a result of internal evaluations that determined alkaline pond fishing settings were in short supply. Use would be by families, groups for special events, and anglers who find it difficult to fish the creeks and rivers. Specific locations and number of ponds to be constructed will be decided at the project level with public and agency input sought.

COMMENT: A standard should be added to the Lakes prescription requiring that native fauna be maintained and non-indigenous species should not be introduced.

RESPONSE: Language is added to the Plan to emphasize the importance of native fauna in the aquatic systems of the Croatan National Forest (Sections 2.1.8, Table 2.1, and Objective 2.2.2.4). Native fish species are preferred over non-indigenous species when manipulating fish populations. However, sometimes non-native fish species are used to assist native populations

with recovery (For example, using grass carp to control aquatic weeds, which results in better habitat for native species.).

KEY INTEREST: Accommodations for disabled hunters.

COMMENT: Consider more and/or different accommodations for disabled hunters than are currently proposed in the Plan. For example, make all hunter use bridges accessible to the disabled; and use funds earmarked for disabled hunter turkey blinds elsewhere since there is a low probability of a turkey wandering by a permanent stand.

RESPONSE: As facilities are constructed, decisions on which facilities/sites will be accessible are based partially on site conditions and the ability to integrate the bridge or platform into the setting. On projects where accessibility is possible and desirable, we strive to meet the Americans with Disability Act standards and guidelines in the design and construction of new facilities and the updating of older facilities. This is done to ensure that the full range of recreational opportunities and experiences are provided for people with disabilities. Efforts to increase accessibility will be prioritized to provide for the widest array of accessibility feasible that serves as many persons with disabilities as possible.

KEY INTEREST: Small game management

COMMENT: The Plan doesn't mention management of quail, rabbit, or other small game. The Croatan has a tremendous amount of hunting pressure put on small game. There should be an aggressive program in cooperation with the North Carolina Wildlife Resources Commission and the Forest Service to provide suitable habitat for these animals.

RESPONSE: The NC Wildlife Resources Commission manages small game populations. The Forest Service manages the habitat. The agencies currently cooperate and consult on hunting and habitat issues primarily at the project level. This cooperation and consultation will continue.

A.3 SPECIAL LAND ALLOCATIONS

A. Wilderness

KEY INTEREST: Additional Wilderness designation

COMMENT: The FS should definitely add the areas proposed in the LRMP (Catfish Lake South Additions A&B (405 acres), Pocosin Addition (286 acres). However, the 691 acres proposed for designation are out of a possible 20,000, which completely fails to provide for increased wilderness protection which is required if endangered species are to recover. The Forest Service should recommend wilderness designation for all inventoried roadless areas, including the Catfish Lake North roadless area (11,294 acres), the Sheep Ridge Addition (5,806), and Pond Pine Addition B (2,980 acres). Each of the areas has partial boundaries to existing wildernesses, and thus would prevent future fragmentation of natural areas on the forest.

COMMENT: We request no additional wilderness be designated because more restriction to National Forest would impact military operations in the area. Specifically, the use of Marine Railroad potentially conflicts with the proposed addition to the Pond Pine Wilderness.

RESPONSE: The preferred alternative in the final EIS, Alternative E, proposes to add 691 acres to the 31,221 acres of Wilderness currently designated on the Croatan National Forest. The additional acreage is to adjust boundaries, which would make management more concise. Wilderness designation currently covers almost 20% of the total Croatan National Forest, and this addition would slightly increase that amount.

The Pond Pine Addition would not be desirable as Wilderness since the values for which wilderness is designated is compromised due to the close proximity of the Camp Lejeune Railroad and military training flights. Additionally, all of the designated Wildernesses on the Croatan National Forest are pocosin ecological landtypes. Designating additional pocosin as Wilderness does not further protection of this type ecosystem. This is especially true since this area and others eligible for designation are classified as roadless areas, and will continue to be managed for roadless values – natural, remote and difficult to access. These areas are also within the Black Bear Habitat Management Prescription and will be managed as semi-primitive.

Endangered species recovery on the Croatan National Forest is more dependent on the longleaf pine-wiregrass ecosystem and less on large blocks of pocosin habitat. The federally listed RCW is unlikely to occur in the pocosin Wilderness on the Croatan and no clusters are currently known to occur in the Wilderness. Rough-leaved Loosestrife occurs in the ecotones between pocosin and upland habitat (savanna and flatwoods). Designating additional pocosin Wilderness would not dramatically contribute to the recovery of the either of these species.

KEY INTEREST: Management of Wilderness Areas

COMMENT: The artificial structures to be allowed for enhancement of threatened and endangered species habitat within wilderness areas should be restricted to those that are required for some natural feature that is either in short supply, or no longer available.

RESPONSE: This standard was not carried forward into the final version of the Plan. Any artificial structures that may be used within wilderness areas will be, as stated in comment, required for some natural feature that is either in short supply, or no longer available. When establishing these artificial structures, all wilderness guidelines must be followed unless otherwise indicated. Since wilderness guidelines are documented in Forest Service regulations and direction, and will be met if any artificial structures are established within wilderness, a standard is not needed.

COMMENT: Any barriers used to restrict motorized access along Great Lake should avoid impacts to rare species, rare natural communities, and high quality natural communities.

RESPONSE: Prior to implementation, projects are analyzed for potential impacts to these types of resources. Any barriers erected would also be analyzed for potential impacts, and mitigated.

COMMENT: Establishing trails through the wilderness for hikers, mountain bikers, and horseback riders seems inappropriate, and may create access for motorized vehicle use of the trails, specifically OHVs, and cause exotic plant infestation and spread.

RESPONSE: Horse trails are proposed in the Plan. Determination of the number and location and further effects will be through a project level NEPA process, which will include public review and comment.

COMMENT: Mechanical and motorized vehicles in the wildernesses must be prohibited.

RESPONSE: No mechanical or motorized use, including mountain bikes, is permitted in designated Wilderness Areas, with the several exceptions as outlined in Forest Service Manual 2326.1, such as a use established before the area was designated as wilderness, e.g. military overflights. Exceptions may also occur under certain emergency situations such as wildfire.

KEY INTEREST: Role of fire in Wilderness

COMMENT: Prescribed fire should be allowed in wildernesses for maintaining fire-dependent natural communities, in addition to fuel reduction, and threatened and endangered species habitat enhancement. According to FSM 2324.2, human ignited fires are specifically allowed as long as such fires are first approved pursuant to documented, preplanned, specified conditions. The manual specifies fire management objectives in wilderness are either to permit lightening caused fires to play its natural ecological role within wilderness, or to reduce to an acceptable level the risk of wildfire within or escaping wilderness.

COMMENT: A let-it-burn policy is the only appropriate alternative to wilderness fires.

COMMENT: When prescribed burning in wilderness, the least invasive firing and control methods should be used. This would involve aerial ignition and possibly aerial control, or using plowed lines outside of the wilderness boundary.

RESPONSE: The Plan acknowledges in Section 2.3.1 the role fire plays in the Croatan National Forest wilderness. Due to years of fire suppression and fuel accumulation, portions of the wilderness are losing the ability to function as diverse, fire-dependent ecosystems. To sustain these ecosystems, fire must be reintroduced as a management tool. As part of the reintroduction, some areas of wilderness that are close to developed/urban areas, may undergo pre-fire treatments to create a defensible space between private and public lands (Goal 2.5.1 and Objective 2.5.1.2). The Plan establishes goals and objectives to accomplish the reintroduction of fire into the wilderness (Goal 2.5.2a-c, Objectives 2.5.1.3 and 2.5.2.3).

Due to years of no fire in the wilderness, large fuel accumulations increase the level of risk out of acceptable range for letting fire in the wilderness burn on its own. Control of wildfire in the wilderness is necessary until some point in the future when the system is under a regular burn regime and fuel loads are decreased. Forestwide standards are established for use of firelines (Standards 4.5.0.11 – 4.5.0.15). More specifically, Forestwide standards are established for wilderness and other sensitive areas (Standard 4.5.0.16) as well. Firing techniques for burning in

the wilderness will be determined based on objectives for the burn. The technique that will more than likely be used to burn the wilderness is a helicopter and aerial ignition devices that are consumed by the fire which they ignite.

KEY INTEREST: Coincidence of Wilderness and Natural Areas

COMMENT: New areas proposed for wilderness designation should also be identified as natural areas and added to the registry concurrent with finalization of the Plan.

RESPONSE: Since all previous designated wilderness areas are registered and identified as Natural Areas, if additional wilderness is designated, it too will be identified and registered.

COMMENT: Since Wilderness Areas are registered and identified as Natural Areas, the water standard under the Wilderness prescription that specifies leaving canals in their existing condition conflicts with the water standard under the Natural Areas embedded prescription that states water flow should be stopped in existing canals and ditches except where necessary along forest roads. One says to leave canals and ditches as they are, and the other says to plug them.

RESPONSE: Since mechanical equipment is prohibited in wilderness (with some exceptions related to fire), blocking ditches and canals is not possible. The intent of the Plan is to restore the hydrology of the wilderness areas by blocking ditches and canals outside of the wilderness boundaries, and letting the water build back up into the wilderness. The standard (4.1.1.2) is eliminated and Wilderness is included in standard 4.1.1.1 with additional wording added to that standard. Standard 4.1.1.1 now reads, "Stop water flow in existing canals and ditches if it will restore natural hydrology. Retrofit with water control structures. Maintain ditches and canals where necessary for forest roads. Where canals and ditches occur in Wilderness, stop water flow outside of the Wilderness in such a way as to restore natural hydrology within the Wilderness area.

Additionally, when wilderness and SIA (natural area) prescription standards overlap each other, the wilderness standard takes precedence because it is the more restrictive of the two prescriptions (this is now explained in the Plan in the introduction to Chapter 3.0).

B. River Corridors Eligible for Wild and Scenic River Status

KEY INTEREST: Designation of rivers as Wild, Scenic, and Recreational

COMMENT: The designation of the White Oak River and Brice Creek as Wild and Scenic Rivers must be a high priority for the Forest Service.

RESPONSE: The designation of Brice Creek and the White Oak River as Recreational, Wild and Scenic Rivers is a high priority for the Forest Service. However, during analysis, the amount of private land ownership along both water bodies influenced the decision to coordinate jointly with the state of North Carolina to further analyze the suitability of the water bodies for designation. The Forest Service will recommend to the State of North Carolina that both the White Oak River

and Brice Creek undergo further evaluation to determine suitability for Congressional designation as a Wild and Scenic River (Objective 2.3.2.2). The Forest Service will manage the National Forest along the corridors to preserve and enhance the outstandingly remarkable values that make the White Oak and Brick Creek eligible for designation (Objective 2.3.2.1).

COMMENT: Please explain the basis for designating portions of the river or creek recreational, wild or scenic.

RESPONSE: Management standards or requirements have been developed for each of the three classifications of river corridors eligible for Wild and Scenic River status. The appropriate classification depends on the level of use in the river corridor at the time of designation. A river may be classed under one category or separate segments of the river may be classified under different categories. Wild rivers are free of impoundments and generally inaccessible except by trail, with watershed or shorelines essentially primitive and waters unpolluted. Scenic rivers are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by road. Recreational rivers are readily accessible by road or railroad, may have some development along their shorelines and may have undergone some impoundment or diversion in the past.

COMMENT: Holston Creek should be included in the Wild and Scenic River designation for the White Oak, since a portion of the tributary to its south is included.

RESPONSE: The study corridor for Wild and Scenic Rivers is ¼ mile on either side of the river measured from ordinary high water mark. That would allow for a portion of tributaries running into the study river to be included, which is the case for Holston Creek as well as the tributary to the south. This does not extend wild and scenic designation to the entire length of either Holston Creek or the tributary to the south. The evaluation for eligibility was looking at values of the White Oak, not the tributaries.

KEY INTEREST: Management of rivers for Wild, Scenic, and Recreational Attributes

COMMENT: A conflict exists between the probable management practice of removing logs or structures that impede free-flowing streams, and the standard under Water/Hydrology/Soils that states only remove log jams and debris enough to provide minimum passage by small boats. To maintain free-flowing conditions more than a minimum amount of debris will need to be removed. Since woody debris is an essential component of habitat structure for aquatic organisms, removal of woody debris should be minimized.

RESPONSE: While this does seem contradictory, the Wild and Scenic River Act, Section 16(b) defines free-flowing as "existing or flowing in a natural condition without impoundment, diversion, straightening, rip-rapping, or other modification of the waterway." Logs or structures that impede free-flowing water would be devices such as beaver dams, or human created devices. To allow a small boat passage would involve removal of some of these impediments, but only enough to restore free-flowing water, and to allow passage for the boat. To clarify the standards, they now read, "Maintain portions of streams and rivers within the National Forest as flowing in a natural condition without impoundment, diversion, straightening, rip-rapping, or other

modification of the waterway (4.1.1.2)," and "Remove enough log or debris jams in the stream channels only to provide minimum passage by small boats in reaching the channel (4.1.1.3)."

COMMENT: If water flow is stopped in existing canals and ditches, as stated in the fourth standard under Water/Hydrology/Soils, including those that run along roadsides, roads may be negatively impacted by the additional water.

RESPONSE: Ditches and canals needed for roadside drainage will not have the water flow stopped. To ensure this, the standard was changed to read, "Stop water flow in existing canals and ditches if it will restore natural hydrology. Retrofit with water control structures. Maintain ditches and canals where necessary for forest roads. Where canals and ditches occur in Wilderness, stop water flow outside of the Wilderness boundary in such a way as to restore natural hydrology within the Wilderness area (4.1.1.1)."

COMMENT: The standard for Fire is written in a way that excludes segments of rivers designated as wild from prescribed burning. This should be changed to support those natural communities that occur along wild segments and which need fire.

RESPONSE: The standard was changed to, "Allow the use of fire in all eligible or designated river segments to maintain or enhance the outstandingly remarkable resource values of the area. (4.5.1.1)."

COMMENT: The standard under Forest Products to "allow tree harvesting in river segments classified as recreational only to maintain or enhance the unique resource values of the area" is confusing. Tree harvesting should only be allowed in recreational segments if access for boats and foot traffic at designated access points is required, or if restoration of a certain forest type is needed.

RESPONSE: To clarify this standard, it was changed to, "Allow tree removal only in river segments classified as recreational to maintain or enhance the outstandingly remarkable resource values of the area or to provide access for recreation use (4.4.1.3).

COMMENT: The standard under Special Uses should indicate that utilities would ideally avoid scenic and recreational river segments, and if avoidance was impossible, efforts should be made to minimize impacts through location, distance and width of crossing, and construction method. Restricting these utilities from wild segments is good.

RESPONSE: This standard was changed to, "Do not permit utilities in river segments classified as wild. Do not allow utilities such as pipelines and powerlines in scenic and recreational river segments unless there is no feasible alternative location. If a utility must be located in a scenic or recreational segment, minimize impacts to the river and corridor (4.7.1.1)."

A.4. SILVICULTURE, FOREST HEALTH, AND FOREST PRODUCTS

A. Restore longleaf and regenerate mixed pines

KEY INTEREST: Consideration of the entire longleaf pine ecosystem and all components.

COMMENT: The Plan does not emphasize restoration of all the important components in the longleaf pine ecosystem, including understory plant composition and open savanna structure. There is more to consider than just overstory longleaf pine trees.

COMMENT: The Plan must utilize the best available information on restoration of the longleaf pine savanna, with particular attention to the essential groundcover component of this system.

RESPONSE: The Plan emphasizes restoration of the important components of the longleaf pine ecosystem including understory plant composition and open savanna structure. The shelterwood with reserve trees method will be favored over clearcutting (Objective 2.4.1.1) to restore longleaf pine to suitable sites and to maintain forest structure. A minimum of six to ten overstory trees will be retained in the shelterwood and longleaf pine will be the species favored for retention. Growing season fire will be used to create open, park like understory conditions (Objective 2.5.2.1). The resulting open savanna structure of the shelterwood will be maintained through periodic prescribed fire (Objective 2.5.1.3). Monitoring the condition of understory shrub, herb and grass layer (specifically wiregrass), along with the midcanopy shrub layer, will help to evaluate understory condition and to guide future management actions (Objective 2.1.1.7).

KEY INTEREST: Longleaf restoration priorities

COMMENT: Longleaf restoration areas should be selected on the basis of location next to old growth or existing natural areas containing sensitive species.

COMMENT: Restoration of longleaf should not take precedence over maintenance of current old (or nearly so) stands of loblolly or pond pine. Restoration should initially focus on elimination of the many young stands of loblolly plantations in the Croatan since the investment in forest time and wildlife values are generally low.

COMMENT: The salvaged area that is at the intersection of the Pringle Road and the Millis Road would make an ideal longleaf stand.

COMMENT: The Plan should provide for the conversion of loblolly to longleaf pine to promote RCW recovery and timber, but not as aggressively as it currently proposes.

COMMENT: We endorse an effort to restore both longleaf pine and hardwood based upon site suitability, especially those that were previously converted to loblolly pine plantation.

COMMENT: Restoration efforts should be based on not only the ecological classification, but also other resource inventory data, and biologist/specialists recommendations.

RESPONSE: The Plan adopts a less aggressive approach to longleaf pine restoration than the 1999 Draft Plan and shifts the emphasis away from clearcutting to the shelterwood with reserve trees method (Objective 2.4.1.1). The ecological classification and the NC Natural Heritage Program site descriptions will be used as a guide to identify suitable sites for longleaf pine restoration (Standard 4.2.0.1). Site-specific analysis of resource inventory data by ecologists, botanists, foresters, and biologists will be used to evaluate stands for restoration.

Nearly one-third of all longleaf pine restoration will occur in "off-site" loblolly plantations where longleaf pine is the more adapted species. Off-site loblolly pine plantations occur at sites such as those at the intersection of Pringle Road and Millis Road. The priority of stands for restoration includes 1) inactive and active RCW forage territories that lack longleaf pine, 2) mature loblolly pine stands, around 80 years old, that have a component of longleaf pine that could be retained using the shelterwood with reserve trees system, 3) off-site loblolly plantations, 4) mature loblolly pine stands, around 80 years old, more suited to mixed pine (longleaf, pond, and loblolly) composition within inactive RCW territories greater than ½ mile from active territories, and 5) in stands where sensitive species would benefit from restoration activities. There are approximately 11,000 acres of old (greater than 60 years in age) stands of loblolly pine and over 30,000 acres of old (greater than 70 years in age) stands of pond pine on the CNF. Only 1,750 to 2,500 acres are planned for restoration to longleaf pine. This will leave a significant amount of current old stands of loblolly pine and pond pine on the CNF.

KEY INTEREST: Techniques for restoring longleaf pine savannas

COMMENT: Rather than removing existing, mature loblolly stands to restore longleaf pine, manage the loblolly to create open, park-like conditions through thinning and prescribed burning. This would favor longleaf pine over loblolly pine, and would provide the opportunity to convert the stands to savanna structure if it became necessary due to major habitat loses elsewhere. The proposed 4000 acres of even-aged harvests in the RCW HMA should be limited to thinning to develop savanna structure.

COMMENT: If longleaf is not the best-adapted species for a site (or where plowing is required for survival of planted longleaf seedlings), prescribed fire should be used to favor conversion to savanna dominated by loblolly or pond pines.

COMMENT: The exceptions to clearcutting under the forestwide standards for Forest Products will swallow the rule forbidding them. The same is true under the standards for Forest Products for the Pine Savanna and Flatwoods prescription. The drive to produce timber volume will force more sales in RCW habitat.

RESPONSE: Only about six percent of the 40,000+ acres of older pine-dominated stands are planned for restoration to longleaf pine (Objective 2.4.1.1). Thinning is emphasized in other pine-dominated stands (Objective 2.4.1.2) to meet forage standards for RCW (Standard 4.4.0.5) and to maintain pine savanna conditions in existing longleaf pine forests (Objective 2.1.1.6). The target residual basal areas vary according to site quality; lower basal area will be retained on sites with growth limiting factors such as droughty conditions, low fertility, or wet (oxygen poor) conditions. Thinning stands to these target basal areas will create more open park-like

conditions in pine-dominated stands. Prescribed fire will be used to favor longleaf pine and other important components in pine savannas and to maintain open stand conditions (Objectives 2.5.2.1, 2.5.2.2, 2.5.2.3). Prescribed fire will also be used to reduce fuel loads to allow lightning-caused fire to function, as much as possible, as a natural process (Objectives 2.5.1b).

The Plan now proposes only 500 to 750 acres of even-aged harvest in the RCW HMA (Objective 2.4.1.1). Clearcutting may be used to restore longleaf pine only where other methods, such as the shelterwood with reserve trees system, has a low probability of successfully creating conditions suitable for longleaf pine regeneration. These areas are limited to poorly drained sites without a current component of longleaf pine (Appendix E). Timber harvest in RCW habitat will only occur if RCW nest and forage habitat standards identified in the RCW EIS and Recovery Plans can be maintained (Standard 4.2.1.1).

COMMENT: The proposed intensive treatments will result in a plantation structure with densely planted longleaf trees in rows. Longleaf should be planted at a density of 250 seedlings/acre to eventually mimic natural densities. Monitoring of mortality should be used to determine what the density of future plantings should be.

COMMENT: When planting longleaf, it should always be by hand with containerized seedlings and planting should start at random points and proceed in a spiral pattern. This would best mimic a natural pattern of distribution.

RESPONSE: Clearcutting is the most intensive treatment for restoring longleaf pine and is proposed on 500 to 750 acres during a 10-year period. The shelterwood with reserve trees method and thinning followed by prescribed burning are less intensive treatments and will be used on approximately 2,150 to 2,850 acres to restore longleaf pine.

When clearcutting is used, the desired condition for longleaf pine seedlings five years after harvest is approximately 300 trees per acre, free of competition, evenly distributed across the area (Objective 2.4.1.1). Containerized longleaf pine seedlings will be used in planting (Appendix E), however, natural seed is favored where existing seed sources are adequate. The density of planted longleaf pine seedlings is well below the levels previously used on the CNF, on Camp Lejeune (which also has an active longleaf pine restoration program), and on private timber land. Following the first or second thinning (age 20 to 40), the plantation structure is expected to be less prominent and forests will approach a structure more like naturally regenerated longleaf pine stands.

COMMENT: Instead of timber sales, use a cut, chip and leave strategy that will leave biomass on site for nutrient cycling.

RESPONSE: Biomass in the form of standing trees, branches, upper tree boles, and needles will be retained on site for nutrient cycling using the shelterwood with reserve trees and uneven aged harvest methods when restoring longleaf pine. Branches, upper tree boles, and needles will be retained on site with the clearcut harvest method. Site-specific analysis will determine the amount of biomass that can be maintained that would not interfere with stand regeneration or create a hazardous buildup of fuels.

COMMENT: If logging is done, it must be done solely by low-impact, cut-to-length operations, and must not be in areas that are supposedly targeted for restoration to the native forest or maintenance of soils. Additionally, routing logging roads through wetlands, especially pocosin/pond pine areas, is unacceptable.

RESPONSE: Low impact logging equipment is currently being used and will continue to be used on the CNF. However, site-specific analysis will determine the type of equipment and the season of logging that would result in the least impact to soils. Refer to Soil Standards 4.1.0.2 and 4.1.0.3.

COMMENT: If clearcutting is used, it should be a mosaic of small acreages and only in areas with low soil erosion potential.

RESPONSE: Regeneration openings are limited to a maximum of 25 acres in size (Standard 4.4.0.3) in the RCW HMA and 40 acres outside the HMA in the Wildland Urban Interface. The size of clearcut openings, however, is limited more by the pattern and size of stands on the CNF. Nearly one-half of the 120 stands that are primary candidates for restoration to longleaf pine (loblolly pine stands greater than 70 years in age that occur on sites that are suited for longleaf pine) are less than 10 acres in size and 80% are less than 25 acres in size. Only about 20% of these stands may require clearcutting to successfully restore longleaf pine (Objective 2.4.1.1). Although site specific analysis will be needed to determine the actual size of a cutting unit, the natural landscape configuration will limit patch size and result in a natural mosaic of small acreages under restoration.

The use of clearcutting to restore longleaf pine is limited to poorly drained soils supporting stands without a sufficient amount of longleaf pine for natural regeneration or stand structure. Poorly drained soils on the CNF have low erosion potential because they are flat and because they have less mineral components the size of sand, i.e. they are loams or clay loams.

COMMENT: The Forest Service needs to use the results from the compaction study on Pine Cliff Road to help make decisions on restoring longleaf pine.

RESPONSE: The compaction study on Pine Cliff Road does not address longleaf pine restoration. The major focus of this study is in identifying site factors and processes influencing productivity in loblolly pine plantation systems and the impact of management on these properties. All sites at the Pine Cliff Road study, including those that have the potential to support longleaf pine, have been planted to loblolly pine. Although this study is important in furthering our understanding of soil-plant processes such as decomposition, mineralization, and water and nutrient delivery and uptake, it has less application for making decisions on restoring longleaf pine.

KEY INTEREST: Uneven- aged management of pine species

COMMENT: The Croatan should use an uneven-age management system with group selection regeneration, or natural regeneration, techniques. This would preclude the need for expensive

treatments other than prescribed burning, and would facilitate low impact harvest and removal methods. The group selection systems as described in the RCW FEIS would be good to use.

COMMENT: Only allow thinning and group selection in pine savannas and flatwoods.

COMMENT: The prescription for mixed pine forests is clearly a prescription for even-aged management strongly oriented towards timber production. The Croatan needs to manage pine forests on an uneven-aged system.

COMMENT: The uneven-aged method described in Appendix E of the Plan would be more advantageous to use than the shelterwood method described. To what extent will each be used when implementing the Plan?

RESPONSE: The Mixed-Pine Management Prescription has been eliminated from the Plan and the areas formerly within this prescription are now included in the RCW HMA Management Prescription. The Plan identifies the following 10-year objectives for regeneration harvests to restore longleaf pine: 500-750 acres using the clearcut method, 1,250-1750 acres using the shelterwood with reserve trees method, and 900-1,100 acres of thinning and prescribed burning to restore "off-site" loblolly plantations to longleaf pine (Objective 2.4.1.1). The latter two methods may result in stand structure that is uneven-aged. The Plan does not prohibit the use of uneven-aged silvicultural systems. Site-specific analysis (Goal 2.4.1.b) will be used to determine which silvicultural system is most appropriate to meet the goal of restoring longleaf pine forests and for increasing the proportion of longleaf pine in mixed pine stands.

COMMENT: When using the shelterwood method, leaving a stand of pine trees at a basal area of 80+ for 70 years is not beneficial for the herbaceous layer. Thinning should occur sooner than the preparatory cut to reduce basal area and sunlight to the herbaceous layer. Additionally, planting under the shelterwood at such high densities as 6000 trees/acre creates such a dense stand that the herbaceous layer is completely shaded out.

RESPONSE: The shelterwood system that is emphasized in the Plan is the shelterwood with reserve trees method (Objective 2.4.1.1). In this shelterwood method, a minimum of 6-10 overstory trees are retained in perpetuity and the desired condition is 150-250 longleaf pine seedlings per acre, free of competition, evenly distributed across the area, 5 years after harvest. Six to ten trees in the canopy do not comprise a basal area of 80 square feet per acre.

KEY INTEREST: The use of bedding as a site preparation technique

COMMENT: While bedding may be appropriate on private silvicultural tracts, it is contrary to the goals embodied in the Croatan Plan. Bedding is inappropriate in the wet savannas and flatwoods landtype. These sites may naturally support a lower density of longleaf pines.

COMMENT: Bedding will result in unsuitable habitat for native understory species such as plants, amphibians and invertebrates, since bedding will alter natural soil conditions. A forestwide standard should be added that prohibits mechanical site preparation.

RESPONSE: The Plan does not prohibit the use of bedding to restore longleaf pine. However, the need for this silvicultural tool has been significantly reduced because the objective for clearcutting has been reduced to 500-750 acres during a 10-year period. In addition, less intensive site preparation, e.g. flat planting, is emphasized and clearcutting would be used only where there is a low probability of successfully regenerating longleaf pine using the shelterwood with reserve trees method (Objective 2.4.1.1). Moreover, site-specific analysis will be used (Goal 2.4.1.b) to determine the regeneration method most appropriate for the site and stand conditions. Also, biological evaluations will be completed to determine effects of bedding on any federally-listed or Regional Forester sensitive species, including plants, amphibians, and insects (Standard 4.2.0.8).

KEY INTEREST: Management of mixed pine forests

COMMENT: I am concerned that the Forest Service includes within the category of Mixed Pine Forest some potentially significant habitats that really should be managed for natural community values. For example, within the areas mapped as "Mixed Pine Forest" (formerly Figure 4.2) there are some high quality flatwoods sites on soil types on which Frost reports there are virtually no remaining examples of natural habitat.

COMMENT: In the reference condition for mixed pine forests, the reference site is said to consist of loblolly and pond pine. However, the caption under the associated photo lists longleaf, loblolly and pond pine. And the same site is described in Frost (1996) as being longleaf and pond pine. This needs to be clarified.

COMMENT: The variation from the reference condition should include descriptions of all areas classified as mixed pine but that are currently dominated by longleaf.

COMMENT: This management prescription seems to be based on silviculturally productive areas, and not with consideration to ecological conditions. The areas mapped as mixed pine forest do not follow the Frost classification, and seem to emphasize loblolly pine over longleaf, pond, and shortleaf pine. The areas are located in a way that regular prescribed burning would be difficult. If the Plan's intent is to establish these areas as suited for intensive forestry management because of the difficulty in burning, it should be stated clearly.

COMMENT: Under water/hydrology/soils standards for mixed pine forests, the restoration of hydrology would be good management. Add also a standard that would avoid any new alteration of the hydrology from management practices such as bedding, ditching, or raised roadbeds.

RESPONSE: The Mixed-Pine Management Prescription has been eliminated from the Plan and areas formerly within this prescription are now included in the RCW HMA Prescription. Standard 4.2.0.1 requires that the ecological classification and the NC Natural Heritage Program site descriptions be used as a guide to identify suitable sites for restoration of native plant communities, such as mixed pine types, within this area. Mixed pine sites identified in the Plan (Chapter 3.6) are intended to include all high quality flatwood sites on soil types identified by Frost (1996). This would include flatwood sites that naturally supported a mixture of longleaf, pond, and loblolly pine as well as those sites found in more rolling, upland topography that may

also support suitable habitat conditions for shortleaf, longleaf, and loblolly pine. The significance of the mixed pine type on the CNF as natural habitats is recognized in the Plan through designation of Holston Creek Forests, Hadnot Creek, and Pettiford Creek as SIAs (natural areas), which include suitable sites for mixed pine forests. The direct and indirect alteration of natural hydrology is prohibited on these sites (Standard 4.1.1.5).

The importance of mixed pine forests on flatwoods sites is also evident by the fact that nearly seven percent or 11,000 acres of the CNF land is classified as the Rains soil type. This soil type currently supports some of the best intact examples of the mixed pine type on the CNF. Although the Plan emphasizes restoration of longleaf pine in this ecosystem, the intent is to manage a mixture of species on these sites that are adapted to local disturbances (Goal 2.4.1a).

KEY INTEREST: Salvage of damaged timber

COMMENT: A more efficient salvage operation needs to be implemented on the Croatan. A tremendous amount of timber was lost due to a slow reaction time by the Forest Service.

COMMENT: The Plan does nothing to constrain salvage harvests of any kind, which could set the stage for unreasonable harvests in combination with normal timber sales. The Plan should require a reduction in the planned timber sale volume during a year following salvage operations – the amount of the reduction being equal to the previous year's salvage logging of storm-damaged timber.

COMMENT: The windthrow hazard is going to continue to increase with the proposed 6000 acres of even-aged harvesting. This will stimulate proposals for more salvage logging of storm-damaged timber.

RESPONSE: The timing and appropriate locations for timber salvage is addressed in Plan standards and management objectives. Salvage is emphasized to remove damaged pine, to reduce risk of bark beetle infestation of healthy trees, to reduce fuel loading, and where appropriate, to restore damaged loblolly pine stands to longleaf pine (Goal 2.4.1.e). An objective is set to annually salvage timber damaged due to bark beetle infestations, wind events, and other major disturbances (Objective 2.4.1.2). The desired condition is to minimize risk of large bark beetle infestation in pines. Clearcutting is allowed for reasons other than restoration of longleaf pine, to rehabilitate land adversely impacted by events such as fires, windthrows, or insect or disease attacks (Standard 4.4.0.6). Trees may be cut on land classed as not suitable as timber production in stands that are substantially damaged by fire, windthrow, insect or disease attack, or other catastrophes (Standard 4.4.0.14). However, standards limit salvage in the Hardwood-Cypress Wetland Management prescription (Standard 4.4.1.4), old growth stands (Standard 4.4.1.5) and in SIAs (natural areas) (Standard 4.2.1.10). The windthrow hazard is not expected to increase on the CNF due to even-aged timber harvest. Clearcutting is likely on only 500-750 acres during a ten-year period.

KEY INTEREST: Mitigation and monitoring restoration efforts

COMMENT: Add a mitigation in the standards under Silviculture, Forest Products, and Forest Health, that would require measures to be added to all timber sales for reducing disturbance and mortality to wildlife species. For example: Restrict timber falling and yarding to the season of the year when neotropical migrants are not nesting.

RESPONSE: A site-specific environmental analysis (EA) will be conducted for all vegetation management projects on the CNF. The risk of disturbance and potential impacts to wildlife species from logging operations will be evaluated during this process. Project proposals (timing and intensity) will be modified if it is determined that mitigation is needed to reduce impacts to wildlife species.

COMMENT: A comprehensive pre-and post-restoration monitoring plan should be implemented to provide data on the effects of various restoration activities. The monitoring should not be limited to tree numbers; rather, other longleaf community indicia should also be monitored.

RESPONSE: Wiregrass will be monitored on the CNF to evaluate management effects on the longleaf pine ecosystem, including areas where restoration activities have occurred (Chapter 5). In addition, the CNF is cooperating with the Southern Research Station at the Research Triangle to monitor amphibians in longleaf pine restoration areas.

KEY INTEREST: Shortleaf pine

COMMENT: More attention should be given to ensuring that shortleaf pine maintains its populations on suitable site in the Croatan, thus increasing biological diversity and the potential for ecological buffering.

RESPONSE: Shortleaf pine is not a common tree on the CNF and its presence adds to the diversity on the Forest. It occurs as scattered individuals in upland longleaf pine stands and on mixed pine-hardwood sites. Site-specific analysis of vegetation management projects is used to evaluate biological diversity issues and determine regeneration needs for native species on the CNF.

KEY INTEREST: Source of tree seed for reforestation

COMMENT: Who is the source of tree seed for growing seedlings used in reforestation? What species are available for use on the CNF? What nurseries produce them? Is there a genetic improvement program and if so for what species? What controls are in place to insure that the proper seed source is used?

RESPONSE: The North Carolina Forest Service is the source of tree seed. Seedlings are purchased from their nursery at Goldsboro. Loblolly, longleaf, and shortleaf pine seedlings are available as are many coastal hardwoods. The CNF started a genetic improvement program in the 80s; progeny tests were established and superior trees were located. This program has been discontinued due to budget cuts. The North Carolina Forest Service controls the collection of

seed and growing of nursery stock and ensures that the CNF receives pine species grown from coastal versus piedmont trees.

B. Sustain pine straw production

KEY INTEREST: Impacts of pine straw raking and the use of fertilizer

COMMENT: Too much is currently unknown about the effects of pine straw raking on fuel and nutrient availability, and the actual mechanical impacts of raking on the herbaceous layer, to allow this practice on 600 acres of National Forest. If the goal of the Croatan is to maintain and restore the longleaf ecosystem, there should be greater understanding of the effects of fertilization and pine straw removal on all components of the ecosystem before these techniques are broadly applied.

RESPONSE: Pine straw raking will be restricted to longleaf pine types that occur on more well drained soils (Standard 4.4.0.7). It is prohibited in SIAs (natural areas), old growth, within ¼ mile of active RCW nest areas, and within 100 feet of rare (threatened, endangered, sensitive, and locally rare) plant species (Standard 4.4.0.12). Based on an analysis of the terrestrial ecological classification maps, CISC data, and records of rare species occurrence, approximately 2,000 acres on the CNF could currently meet these standards. However, as a further precaution to retain ecosystem values in longleaf pine stands, only 600 acres are proposed for pine straw raking. In addition, other standards are included in the Plan to reduce site impacts from pine straw raking operations (Standards 4.4.0.8, 4.4.0.9, 4.4.0.10, and 4.4.0.11).

COMMENT: Pine straw removal should be done in a limited enough manner so that fertilization is not necessary. A change in plant composition due to the use of fertilizer is undesirable. If an area needs fertilizer "once every ten years to maintain long-term site productivity", as the FS appears to believe, then the raking is not being done in a sustainable manner, and should not be allowed.

RESPONSE: Site specific analysis will be conducted to determine if pine straw raking will impact plant composition before any operations are implemented. It is believed that fertilization once every 10 years ensures long-term productivity of a site, but may not be necessary once an on-site evaluation is conducted. The proposal to fertilize a site if needed, is not an indicator that pine straw harvest is not sustainable.

COMMENT: Using fertilizer in pine straw raking operations may impact water quality. The impacts of these chemicals on other species and water quality have not been adequately addressed.

RESPONSE: The risk of fertilizer leaching out of the soil profile and into the water table is less in soils with some clay content and a moderately high cation exchange capacity. Pine straw raking on the CNF is restricted to those soils that have these characteristics (Standard 4.4.0.7). Fertilizer will only be applied if needed based on Soil testing (Objective 2.4.2.1)

KEY INTEREST: Management of pine straw production

COMMENT: Pine straw raking should be prohibited within 1 mile of active or inactive RCW nests, in RCW foraging territories, natural areas, and areas that are or may be occupied by other PETS species. Limit the raking to 50 acres, rather then 600 acres, and implement it on an experimental basis.

RESPONSE: The standards for pine straw raking have been revised. In the Plan, pine straw raking is prohibited in SIAs (natural areas), old growth areas, within ¼ mile of active RCW nest areas, and within 100 feet of rare (threatened, endangered, sensitive, and locally rare) plant species (Standard 4.4.0.12). Pine straw raking was implemented on an experimental basis on the CNF in the early 90s and found to have no significant impact on rare plants.

COMMENT: It is not clear how pine straw harvesting is to be managed – rotating sites, permits for commercial or personal use, signage delineating areas? Individuals/companies that are conducting this activity should pay a fee that fully covers a comprehensive, long-term monitoring program to assess the effects of pine straw removal.

RESPONSE: Although not identified in the Plan, pine straw will be sold on the CNF following similar procedures and laws that are applied to other forest products sold on the CNF such as timber. This would include a sale to the highest bidder, a contract, and sale administrators that would periodically check for contract compliance. A long-term monitoring program could be established from a portion of the sale receipts.

COMMENT: What is the feasibility of a raking operation on the wetter sites and how it is to be integrated with the wildlife habitat goals for the area?

RESPONSE: Pine straw raking will be restricted to longleaf pine types that occur on more well-drained soils (Standard 4.4.0.7). It is prohibited on the wetter pine savannas (LTP 920, 921, and 1023).

A.5. FIRE MANAGEMENT

A. Reduce Wildfire related risks

KEY INTEREST: Wildland Urban Interface (WUI)

COMMENT: The activities proposed in the LRMP that address the wildland urban interface concerns have the full support of the NC Department of Forest Resources (NCDFR).

RESPONSE: The NCDFR is a much-valued partner in the Fire Management Program of the NF's in NC.

COMMENT: Establishing a protective defensible space to benefit private landowners should not be at other taxpayer's expense, and should not detract from other programs that require funding (budget figures show $490,000 allocated to fully implement defensible space – 33% of the total

budget). The private landowner that decides to live adjacent to National Forest should be responsible for creating a sufficient buffer on their property. At least use a cost-share partnership approach to fund the work.

COMMENT: The extent of a ¼ mile wide wildland urban interface defensible space is too much. With the highly fragmented boundary of the Croatan, the growing development along it, and the large amount of forestland, the defensible space could have significant ecological implications. Forestland ecology should not be adversely affected to provide additional prevention benefits to private landowners.

RESPONSE: Congress has directed, through the National Fire Plan (NFP) that all federally owned land shall have Fire Management Plans devised to manage and or mitigate fire occurrence, risk and hazards. The primary determinant of Fire Management Programs on all Federal lands will be to provide for the safety of firefighters and the public. Public may be defined as Forest visitors and Forest neighbors. Specific funding is attached to meeting this goal. Work may be accomplished using cost-share, partnerships, cooperators, or direct funding. Due to the past management emphasis of immediate fire suppression, lands within the NF's currently are not in a condition to allow fire to work in it historic capacity. Private development puts additional constraints on fire use. In a recent economic analysis of fire suppression costs on the Croatan National Forest for the last 10 years, out of a total of 124 fires, 31% involved some amount of both private and federal lands, and 69% involved only federal land. Statistics are not recorded for those fires that start on private land and threaten federal land. The data is not available at this time to determine the percentage of fires spreading from private to federal.

The WUI is designed to reduce the risk of fire spread onto FS as well as from within FS onto adjacent land ownership. The width of the WUI will be no more than ¼ mile wide, and will be determined on a site-specific basis depending on conditions and natural resources. When ever possible the resource needs of the areas will guide mitigations of the treatment types or methods although safety will remain the overriding determinant.

COMMENT: Standards for establishing the WUI defensible space must be clearly stated in the Plan. Standards such as minimum and maximum widths, methods of reducing fuels and which method is preferred, fuel reduction should focus on the midstory and not overstory – especially in Old Growth areas.

RESPONSE: Activity within the Wildland Urban Interface (WUI) zone will be guided by the standards for the adjacent management prescription (Standard 4.5.0.17).

COMMENT: If Old growth and WUI prescriptions overlap, old growth should take precedence since it is more restrictive.

RESPONSE: Only the Southern Wet Pine Forests, Woodlands, and Savanna old growth type could overlap the Wildland Urban Interface (WUI). The designated old growth longleaf pine stands do not overlap the WUI prescription. There is no suitable habitat for Coastal Plain Upland Mesic Hardwoods in the WUI, and the Cypress-Tupelo Swamp Forests, because they are wet and therefore currently act as a firebreak, would not need vegetation treatment in the WUI.

When old growth areas are selected, they will not overlap with the wildland urban interface. Additionally, the direction outlined in the National Fire Plan, direct from Congress, is that firefighter and public safety will be the first priority in all Fire Management Plans. Congress has directed that resource values will be a second priority. At the operational plan level, treatments will be devised to protect previously identified unique resources as much as possible without compromising safety factors.

COMMENT: On the GIS map depicting the WUI, why is there such a broad zone between Masontown and Union Point pocosins? Why is the northwest corner of Catfish Lake/Catfish Lake South Wilderness designated a WUI?

RESPONSE: The map depicting management prescriptions was in error and has been corrected. The Wildland Urban Interface between Masontown and Union Point pocosins is a ¼ mile zone along the CNF boundary with private land. Similarly, the Wildland Urban Interface on the northwest side of Catfish Lake South Wilderness is a ¼ mile zone along the CNF boundary and private land.

COMMENT: In the WUI portion near Havelock, if you attempt restoration of the pond pine savanna habitat (as mapped by Cecil Frost) it would reduce fuel loading while benefiting a natural habitat.

RESPONSE: We agree. Restoration of pond pine savanna to presettlement conditions having a discontinuous shrub layer and reduced ladder fuels could serve as a defensible space in the Wildland Urban Interface.

COMMENT: Regular burns near urban areas may reduce hazards of wildfire. Forest management practices are safer if irregular borders can be acquired or maintained as barriers to wildfire.

RESPONSE: Through land adjustment objectives, we strive to acquire tracts that would essentially create additional undeveloped land between National Forest and development, thus eliminating irregular borders. The establishment of a Wildland Urban Interface Zone (the WUI) is an attempt at buffering National Forest land from fire that may escape from private lands and spread onto National Forest or vice versa. The Forest Service does not have the regulatory authority to establish buffer zones on private property that surrounds National Forest System lands.

KEY INTEREST: Fuel reduction outside of the wildland urban interface

COMMENT: Areas on the Croatan are a tinderbox and a catastrophe waiting to happen if a wildfire starts. However, due to heavy fuels, organic soils, and thick vegetation, prescribed burning is unsafe. Thinning according to sound forest management plans with a pay-as-cut method would be one solution.

RESPONSE: In many areas, the reintroduction of fire may occur in conjunction with other treatments. Fire may be combined with thinning or bush hogging. The reintroduction of fire is anticipated to be a multi-step project. The goals outlined in the final Plan will guide the desired end results. The standards included in Section 4.5 will specify mitigations or constraints to be incorporated into the operational plans.

B. Expand the role of prescribed fire.

KEY INTEREST: The role of fire in maintaining and restoring the longleaf pine community

COMMENT: The goal for prescribed fire may be unattainable with the proposed increase in acreage in new areas to be prescribed burn, along with smoke management constraints, and an ever increasing urban interface problem.

RESPONSE: The final Plan presents the acreage figures (Objective 2.5.1.3) for prescribed fire in a way that emphasizes continued burning in areas that are within a fire compartment, and expanded use of fire in areas that are not currently being burned. Accomplishing more acres of burning will require a combined effort of fuel treatment in the wildland urban interface while actively striving to expand the use of fire. The final Plan sets the stage for accomplishing this.

COMMENT: The objectives need to state how many acres are going to be treated with fire.

RESPONSE: The final Plan includes prescribed fire acreage figures in Objectives 2.5.1.3 and 2.5.2.1:

Objective 2.5.1.3: Reduce fuel loads to aid in wildfire suppression with a prescribed fire program:

- A 5-12 year rotation in 25,000 acres of pocosin ecological types within previously burned fire compartments; as research results become available, expand the use of fire in an additional 48,000 acres of pocosin. No new fire plowlines will be allowed along savanna-pocosin ecotones.
- A 3-5 year rotation in 22,500 acres of mixed pine and pond pine woodland ecological types in previously burned fire compartments; as wildfire risks are reduced in adjacent stands, expand the use of fire in an additional 19,000 acres of mixed pine and pond pine.
- A 2-4 year rotation in 21,000 acres in longleaf pine ecological types in previously burned fire compartments; expand the prescribed burning program to include an additional 5,500 acres of longleaf pine. No new fire plowlines will be allowed along savanna-pocosin ecotones.

This program includes burning for silvicultural purposes. Burning rotations may change during site preparation but will return to rotation cited above within a 10-year period. The program also includes WUI acres, but these fuels may be treated by methods other than prescribed fire.

Objective 2.5.2.1 Longleaf Pine:

- Apply prescribed fire to 2750-3500 acres to reduce woody vegetation and logging debris for seedbed preparation of pine stands.
- Burn once while longleaf pine is in the grass stage.
- Burn on a 2- to 4-year rotation with growing season fire after longleaf pine seedlings are out of the grass stage and greater than 4 feet in height.
- Use growing season fire to create open, park-like understory conditions.

COMMENT: While the Plan says growing season fire will be applied every 2-4 years, the optimal fire frequency for longleaf pine savanna is around 3 years.

COMMENT: When prescribed burning cycles are established at 2-5 years in standards for fire under the pine savannas prescription, it should be stated that the optimum cycle is every 3 years. This will not only help the longleaf pine savanna but also canebreaks. Special emphasis needs to be placed on using fire to reestablish canebreaks.

COMMENT: To restore canebreaks, a habitat type that has not persisted due to fire suppression, fires that occur in adjacent uplands should be allowed to spread into pond pine woodlands. Cane breaks should be burned approximately every 10 years.

RESPONSE: To maintain flexibility in accomplishing the necessary use of fire, a range (2-4 years) is given. It is understood that the time interval falling between 2 and 4 years, optimally, is around 3 years. Providing a larger window of time to implement reduces the time constraint, which could potentially eliminate the possibility of accomplishment completely. Restoring 500 acres of canebreaks is included in the final Plan (Objective 2.1.3.4). It is anticipated that the restoration of canebreaks will occur as the use of fire is continued and expanded in the transition areas between pond pine and pocosin (Objective 2.5.1.3), which is where Frost places historic canebreaks. As fuel loads are decreased, a fire use program will be implemented (Objective 2.5.2.3) that allows for natural fires to be used if they occur during the times of year when natural fires historically occurred.

COMMENT: Prescribed fire during the growing season is required to restore natural communities, mimic natural fire processes, restore longleaf pine, and to control hardwoods in RCW clusters, avoiding significant effects on the RCW. The Forest Service has fallen short of accomplishing growing season burning in the past, and must begin using this management tool to successfully implement the new Plan. Discussion and specific recommendations about using fire to control hardwood midstory in current and future RCW habitat is lacking.

COMMENT: Where hardwoods are too dense in the midstory, fire should eventually be used to control their growth. If manual removal occurs prior to burning, hardwood tops should be scattered to prevent intense pockets of fire.

COMMENT: Efforts to restore longleaf pine though fire are commendable, however, restoration of the entire savanna ecosystem with its associated plant communities and rare species should be the goal.

COMMENT: Burning and thinning should be used to create the open understory ideal for RCWs, and thereby increasing the number of clusters in the short-term and long-term.

RESPONSE: The FS recognizes the importance of growing season prescribed fire in controlling midstory hardwoods and understory shrubs in RCW habitat. In an attempt to focus on the role of fire beyond what it provides for RCW, prescribed fire is discussed in association with vegetation communities. Many rare species of plants and animals inhabit the fire-adapted ecosystems of the CNF, and proposed fire objectives attempt to consider the management needs of the entire ecosystem, rather than one species. The Plan sets an objective to maintain the existing longleaf pine forest as pine savanna (Objective 2.1.1.6). Fire objectives are focused on vegetation communities rather than specific species (Objectives 2.5.1.3 and 2.5.2.1).

Both prescribed burning and thinning will be used to create the open understory conditions suitable for RCW. These goals are stated at 2.5.2a, 2.5.2b, and 2.5.2c, and outlined in objectives 2.5.2.1 through 2.5.2.3. Standard 4.2.1.1 requires management of RCW nest and forage habitat in accordance with the RCW Management Standards and Guidelines and Recovery Plans. Growing season burning is recognized as a valuable tool in accomplishing many of the goals and objectives outlined in this plan. It is explicitly stated in Objective 2.5.2.1 to use growing season fire in certain situations. In Chapter 3.6, the probable management practices include prescribed burning to maintain stand structure and provide favorable conditions for longleaf pine regeneration.

Thinning in other pine stands that could provide forage habitat for RCW is also emphasized and standards identify target basal areas for thinning (Standard 4.4.0.5). However, the use of artificial cavities and translocation of birds may be necessary, in conjunction with thinning and prescribed fire, to meet population objectives for RCW on the CNF (Objectives 2.1.1.1, 2.1.1.3, and 2.1.1.4).

COMMENT: In order to control loblolly regeneration in areas where longleaf is trying to get established, the longleaf must be allowed to grow and get established for 12-14 months, and then the area should be burned. Subsequent burns must take place within a year of the initial burn and then on a regular schedule to avoid loblolly regeneration.

RESPONSE: The use of fire is vitally important in areas where longleaf restoration is the goal and loblolly remains as a component. For this reason, the final Plan establishes goals (2.5.2a) and objectives (2.5.2.1) for the use of fire in longleaf pine, especially restoration areas.

KEY INTEREST: The role of fire in pocosins and pond pine woodlands

COMMENT: Although the historical fire frequency in pocosins is not known, it is suspected that it is similar to that of the adjoining uplands. The areas should be burned as a large unit containing both uplands and wetlands, allowing the fire to spread from the upland into the wetland. During this burning, natural firebreaks should be used.

RESPONSE: Based on Cecil Frost's work for fire return intervals on the Croatan National Forest, the final Plan continues and expands the use of fire in the pocosin, pond pine, mixed pine,

and pine savanna (Objective 2.5.1.3). The use of natural barriers as fire lines is emphasized for all fire operations (Standard 4.5.0.11). Large units containing mixtures of landtypes are burned on the CNF using a helicopter. Some areas of pocosin are not included due to heavy fuel loads or proximity to private land. Through pre-fire fuel treatments and increased knowledge of suitable burning techniques, these pocosins will be added to the overall area to be burned on the CNF (Goal 2.5.1 and Objective 2.5.1.3). A broad aim of using fire is to resemble natural frequencies, intensities and spread where possible to achieve the type of forest ecosystems found to be healthy and sustainable given the constraints of the current situation.

KEY INTEREST: Fire effects

COMMENT: Patchy burns are ideal to minimize impacts to invertebrates since they are vulnerable to local catastrophic disturbance. When planning and implementing prescribed burns, the needs of invertebrate populations needs to be assessed. Burns should be timed to avoid periods of invertebrate dormancy, and to avoid burning all of any particular habitat type within the vicinity of the burn.

COMMENT: The plan needs to include a standard that captures the need to plan burns with consideration for causing minimal impacts to animal species which are rare, have highly specific habitat needs, or are not mobile during part or all of their life cycle.

RESPONSE: The final Plan specifies fire to be used in a way that minimizes impacts to animal species that are rare and immobile during part or all of their life cycle (Objective 2.5.2.2). Fire will be allowed to burn in a mosaic pattern without attempting to force all portions of an area to burn with excessive firing techniques. Specifically for the Millis Road Savanna area, adjacent fire compartments will be burned on an alternating 3-year cycle, with adjacent compartments not being burned within 3 years of each other. Additionally, a site-specific burning plan will be developed for the Millis Road Savanna Registered Natural Heritage Area.

KEY INTEREST: Fire lines for prescribed fire and wildfire

COMMENT: The Plan needs to emphasize that fire should be allowed to spread, when possible, from uplands into adjoining land. If control lines are necessary, natural firebreaks should be used whenever possible to reduce impacts.

COMMENT: No new plowed fire lines should be constructed in ecotones between pine savannas and pocosins. If fire lines are required to be constructed through wetlands, the line should be perpendicular to the wetland boundary.

COMMENT: Allow fire lines to revegetate into herbaceous species native to the site, rather than planting perennial grasses and forbs.

RESPONSE: The final Plan outlines the background and proposed resolutions (Chapter 2.5), along with goals and objectives for creating the environment in which fire may function as close as possible to historic patterns. Goals 2.5.1a and 2.5.2b strive to reduce fuel loads and to create a fire use program.

Standards included in the final Plan regulate use, placement and rehabilitation of firelines (Table 4.5). Standard 4.5.0.11 emphasizes the use of naturally occurring barriers. Standard 4.5.0.15 prohibits fire lines in ecotones between pine savannas and pocosins on Murville soils unless it is an emergency or on property boundaries. Fire lines will be rehabilitated based on the objectives of fire plans and in coordination with district or forest resource specialists (Standard 4.5.0.13). Impacts to heritage resources or PETS species from construction of a fire line and that are unavoidable must be mitigated (Standard 4.5.0.14).

Generally, fire line placement is based on the topography, predicted fire behavior, and safety considerations. Right angles, or any 90-degree turn in a fire line are tactically inferior to other alternatives and as a general rule compromise safety.

KEY INTEREST: Shortage of personnel to accomplish prescribed fire goals

COMMENT: Since personnel shortages caused prescribed burning to be postponed in the past, additional full-time people should be hired.

RESPONSE: Within the National Fire Plan is the direction to increase the emphasis on community involvement and resource support for federal fire use projects. Additional funding within the National Fire Plan supports the contracting of additional personnel and equipment. The CNF has many successful partnerships in place currently and will be pursuing avenues to increase their options.

Additional firefighters were hired in the last few years to assist with prescribed fire and wildfire. The CNF utilizes a number of people on detail, and contracts for equipment, manpower, and a helicopter to assist with prescribed burning during January, February, and March.

C. Maintain Air Quality

KEY INTERST: Quantitative air quality standards

COMMENT: To make the air quality standards more quantitative, measure air quality indicators such as particulate density or PM_{10} and $PM_{2.5}$ guidelines.

RESPONSE: The EPA is the governing body for air quality standards. All operational plans must conform to their regulations and standards. Currently the partnership between the EPA and the Forest Service is looking into increasing the ability to measure and quantify air quality as it pertains to fire use.

A.6. ACCESS

A. Providing access while protecting natural resources

(In the proposed 1999 Croatan Plan this was split into 2 sections - Manage roads for safe, clean environment, and Phase out unauthorized access.)

KEY INTEREST: Extent and rate of road closures

COMMENT: The goal of closing unnecessary roads is admirable, but the scheduling and amount of closings is too slow and inadequate in quantity. It would seem that a quicker rate would be more cost beneficial and advantageous to the natural resources.

COMMENT: Closing 80% of unauthorized roads over 10 years is too long. The current schedule for closing roads is inadequate to effectively handle the problem. All illegal routes should be closed immediately and restored.

RESPONSE: With the amount of resources available, closing all unnecessary and unauthorized routes is not possible. A comprehensive analysis of the existing unauthorized roads and trails was conducted to identify priorities. This analysis is documented as part of the Croatan Roads Analysis Process (FEIS Appendix B). The analysis developed a schedule of road closures that was feasible with the resources available. Closing roads may happen at a more rapid rate depending on funding and personnel. Decisions on road closures, including prioritization, will happen at the project level. (NOTE: The objective of closing 80% of unauthorized roads was not included in the new version of the Plan. The two sections previously included in the Access section were combined into one section that focuses on closing unnecessary open roads and unauthorized routes, in addition to restoring natural vegetation. See Table 2.6.

COMMENT: Suggestions for specific roads to close include Forest Roads 169, 3046, and spurs 143, 3052, 136, 3015, 766, 603 (east part), 157, and 306. The roads across the dirt dams at the historic sites Bell's Mill Dam on Pettiford Creek, and Hill's Mill Dam on Reedy Branch need to be closed due to impacts from motorized vehicles.

RESPONSE: These suggestions will be utilized when site-specific road closures are proposed.

COMMENT: Since many wildlife species are highly sensitive to road density, quantitative data needs to be provided to determine impacts from making changes.

COMMENT: Seasonal road closures would be beneficial to wildlife to minimize disturbances to core habitat areas during critical periods, allow for soft mast production along road shoulders as well as provide linear wildlife openings.

RESPONSE: During the Croatan Roads Analysis Process (FEIS Appendix B), road density and impacts to species from roads were two of the criterion used to prioritize roads that need to be closed, or managed open seasonally. From this analysis process, several objectives to close roads or manage roads for seasonal openness were established in the Plan (2.1.5.3, 2.1.5.4, 2.2.2.3, 2.6.1.1, 2.6.1.2, 2.6.1.3):

- Objective 2.1.5.3. Reduce disturbance from motor vehicles in the bear habitat management prescription. One effective method is to reduce the miles of open road.
- Objective 2.1.5.4. Provide 20 acres of soft mast for black bear. One method is to establish a minimum 5-10 miles of roadside soft mast buffers on roads closed to public motorized vehicles within the bear habitat management.

- Objective 2.2.2.3. Provide opportunities for walk-in hunting away from easy access by vehicles.
- Objective 2.6.1.1. Close at least 15 to 20 miles of open roads over the next 10 years. Schedule road closure at the rate of approximately 1 to 2 miles per year.
- Objective 2.6.1.2. Close unauthorized routes over the next 10 years, and restore to the ecological landtype. Those routes that are least expensive to close should be first priority.
- Objective 2.6.1.3. Manage an additional 15 to 20 miles of open roads using seasonal closures.

KEY INTEREST: Enforcement of road closures

COMMENT: The proposed methods of closing unauthorized routes – gates, ditching – will not be successful without a greatly expanded and intense law enforcement program. The ability to apprehend violators must be increased. The meager dollar amount allocated for law enforcement in the annual budget (Appendix L) is woefully inadequate.

RESPONSE: The revised Plan lays out a strategy to handle unauthorized access (Section 2.6.1, Providing Access While Protecting Natural Resources). The operational implementation of the strategy will be closely coordinated with law enforcement. In the budget for Fiscal Year 2004, an additional law enforcement officer is funded.

COMMENT: Initiate a fee-based permit system for travel of Forest roads as an integral part of the law enforcement program. Every user or vehicle should be required to purchase a permit and the proceeds used to support the law enforcement program, public education, and clean up of major dumpsites.

RESPONSE: Effective user information and education efforts are the first priorities in controlling impacts and curtailing illegal use of the forest. A consistent law enforcement presence generally reinforces these efforts. Restrictive permits systems are expensive and difficult to administer, and are a last resort in controlling access and use.

KEY INTEREST: Paving of Forest roads

COMMENT: The Plan should include a statement that says no Forest roads will be paved.

REPONSE: If a Forest road is identified to be paved, the decision would include analysis of why the paving needs to occur and the repercussions of paving, such as increased speeds, change in access, and altering the forest visitor's experience. Sometimes paving is necessary for protection of natural resources or public safety. These decisions would be informed through the NEPA process, which includes public input and comment.

KEY INTEREST: High speeds on Forest roads

COMMENT: Vehicles traveling at high speeds on the thoroughfare of Catfish Lake Road are endangering bears.

RESPONSE: The Plan identifies motorized traffic as a concern in bear habitat, especially core areas (Section 2.1.5 Maintenance of Black Bear Habitat). The Plan proposes to reduce the miles of open road to protect bears from vehicle traffic and provide the large blocks of habitat necessary to support the bear population (Objective 2.1.5.3). However, since Catfish Lake Road is a state maintained, well-traveled road it will not be closed. The Forest Service and NC Department of Transportation work together to manage speeds and enforce speed limits. As the Plan is implemented, other methods may be identified to control vehicle traffic on this main thoroughfare.

KEY INTEREST: Use of closed roads

COMMENT: Using closed roads as trails for mountain bikers, horses, or OHVs is inconsistent with closing the road in the first place. Closed roads should be restored and essentially eliminated, not used for another activity that may cause adverse impacts also.

RESPONSE: Non-motorized public use may be appropriate in some cases (Standard 4.3.0.2). Other uses of closed roads would be determined through site-specific proposals and analysis. Some closed roads will be gated to retain access for emergency situations such as wildfire.

KEY INTEREST: Trash dumps

COMMENT: Trash dumps at the following locations need attention - Patsy Pond, and near the Primitive Baptist Church at Pelletier between Highway 58 and State road 1104, near Hadnot Creek.

RESPONSE: The location of these dumps will be used when prioritizing areas to cleanup.

A.7. LOCAL COMMUNITIES

A. Adjust land ownership

KEY INTEREST: Importance of acquisition

COMMENT: The endeavor of the Forest Service to purchase and trade land is important and should be a stand-alone issue in the Plan.

RESPONSE: We agree it is important. Since land acquisition is one way that the Forest Service interacts with local communities, we decided to include land ownership adjustment as a subheading of the overall category of local communities. We believe land ownership adjustment should be viewed in conjunction with the other ways that the Forest Service interacts with the local community.

COMMENT: We have concerns about the continued urban development around the CNF, and how this development will impact the successful completion of the goals proposed by the USFS.

It would appear necessary to establish buffer zones surrounding National Forest to successfully manage the natural resources on National Forest. The buffer zone proposal should be considered and addressed in the final environmental documentation.

RESPONSE: The Forest Service does not have the regulatory authority to establish buffer zones on private property that surrounds National Forest System lands. Through our land adjustment objectives, we strive to acquire tracts that would essentially create additional undeveloped land between National Forest and development. Tracts that enhance management of natural resources are also sought to include the protection of sensitive ecosystems. The establishment of a Wildland Urban Interface Zone (the WUI) is an attempt at buffering National Forest land from fire that may escape from private lands and spread onto National Forest or vice versa.

KEY INTEREST: Prioritization of areas for acquisition and exchange

COMMENT: The Plan has criteria for prioritizing lands to be acquired, but none for federal lands to be exchanged. These criteria need to either be developed and/or disclosed. One idea using the existing priority criteria for acquisitions is if a federal land meets Priority 1 criteria, it will not be exchanged. Additionally, lands to be acquired should meet some minimum condition.

COMMENT: It is unclear how the priorities 1-3 in Forestwide standards will be used to make decisions on land acquisition. If a tract meets one of the criteria under Priority 1, but several under Priority 2, will it become a Priority 2 tract? Or if it meets one or more of Priority 1 criteria, it will be the highest priority for acquisition. This needs clarity.

RESPONSE: Table 4.8a in the final Plan provides guidelines for both land acquisition and federal land conveyance. The bullets under each category are not listed in any order of priority, but are meant to serve as guidance for making an initial assessment of whether to proceed with a proposed land exchange. During the land exchange process, land to be acquired is assessed to determine whether it meets the objectives of land acquisition as identified in Table 2.7, Objective 2.7.1.1, "Acquisitions will focus on acquiring land that has been identified in the land adjustment plan for resource and recreation management areas. High priorities will be placed on the acquisition of land in the White Oak River and Brice Creek corridors; to providing linkages to other land in conservation management; in areas adjacent to Congressionally designated areas; and in other riparian ecosystems. Land identified for acquisition for the consolidation of national forest ownership will be considered only when other resource objectives have been met."

COMMENT: Additional priority 1 criteria could be if a tract has perennial stream and riparian buffers equivalent to Forest Service standards, or if a significant natural area – specifically savanna habitat – occurs on the tract.

COMMENT: The highest priority for acquisition should be high quality longleaf stands with an intact herbaceous layer.

RESPONSE: The guidelines for determining if a property is highest priority for acquisition (Table 4.8a) includes existing or potential habitats that support federally listed endangered or

threatened fish, wildlife or plant species, and Forest Service sensitive species; and areas needed to enhance or promote watershed improvements that affect the management of national forest riparian areas. High quality longleaf stands with intact herbaceous layers would be considered vital habitat for the RCW and rough leaved loosestrife. Tracts with perennial streams and riparian buffers would qualify under the criteria of enhancing or promoting watershed improvements that affect riparian areas on National Forest. During the analysis process, unique features that tracts contain will be highlighted.

COMMENT: The three categories used to separate areas of the Croatan for acquisition, as described in the Land Adjustment Plan, Appendix D, and how they correlate to the priority criteria outlined in Forestwide standards needs to be explained.

RESPONSE: The information in Table 4.8a in the final Plan provides specific guidelines for making land ownership adjustments. Appendix D in the final Plan projects where the land adjustments are likely to occur (Figure D-1) and which objectives the land adjustment would fulfill. This is a guide and can be changed by the Forest Supervisor without an amendment to the Land and Resource Management Plan. If parcels are identified that are outside of the areas currently depicted on the map, but through acquisition would satisfy one or more of the objectives, these parcels may be pursued.

KEY INTEREST: Areas targeted for acquisition

COMMENT: More emphasis should be placed on acquiring lands to potentially link the Croatan National Forest with Marine Corps Base Camp Lejeune, Holly Shelter, and Hoffman Forest.

RESPONSE: Linking the Croatan National Forest to other lands under conservation management is emphasized in the Plan. Goal 2.7.1 includes, but is not limited to, providing linkages to Marine Corps Air Station Cherry Point as well as Marine Corps Base Camp Lejeune and Hoffman Forest. The USFS is participating in an initiative on the coast with several other federal and state agencies, and non-governmental organizations to identify and conserve lands in the Onslow Bight Ecoregion. The objective 2.7.1.1 also emphasizes acquiring land that supports natural resource management objectives. Providing linkages to other lands managed for conservation would help to accomplish that objective.

COMMENT: Lands along the White Oak River should be classified as having both recreational *and* resource values as depicted on the Land Adjustment map. Lands along Brice Creek should be designated for either resource or recreational, and depicted as such on the Land Adjustment map.

RESPONSE: Lands along the White Oak River and Brice Creek are now identified on the land adjustment map (Figure D-1) as meeting both natural resource and recreational management objectives.

COMMENT: Additional lands that are high priority for acquisition include north of Holston Creek, Walkers Millpond/Black Creek, coastal fringe evergreen forest in the area of Cedar Point, rich mesic slopes associated with Otter Creek, and any other areas between Flanners Beach and

Fishers Landing. The first two areas mentioned will probably be proposed for natural area status in a future plan revision.

RESPONSE: Lands that were identified in the Land Adjustment Plan (Appendix D, Figure D-1) were generally areas that are currently not developed (commercial, residential or agricultural). These areas are contiguous to the Croatan National Forest and are large blocks, unless they are private land inholdings surrounded by National Forest and then size is not as important. Lands that may be proposed for future development and which may contribute to the local economy were not included in areas identified for potential acquisition. The Land Adjustment Plan is a guide and can be changed by the Forest Supervisor without an amendment to the Land and Resource Management Plan. If parcels are identified that are outside of the areas currently depicted on the map, but through acquisition would satisfy one or more of the objectives, these parcels may be pursued.

The area along Holston Creek is currently identified in the land adjustment map (Figure D-1) as meeting recreational management objectives. Walkers Millpond and Black Creek are currently identified as meeting consolidation management objectives. The land to the north of Holston Creek was not identified because it is currently developed. The same situation exists in the area between Fishers Landing and Flanners Beach, Otter Creek, and the cedar point area, where much of the land is either already developed, or could contribute to the local economy in some way if developed in the future.

KEY INTEREST: Areas targeted for exchange

COMMENT: If areas are exchanged, the land acquired by the Forest Service should be similar habitat and more contiguous to National Forest.

RESPONSE: Since consolidation of National Forest land is important in land exchanges, those lands acquired are preferred to be more contiguous with National Forest than those lands being conveyed. Several exceptions exist where a non-contiguous piece of property may be advantageous to acquire, such as unique habitat or a threatened ecosystem. According to Forest Service regulation, lands acquired do not have to be similar habitat. Situations exist where acquiring dissimilar land could meet certain objectives. During the land exchange process, the habitat features of each parcel are considered and weighed to make the best decision.

COMMENT: The Plan must more fully assess all proposed land exchanges and adjustments to determine the consistency with Plan objectives, particularly maintenance or biological diversity and recovery of endangered species.

COMMENT: The three tracts identified for exchange in the Cedar Point area should be evaluated for restoration potential prior to exchange.

COMMENT: Retain the area northeast of Sheep Ridge Wilderness identified as a consolidation tract, since it buffers National Forest, may facilitate fire management, and it contains some longleaf pine. The same is true with a tract that straddles US 70, north of state road 1129, near

Masontown Pocosin, which if lost would complicate management of the adjacent National Forest.

RESPONSE: Each land exchange proposal undergoes a feasibility study and NEPA analysis according to Forest Service regulations (36CFR Part 254.3 (f and g)) and direction (Forest Service Manual 5430 and Handbook 5409.13). This analysis helps to determine consistency with Land and Resource Management Plans, potential environmental impacts, and effects on management. During the NEPA analysis, public input is sought. Part of this analysis is also to analyze the restoration potential, as well as existing habitat condition, of tracts to be conveyed.

COMMENT: The area targeted for exchange northwest of Marine Corps Air Station Cherry Point contains floodplain swamps, roadside populations of spring-flowering Goldenrod, upland flats, and is bordered by rich mesic slopes supporting numerous species not typical of the coastal plain. This area should not be targeted for exchange; rather it should be retained as potential connection to Marine Corps Base Cherry Point.

RESPONSE: The proposed land exchange involving this tract, known as Paupers Island, is no longer active. The tract is being removed from the Land Adjustment Plan (Appendix D, Figure D-1) since it contains unique plants and ecosystems (as described in the comment). Additionally, discussions with MCAS Cherry Point support the potential linkage this piece of property could provide between National Forest and undeveloped Department of Defense land.

KEY INTEREST: Alternatives to acquisition

COMMENT: An alternative to land acquisition that should be emphasized in the Plan is to seek conservation easements with willing landowners. This could be especially useful along the corridors of the White Oak River and Brice Creek.

RESPONSE: We support other organizations acquiring conservation easements on private land. A statement emphasizing this support and option for conserving land is now in the proposed resolution and goal for Land Adjustment (Chapter 2.7.1 and Goal 2.7.1). The Forest Service itself does not strive to acquire conservation easements from willing landowners because of enforcement difficulties.

KEY INTEREST: Management of new acquisitions

COMMENT: It is unclear how new acquisitions will be managed based on the language under Forestwide standards, New Acquisitions. Please clarify.

RESPONSE: This forestwide standard (4.8.0.3) was clarified. It now reads, "Determine management direction for new acquisitions and exchanges by identifying in which Management Prescription the parcel is located. Use the landtype(s) in which it is classified (Appendix A, ECS), and the reference condition to which it best matches (Chapter 3.0) for determining the management prescription by which the parcel is to be managed."

COMMENT: New acquisitions should not be suitable for timber management if they fall within the black bear habitat prescription, where timber production is not allowed, or within RCW habitat where timber production is restricted. This forestwide standard needs to be changed.

RESPONSE: This forestwide standard (4.8.0.4) is changed to read, "The new land is suitable for timber production if it is classified as management prescription RCW HMA, and it is not part of an RCW nest area. However, if the new acquisition is a pocosin ecological type, it is not suited for timber production even if it occurs within the RCW HMA (see standard 4.4.1.1)." Timber management is allowed within the RCW HMA to accomplish longleaf restoration, and RCW forage and nest needs. Since the mixed pine prescription and small to medium pocosin patches prescription have been combined into the RCW HMA management prescription in the final Plan, those areas that are classified as a pocosin ecological type will be classed as not suited for timber production even when occurring within the RCW HMA.

B. Special Uses

KEY INTEREST: Special use permits involving wetlands

COMMENT: Does the Forest Service allow special use permits to be granted if wetlands will be altered or impacted?

RESPONSE: Special Use Permits are processed according to Forest Service regulations (36CFR Part 251 Subpart B) and direction (Forest Service Manual 2700 and Forest Service Handbook 2709.11). Consideration of wetlands and potential impacts are part of the application and permitting process (36CFR 251.54(e and g) and Executive Order 11990 Protection of Wetlands (1977)). There is no blanket regulation that allows or prohibits the permitting of special uses if wetlands could be impacted or altered. However, these potential impacts are considered during the analysis process. The NEPA process also provides opportunity for the public to comment on agency proposals that may involve wetlands.

KEY INTEREST: Selection and management of administrative, electronic and communication sites

COMMENT: During site selection strongly consider avoiding high quality natural communities, rare species populations, and fragmentation of the landscape. Avoid Masontown and Union Point pocosins with any special use that is incompatible with maintaining the high quality ecosystems found there.

RESPONSE: Standards are included in the CNF Plan to regulate the authorization of new permits/applications, and the selection of sites for communication equipment. Additionally, prior to permitting Special Uses, possible locations are identified and analyzed for environmental impacts. During this process any natural communities, rare species, or designated Natural Areas would be identified and avoided if at all possible.

COMMENT: Encouraging the location of utility lines along the outer edges of the Forest may impact some of the highest quality natural areas occurring on the periphery of the Forest.

RESPONSE: Forest Service direction is to utilize existing transportation and utility corridors and consolidate linear uses of National Forest. The Plan is changed to better reflect that direction by deleting text that simply encourages new sites to be located at the periphery of the Forest. Additionally, prior to permitting special uses, applications are reviewed, possible locations are identified, and analyzed for potential environmental impacts. During this process, any natural areas that could be impacted by a certain location option would be identified and avoided if at all possible. Additionally, two standards (4.7.0.3, 4.2.0.8) in the Plan directly or indirectly influence issuance of special use permits.

COMMENT: Powerline clearings should be considered as major contributors to biological diversity on the Croatan, rather than having little ecological significance, as they are currently portrayed in the Plan. Because of the frequent disturbance, these areas favor herbaceous growth and rare plants.

RESPONSE: Powerlines do have high numbers of rare species occurrences due to the area being maintained grassy and free of overstory shrub and trees. Maintenance of existing powerlines will continue to support good habitat for rare species. Any new applications for powerline rights-of-way will be processed in the same manner as all applications for new permits, and in accordance with the standards outlined in Table 4.7 Special Uses in the Plan.

COMMENT: The Forest Service should manage the work center and office area as a frequently burned flatwoods rather than a lawn. This would provide habitat for native species, and a good opportunity for visitors to see the ecological values of prescribed burning.

RESPONSE: Since prescribed fire is difficult to use in areas with development such as buildings and roads, maintaining the office and work center as a frequently burned flatwoods would be challenging due to smoke management and risk of escape. However, this is an interesting idea and will be considered if a change in current landscape management at the office/work center complex is desired.

KEY INTEREST: Military exercises on the Croatan National Forest

COMMENT: If military exercises are occurring on the Croatan National Forest, such missions should be reconsidered or controlled.

RESPONSE: Military training is an allowed use on National Forest and is authorized under the Organic Act of 1897 (FSM 2700 and FSH 2709.11). With Marine Corps Air Stations Cherry Point and New River, along with Marine Corps Base Camp Lejeune, located in the area of the Croatan National Forest, support of military training exercises is sought. For the last several years an average of five permits per year were issued for military ground training exercises. Each ground exercise lasted an average of two days. The operations include foot travel by infantry Marines, bivouacking, individual/small group parachuting, and low level helicopter flights. Many times the foot travel training exercises take place within pocosin habitat to

simulate rough conditions found elsewhere in the world. Low-level flights occur in defined flight patterns over all of the Croatan National Forest. Ground military training exercises are not permitted in specially designated areas including wilderness areas and special interest areas. Military vehicles are prohibited from going "off-road". Military ground training exercise is evaluated prior to approval and issuance of a permit, and any necessary mitigations are identified and coordinated with the military.

A.8 MONITORING AND EVALUATION

A. Management Indicator Species

KEY INTEREST: Inadequate Management Indicator Species

COMMENT: The MIS list needs to be revised to reflect a more diverse group of species, including plants, reptiles, amphibians, and aquatic species. It also needs to be revisited to make sure species selected are the best representative for a particular vegetative community. In this way, you can best track the health of the underlying ecosystem.

COMMENT: The Management Indicator Species list (4.12) is very poor; it does not reflect an appreciation of the natural communities within the Croatan. The FS needs to comprehensively revise the MIS list to include species that more adequately represent all of the various aspects of the communities on the Croatan.

COMMENT: This very brief group of MIS completely leaves out plants, reptiles, or amphibians, which, of course, comprise a very large number of species on the Croatan, including sensitive or listed species. For example, there are at least five species of reptiles or amphibians with recognized viability concerns that are known or likely to occur on the Croatan…yet, not one of these is included. We are very concerned that the species that are included on the MIS list do not adequately indicate the effects of management activities on other species of major biological communities or on water quality.

COMMENT: You need to both increase your cluster of key indicator species and determine how to otherwise supplement key indicator species monitoring so as to best track the health of the underlying ecosystem.

RESPONSE: MIS are selected because their population changes are believed to indicate the effects of management practices. Using this criterion, the MIS list was reviewed and revised between the Draft and Final EIS. The rationale for selection has been documented in FEIS, Appendix G. The MIS list has not grown, but instead, has been reworked to make sure the species selected would indicate effects of management practices, can be monitored on a forestwide basis, the monitoring information would provide useful information, and other criteria listed in FEIS, Appendix G.

Although Threatened, Endangered, and Sensitive (TES) species were considered as MIS, you state the need to include species because there are viability concerns. Rare species may not

indicate the effects of management activities, or other criteria in FEIS (Appendix G), and therefore, may not be appropriate as MIS. The viability of TES is protected through other means. Threatened and Endangered species are evaluated under the Endangered Species Act. Sensitive Species are evaluated through Forest Service Policy in FSM 2670. Compliance with these laws and policies assure the viability of rare species.

You express concerns that a broader list of MIS is needed to track the health of the underlying system. Our approach is to track the underlying system directly as much as possible, and, to use MIS to indicate effects of management activities.

KEY INTEREST: Species to use as Management Indicator Species

COMMENT: MIS for pine savannas needs to use other species which are more specific to pine savanna and are indicative of a high quality herbaceous layer in order to truly indicate natural community quality. In order to determine the quality of the longleaf pine savanna and flatwoods natural communities, it would be useful to evaluate the presence of the following indicator species: Bachman's sparrow, little metalmark, Georgia satyr, wiregrass, and deertongue. The two invertebrate species are even more closely tied to savanna and flatwood habitat and are differently sensitive to prescribed burning factors. The butterflies are common and visible enough that they can be used by USFS personnel, and are often tracked as part of butterfly counts. Natural Heritage Program has good baseline data for some of the CNF savannas and elsewhere on the coastal plain where these butterflies occur. Both plant species mentioned are common and easy to identify.

COMMENT: Consider using red-shouldered hawk and barred owl as additional MIS species for "oak gum cypress" due to their dependence on large or decadent trees. Since pine flatwoods lack MIS species for late successional primary habitat, we suggest hairy woodpecker. Also, due to limitation on wild turkey populations not directly related to habitat quality, we suggest downy woodpecker as an indicator of late successional maritime forest. We are concerned that there is no MIS for tree cavity habitat in early successional upland habitat. We suggest northern flicker since it is a primary excavator with an affinity for open stands of trees/forest edge that is known to nest in snags in open habitats.

COMMENT: The prairie warbler would be found in pine savanna, but probably not any more frequently than in early successional habitat of other types. The red-cockaded woodpecker is indicative of mature longleaf trees, but is able to nest in other pine types and in longleaf when it occurs in otherwise poor quality habitat (golf courses, etc.).

COMMENT: Bachman's sparrow is a better indicator of pine savanna than prairie warbler. Bachman's sparrow would be well-suited for the MIS list since it is on the state and federal lists, has special habitat requirements that may be influenced significantly by implementation of the Plan, and is a non-game species of special interest with a high Partners In Flight score (30). Good data exists on its current distribution within the Croatan.

COMMENT: Prairie Warbler should be listed for Pine Flatwoods.

COMMENT: The maritime forests of the Croatan are so limited, it may be the case that wild turkeys will never occur there. Based on old literature, wild turkeys were common in open pine communities with frequent fire – thus it would be a good MIS for areas mapped as Pine Savanna and Mixed Pine Forest (pine flatwoods).

COMMENT: Pileated Woodpecker should be listed for maritime forest, pond pine woodland, pine savanna, and pine flatwoods.

COMMENT: Black-Throated Green Warbler occurs in headwater areas, in communities like non-riverine systems, which is the main reason there is so much concern about them (very high PIF concern score); the majority of their original habitat is gone. They do not occur in most examples of oak-gum cypress habitat type. Oak-beech is entirely inappropriate. Pond Pine Woodland is ok.

COMMENT: Prothonotary Warbler should not be listed under pocosin, but should be listed under Pond Pine Woodland.

RESPONSE: MIS for effects of management activities in pine savannas include RCW, longleaf pine, and wiregrass (FEIS, Appendix G). Other species, such as Bachman Sparrow, were considered. We believed that monitoring the important components of the habitat, longleaf/wiregrass, would provide useful information, could be directly tied to management practices, and could be obtained at reasonable costs. Therefore, the longleaf/wiregrass species were selected rather than Bachman Sparrow and other species.

When habitats or components are not likely to be affected by management practices, MIS are not needed to convey the likely effects of planning alternatives. Most of the bird species you mention would have been indicators of hardwood wetlands, or pond pine habitats, or others, where management activities are so infrequent and low impact, the results of management practices would not cause changes in populations. Therefore, they were not selected for MIS.

B. Monitoring

KEY INTEREST: Monitoring PETS species

COMMENT: The proposed monitoring plan in the draft LRMP would not adequately conserve PETS species and their habitats, or sensitive natural communities on the Croatan.

COMMENT: Field checking PETS populations every decade, as proposed, is inadequate. A comprehensive, ongoing monitoring program for PETS should be developed and implemented.

RESPONSE: The approach to monitoring in the final Plan involves monitoring both species populations and habitats. Focusing on specific species (Management Indicator Species) would gauge impacts to the overall health of those management prescriptions that have the most active management proposed. Monitoring habitats in the management prescriptions that have the least management proposed will gauge general health of the overall system. TES species are monitored on different time schedules based on the level of listing (federally endangered versus

Forest Service sensitive), and potential habitat changes that may occur. The RCW and Rough-leaved loosestrife require more frequent monitoring due to being federally listed than due sensitive species whose viability is not as much at risk.

KEY INTEREST: Monitoring Plan implementation

COMMENT: The monitoring questions are extremely limited, and do not ensure that the relevant issues are adequately addressed in general forest planning, as well as in the implementation of the forest Plan.

COMMENT: Specific information on practice implementation is not present in the plan. It is our perspective that Croatan field personnel look to the plan to provide them specific details. In addition, several references are made to establishment of other species sub-populations. It is uncertain whether this is a practical or viable effort, and how its outcome will be documented is unclear.

RESPONSE: The Monitoring Chapter is organized differently in the Final CNF Plan. Five categories of questions monitor actual implementation of Plan goals and objectives and the effectiveness of that implementation. (i.e. is implementation moving the Forest toward the desired condition?). Specific information is identified such as baseline data, items to be measured, frequency and method of reporting, and person responsible for monitoring. This approach to monitoring utilizes existing data collection and clearly identifies additional data to be collected.

A.9. DRAFT EIS/BE/BA

KEY INTEREST: DEIS Summary

COMMENT: Using the language, "People are concerned…" is not presenting a fair and balanced view of the issue. In a balanced statement it would be indicated that without natural area designation the concern exists that resources are abused and that resource management is too narrowly focused on individual species. These statements should not be biased to represent a single-sided view.

RESPONSE: This language was changed in the final EIS and summary to present a balanced perspective on the issues.

KEY INTEREST: Description of Alternatives

COMMENT: The longleaf restoration numbers presented throughout all the alternatives are confusing and seemingly inconsistent.

COMMENT: The numbers under comparison of land allocations by alternative conflict with numbers elsewhere in the document. Additionally, the paragraph associated with this table should use the same language used in the Plan text for management prescriptions and embedded

prescriptions. The text should emphasize that embedded prescriptions apply if they are more restrictive than others.

RESPONSE: The numbers have been compared, corrected, and clarified for longleaf restoration and land allocations throughout the document. The management prescription map uses terminology that corresponds to the text in the Plan. The introduction to Chapter 3.0 in the Plan discusses how levels of prescriptions apply, "Where embedded prescriptions apply, the more restrictive prescription should be enforced, except where Natural Areas overlap with Wilderness Areas. In those cases wilderness prescriptions will apply."

KEY INTEREST: Soils

COMMENT: With the application of fertilizer on phosphorous deficient soils as part of site preparation, the DEIS describes the application at 92 lbs per acre of P205 on beds that are 7 feet wide. In the Silvicultural Methods appendix to the Plan, the distance between beds is stated to be 14 feet wide. This distance between beds is relevant to determining soil impacts and should be mentioned in the DEIS.

RESPONSE: Since application of fertilizer is localized to the beds, and since phosphorous does not move through the soil far if the roots of plants do not take it up, the 14-foot wide space between beds would not be impacted from the proposed fertilization.

KEY INTEREST: Water

COMMENT: Under Potential environmental effects of probable land and resource management activities, it is indicated that state BMPs would limit or eliminate environmental effects from proposed timber harvesting and other activities. Since the BMP guidelines only partially address conservation of natural resources, it would be worth instituting practices that exceed state or federal BMPs. Also, the state wetland BMPs are being revised and should be released soon.

RESPONSE: During the formulation of planning alternatives, the effects of sedimentation were considered. Since soil movement is generally not a problem on the CNF, following state BMPs was determined to be adequate to mitigate effects. The hardwood cypress wetland management prescription was identified to prevent any erosion or pollutants from entering streams. This prescription creates buffers around streams much greater the 100 feet on each side of streams as suggested by BMPs. The buffer widths are also substantially higher than those called for by DENR for Neuse River basin.

KEY INTEREST: Vegetation

COMMENT: The description of the mesic pine flatwood community does not capture or acknowledge the rarity of this community throughout the state. The assessment of this community's rarity needs to be reconsidered, in conjunction with why these areas were not accepted for designation as natural areas.

RESPONSE: The Mixed-Pine Management Prescription has been eliminated from the Plan and the areas formerly within this prescription are now included in the RCW HMA Management Prescription. Objectives for harvesting stands within the former Mixed-Pine Management Prescription have also been eliminated from the Plan. These changes reflect a reconsideration of the importance and rarity of this community on the CNF and throughout the state. The Plan emphasizes restoration of longleaf pine in both pure longleaf pine stands and as a component of mixed-pine stands. These mixed pine stands would be included in the mesic pine flatwood community description.

The effect analysis for Alternative E (the preferred alternative) reflects this change.

COMMENT: In the effects to rare species under vegetation, it is not clear that the distinction between alternatives B and C is largely due to the two pocosins, Masontown and Union Point, proposed for natural area designation. Without an explanation of how these two areas are being protected without a natural area designation, it seems as if the Heritage Program proposal to designate was based on thin air.

RESPONSE: The NC Natural Heritage Program's proposal to designate Masontown and Union Point Pocosin as Natural areas in the Plan was based primarily on natural community protection. The designation of SIAs (Natural Areas) in the Plan was based on (1) capturing the largest number of rare species element occurrences and (2) having natural areas represent the full range of environmental conditions and plant communities found on the CNF. Nearly 30,000 acres of pocosin habitat is in SIAs (Natural Areas) in the Plan. Adding Masontown and Union Point Pocosin Natural Areas to this system would not provide additional improvement in rare species viability on the CNF for three reasons; (1) there are few documented rare species element occurrences in the Masontown and Union Point pocosins, (2) this area is designated as part of the Black Bear management prescription, a prescription that emphasizes prescribed fire as the primary management activity; prescribed fire will be beneficial to rare species that do occur in this area, and (3) before any vegetation management project is implemented in this areas, site specific analysis will be used to evaluate the effects of management actions and mitigation will be included to protect rare species.

COMMENT: Alternative B has increased natural area designation coupled with reduced restoration and old growth allocation. Old growth and natural area designation can overlap, as can restoration efforts, where needed.

RESPONSE: Alternative B represents a "less active" management option that relies heavily on natural processes such as wildfire and natural succession to restore ecosystem structure and function on the CNF. Designation of all proposed Natural Areas precludes the need to designate old growth in this alternative. The full range of Coastal ecosystems found on the CNF would be encompassed in Natural Areas. These areas would succeed and progress to an old growth condition without interruption from active timber management. Under this alternative, prescribed fire would be used primarily in Natural Areas to maintain their current condition that would also facilitate their movement toward an old growth condition. Restoration using more active management would be used on a limited basis in this alternative.

KEY INTEREST: Forest Health/Insects and Disease

COMMENT: Hurricane damage guidelines are reasonable for areas managed for timber production. However, in areas that are not managed as suitable for timber production (old growth, natural areas, bear HMA), it should be emphasized that hurricanes are a natural process and should be allowed to operate as they would without human intervention. If adjoining stands containing commercial timber are potentially affected by insect outbreaks, then action should be taken.

RESPONSE: The Plan establishes a goal to provide core areas for rare species and unique communities that represent the range of ecological conditions found on the Croatan. One of the objectives allows for natural disturbances, including hurricane damage, to function in SIAs (natural areas) as natural processes (Objective 2.1.2.2). To support this objective, a standard (4.4.1.9) has been added to allow only cut and fell operations in SIAs (natural areas) to provide for safety of forest users, or where disease or insect infestations threaten adjacent private or public lands. Exceptions to the standard include allowing necessary removal of trees if the recovery of a threatened or endangered species is compromised, or if a hazard tree is in a developed area. Other standards regulating removal of trees in areas classified as not-suited for timber production include 4.4.0.14 (providing a list of situations where trees may need to be cut), 4.4.1.3 (restricting removal of trees in the river corridors eligible for Wild and Scenic River status Management Prescription), 4.4.1.4 (restricting removal of trees in the Hardwood Cypress Wetlands and Upland Hardwoods Management Prescriptions) and 4.4.1.5 (restricting removal of trees in Old Growth Management Prescription).

KEY INTEREST: Silviculture

COMMENT: The management approach taken by the alternatives for the Pocosin Pond Pine Patches (over 13,000 ac) should be further discussed in the FEIS. For example, it is unclear if the difference in the pocosin/pond pine patches acreage listed for Alternative B (14,229 ac) and Alternative C (13,377 ac) implies that more pocosins would be managed under B or if the difference would be harvested or filled under C. The FEIS should discuss.

RESPONSE: The difference is due to more Natural Areas being designated under Alternative B than Alternative C. These additional Natural Areas would include a small portion of the Small Pocosin/Pond Pine Patches leaving fewer acres in the this prescription. Regardless of this differentiation, the Plan now includes these pocosin patches in the RCW HMA and excludes them from lands suited for timber production. It is very unlikely that any timber harvest, including salvage, would occur in these areas because: (1) they are not capable of producing merchantable tree sizes and (2) they are not suitable sites for longleaf restoration, the primary emphasis of silvicultural activities in the Plan.

COMMENT: Table S-7 indicates that Alternative C/C-mod. Proposes 273 acres per year of clearcutting and 400 acres per year of conversion from loblolly to longleaf. Intuitively, we would expect that the two acreages might be more similar. Apparently, existing open areas such as a CNF savanna would also be converted to longleaf pines to attain the 400 acres per year. If

so, what environmental effects would forestation of savannas have on the overall ecology of the CNF. The FEIS should clarify.

COMMENT: The LRMP completely understates the extent and impacts from logging. In total, the proposed LRMP calls for 1755 acres of "regeneration" or clearcuts and 4885 acres of thinning. In addition, 22850 acres will be fire stripped, and 10800 acres of loblolly will be "restored". This is 40290 acres or over 25% of the entire Croatan National Forest will be subject to heavy-handed management over the next 10 years.

RESPONSE: The final Plan adopts a less aggressive approach to longleaf pine restoration and mixed-pine management than the 1999 Draft Plan and shifts the emphasis away from clearcutting to the shelterwood with reserve trees method (Objective 2.4.1.1). The Plan identifies the following objectives for regeneration harvests to restore longleaf pine over a 10-year period: 500-750 acres using the clearcut method, 1,250-1750 acres using the shelterwood with reserve trees method, and 900-1,100 acres of thinning and prescribed burning to restore "off-site" loblolly plantations to longleaf pine (Objective 2.4.1.1). Also included are 3,200 acres of thinning to maintain stocking levels suitable for RCW (Objective 2.4.1.2) and 1,000 acres of thinning in "off-site" loblolly stands (Objective 2.4.1.1) to help meet the 2,000 acre objective of restoring hardwoods to these sites (Objective 2.1.7.2). Existing longleaf pine savannas will not be regenerated during Plan implementation because they provide forage and nest habitat for RCW and because they are well below the 120-year rotation for longleaf pine.

The Plan retains an aggressive approach to reduce wildfire related risks (Goal 2.5.1) and to expand the role of prescribed fire (Goals 2.5.2.a to 2.5.2.c). Prescribed fire will be used extensively to restore structure and composition of longleaf and mixed pine stands and to recover and sustain short interval fire-adapted systems.

KEY INTEREST: Fire

COMMENT: Alternative B represents the low impact, maximum preservation alternative. However, reduced prescribed burning levels as described in this alternative, would not be low impact, but would have devastating impacts on the natural resources.

RESPONSE: Alternative B's overall theme was low, on-the-ground impact management, and less human induced management actions. Since most of the fire on the Croatan is not natural ignition, following the theme of Alternative B, less prescribed fire would be applied to the ground. Additionally, since this alternative strives to minimize the use of mechanical equipment to reduce on-the-ground impacts, the use of prescribed fire would be significantly restricted on most of the CNF, especially pocosins, since mechanical equipment is used to reestablish existing plowed firelines.

KEY INTEREST: Recreation

COMMENT: We feel Section III-106-108 overemphasizes hunter's needs. Additional suggestions should be made to promote more passive, nature-based recreation such as birding, botanizing, etc.

RESPONSE: This section mentions terrestrial and wetland wildlife viewing and the need to increase the opportunities for the public to recreate in this way. However, the main purpose of this section is to describe the opportunities that currently exist. The need for more wildlife viewing, nature study, and other nature-based recreation opportunities are emphasized in the Forest Plan in Table 2.2.

KEY INTEREST: Wildlife species

COMMENT: On III-107, it should be noted that the loggerhead shrike is not found on the CNF.

RESPONSE: Since the loggerhead shrike has been found in Carteret County, it was included as a general possibility of occurrence in old fields on the Croatan National Forest. An element occurrence record exists that is less than 20 years old for this species in Carteret County. Effects from possible management actions are analyzed for a lot of species that are not currently known to occur on the CNF, but may occur in adjacent counties and the CNF has suitable habitat.

COMMENT: On page III-110 it should be known that the tiger salamander is not known from CNF, nor from anywhere near there. They are known from the Sandhills, plus a site in Wake County.

RESPONSE: This species will be deleted from the paragraph.

COMMENT: The cumulative effects to wildlife species dependent upon early successional plant communities needs to be addressed so that these effects include the consideration of early seral habitat provided by private lands.

COMMENT: In Section III-120, the proposed plan revision states that "Early seral habitat . . . would not adequately meet the habitat needs for wildlife species dependent upon early successional plant communities...", mentioned under the Alternative B description. However, CNF needs to examine the availability of early successional habitat beyond its boundaries. In the Coastal Plain, there are hundreds of thousands of acres of pine plantation in private ownership, and, at any given time, a large percentage of these holdings are in early successional stages. The CNF does not need to be overly concerned with providing large acreages of early successional habitat for wildlife.

RESPONSE: To provide viability of species across the Forest, in accordance with the National Forest Management Act, the Plan emphasizes a variety of habitat types and ages, including early seral. The Plan includes objectives for providing early seral stages in an attempt to ensure that wildlife species dependent on this habitat are not confined to adjacent private lands (Objectives 2.1.5.1 and 2.1.5.2). Cumulative effects on wildlife species of providing early successional plant communities are analyzed in Chapter 3.0, Wildlife and Rare Animals, Alternative B, in EIS.

COMMENT: We feel there is no need to create additional food plots for turkeys and other early successional species. Enough early successional habitat is provided already, and the intense prescribed burning plan will create additional habitat of this sort.

COMMENT: On page III-104 of the FEIS, we question the need for additional food plots (10 acres or especially use of linear food plots in powerline rights-of-way), considering the current availability of early successional habitat and the likelihood that additional early successional habitat will probably be created or enhanced by prescribed burning. Powerlines often include rare species habitat or potential rare species habitat, and 100 miles of linear food plots represents much greater fragmentation of the landscape by a less-than-natural herbaceous layer type than small, isolated food plots. We are concerned that the food provided in the wildlife food plot is specific to game species, and it would not be representative of native vegetation.

RESPONSE: In areas where certain species that are dependent on early successional habitat are emphasized, such as turkey, permanent grass/forb openings are proposed (Chapter 3.0 Upland Hardwood Management Prescription). Providing habitat for these species not only decreases their need for private land, but also increases and supports other activities on the National Forest such as hunting and animal watching.

The potential exists to manage up to 100 miles of additional grass/forb habitat along powerline rights-of-way, as stated in the DEIS. The powerline rights-of-way are existing linear, open habitat that is burned. It is highly unlikely that 100 miles would be planted and used as grass/forb openings. Several constraints exist to limit the creation of additional grass/forb openings. The North Carolina Wildlife Resources Commission assists with maintaining openings and would have to be available to assist with additional acreage. The money and time required to create and manage additional openings is not readily available. Prior to any actions taking place within the powerline rights-of-way, surveys for rare species would occur and any occurrences would preclude a planted grass/forb opening. Lastly, native annuals and perennials are emphasized when planting does occur.

KEY INTEREST: Air quality and Wildland Urban Interface zone

COMMENT: The DEIS should mitigate, at the least, to protect the air standards of New Bern.

COMMENT: Given the highly fragmented boundary of the forest and the large amount of forest land, the potential ecological implications of this designation (WUI) could be severe. The DLRMP and DEIS do not adequately address the direct, indirect, and cumulative effects of this designation and the accompanying management practice and fire management standards.

RESPONSE: Before each prescribed fire, a plan must be developed to follow parameters necessary to assure compliance with air quality laws and regulations. The State agencies responsible for implementing the Clean Air Act regulations are notified before each prescribed fire, in order to assure compliance with air standards. Plan standards (4.5.0.7 and 4.5.0.8) also specify additional requirements to assure compliance with the Clean Air Act.

KEY INTEREST: Economic analysis

COMMENT: Economic analysis gives little consideration to a broad range of alternatives and doesn't clearly reflect tradeoffs between a timber sale program and other resource values.

COMMENT: The economic analysis gives little if any consideration to a broad range of values, both quantified and unquantified. The EA [sic] must include in its economic analysis the net present value of recreational value within the sale area and the opportunity cost of logging these areas. In addition to Croatan NF timber sale program being a monetary loss to the taxpayer, the costs associated with a loss in future revenue streams to the local community due to less recreational use or declining property values in the area must be counted in the economic analysis.

RESPONSE: Estimates of recreation and timber values and tradeoffs are provided in Appendix B, Section B.4.2. Economic efficiency estimates are made as well as economic impacts of planning alternatives. The timber program is not considered a financial monetary loss on the CNF. Each alternative has projections about recreation use, which consider the level of the timber program.

COMMENT: The planned Croatan timber sale program will only increase future restoration expense by further degrading local watersheds. We need to consider the cost of perpetuating the degradation of these watersheds. This represents an external cost that will be attributed to the taxpayer and the local economy.

RESPONSE: Protection measures for water quality are provided through the hardwood/cypress wetlands prescription, which creates wide buffer zones around streams. The timber sale program would be used primarily to restore the longleaf/wiregrass plant community, which has declined dramatically in the recent past. The cost of not restoring these plant communities would likely cause the extirpation of an endangered species, the red cockaded woodpecker.

COMMENT: We would like an economic analysis of an alternative that includes no commercial timber cutting and uses prescribed fire, natural fire, road closures and obliteration, and planting native species to accomplish Plan objectives. This analysis should include the existence values on keeping an area unlogged, as well as the long-term costs and benefits of returning fire to these fire dependent forests.

RESPONSE: The economic analyses of planning alternatives are displayed in the FEIS, Appendix B. The alternative you describe was considered, but not studied in detail. However, Alternative B of the FEIS approximates your requests. The values of unlogged areas are considered for resources such as scenery, recreation, old growth and explained the Record of Decision. However, it was not necessary to place an explicit economic estimate of value in order to judge the public net benefits of the plan.

COMMENT: Alternative C indicates that the increased ability to harvest would result in a fourfold increase in jobs. This is a short-term increase, however, since the restoration efforts would be completed in 50 years, and maintenance of the stands would take over. What is the

negative impact on the industry and jobs with the short-term duration of this employment opportunity? Will pressure be exerted to maintain a higher volume level to sustain the new jobs that were created?

RESPONSE: Maintenance of the system would require a sustained yield after 50 years. Therefore, the amount of jobs and income would be about the same over the long term. The relative significance of timber removals in the market area, however, is negligible. As shown in Appendix B, the CNF relative share of the market is less than one-half of a percent.

KEY INTEREST: Impacts from OHV use.

COMMENT: According to the literature, OHV use leads to negative impacts on animal populations, including invertebrates, insects, fish, small mammals, reptiles, game birds, migratory birds, and rodents. Plant growth, germination and vigor can be affected and cause introduction of exotic species. Soil compaction can cause the loss of invertebrates and microbes. This use can disrupt the natural hydrology and riparian areas, and increase the amount of air pollutants. They adversely affect scenery and other non-motorized users. These impacts range from destruction of habitat, loss of food and cover, reduction in reproductive success, harassment, and increased predation. These impacts result from the loss of vegetation, soil erosion, damage to vegetation, reduction in diversity and biomass, noise exposure, and changes in feeding and spatial-use patterns.

RESPONSE: The effects of motorized access, including OHVs, are considered in the FEIS for the resources affected. The analyses are commensurate with the scope of the decision to be made in the plan, which is programmatic in nature. OHV designations would vary by alternative. The greatest effects are derived from user-created, unauthorized trails and how well these are handled in the planning alternatives. OHV use is a legitimate activity on National Forests if certain conditions are met. OHV use must be located and managed in such a way that there are no unacceptable impacts to soils, water, vegetation, wildlife, or human values. The Forest Plan limits OHV routes to an area east of Black Swamp Road. By locating OHV use in this one area, impacts to other recreational users are mitigated as much as possible, while still offering OHV riders an option for recreation. This area overall offers the best location to provide enjoyable OHV use while sustaining other natural and human values on the Forest.

KEY INTEREST: Biological Evaluation

COMMENT: We are concerned that the Biological Evaluation (BE) and Draft Environmental Impact Statement (DEIS) do not reflect enough information about Proposed, Endangered, Threatened, and Sensitive species. The information that currently exists in these documents is very brief.

COMMENT: We request the FS include the following information for all PETS species in the EIS: historical range; current range; range on the Croatan; date of last survey on the Croatan; habitat use (community types) threats; management actions to address threats and conserve species; and a detailed viability discussions (rather than a brief ranking, as the BE currently contains).

RESPONSE: The best sources of the specific information you requested are: (1) the Biological Conservation Database, (2) geographic information system coverage of rare element occurrences maintained by the NC Natural Heritage Program (3) Natural Heritage Program List of Rare Animal and Plant species, (4) NatureServe: an online encyclopedia of life, and (5) T&E species Recovery Plans developed by the USDI Fish and Wildlife Service. These documents are referenced in the Biological Evaluation (BE) and Biological Assessment (BA) (Appendices of FEIS). Information on rare species' range on the Croatan (Table F4), habitat use (Tables F4-F6), and threats (main discussion in the BE) is included in the BE. Including all the information presented from these sources in the BE or BA is not practical or essential; this information is incorporated by reference. An evaluation of species viability is included in Appendix H of the FEIS.

COMMENT: We are concerned about the status of the Rafineque's Big-Eared Bat on the Croatan National Forest. The BE did not mention this species.

COMMENT: We also request the FS address the status of Rafinesque's Big-Eared Bat on the Forest, and how the issues noted above apply to this species. The proposed Havelock bypass "may cause a trend toward federal listing and loss of viability to the Rafinesque's big eared bat." The viability analysis (BE) for the DLRMP did not mention this species.

RESPONSE: The Rafinesque's Big-eared Bat (*Corynorhinus rafinesquii*) has not been documented on the CNF. The NC Natural Heritage Program does not list the species as occurring in the counties where the CNF occurs (Carteret, Craven, or Jones). However, the species has been found near the CNF at Ft. Macon State Park and the Lumbar River area (personal communication: NC Museum of Natural Sciences). The species roosts in old buildings, hollow trees, caves, mines, and beneath bridges, usually near water. Based on this information, the USFS assumes the Rafinesque Big-eared Bat is likely to occur on the CNF. This species will be included in ongoing monitoring of bats on the National Forests in North Carolina. Mist netting is the method currently used to complete this monitoring. This species is listed as "proposed threatened" by the State, a federal species of concern by the USDI Fish and Wildlife Service, and as a Sensitive species by the USFS. The Rafinesque Big-ear Bat has been included in the BE (Appendix F, FEIS).

There are many rare species that are dependent on coastal aquatic environments or environments in close proximity to streams and rivers that could occur on the CNF. The Rafinesque's big-eared bat is one of these species. As discussed in the current BE, the Plan provides direction to maintain and enhance aquatic systems (the Hardwood-Cypress management prescription) and proposes to manage river corridors eligible for Wild and Scenic River status to retain their outstandingly remarkable values. Forest-wide standards require stabilizing erosive uplands adjacent lakes and streams, maintaining natural free-flowing streams in Wilderness and SIAs (Natural Areas), restoring altered hydrologic systems in SIAs (Natural Areas), and stopping the water flow in existing canals and ditches that are no longer needed to control drainage.

The CNF Plan also emphasizes maintenance and improvement of aquatic habitats and follows best management practices to reduce sedimentation from activities in the adjacent uplands.

Implementation of the CNF Plan should improve habitats for rare species associated with streams and lakes and riparian habitats. However, total protection of these systems and the species they support may not be feasible because of the inherent complexity of aquatic systems, and the probability that some mitigation measures designed to reduce aquatic impacts may fail. Therefore, it is expected that some activities implemented through the CNF Plan may impact rare aquatic species but that this will not lead to a trend in federal listing of these species.

COMMENT: We feel there should be no timber management on the Croatan National Forest due to the loss of several species, which have been partially or totally extirpated from the Croatan. The Venus flytrap, American alligator, and other species have been virtually wiped out. Of particular concern is the Croatan crayfish.

COMMENT: We also note from Appendix C the loss of several species, which have been partially or totally extirpated from the Croatan. Venus flytrap, American alligator, and other species have been virtually wiped out. Of particular concern is the Croatan crayfish, an endemic which is virtually extinct. SABP fails to understand why the Croatan LRMP calls for any activity, such as clearcuts or increased OHV use, when these plans conflict with the survival and recovery of rare species.

RESPONSE: We agree that ground-disturbing activities such as clearcutting and OHV use on the CNF can potentially affect endangered, threatened, sensitive, and locally rare species. The Plan is a programmatic document and therefore the appropriate analysis and document (Biological Assessments and/or Biological Evaluations) will be completed to determine potential site-specific effects to these species (Standard 4.2.0.8) before any project proposals are implemented. One of the major objectives in the Plan is to close and restore all unauthorized roads on the CNF over the next 10 years to reduce the impacts of OHV use (Objective 2.6.1.2). In addition, the Plan now takes a less aggressive approach to longleaf pine restoration by proposing only 500 to 750 acres of clearcutting. This reduction in intensive management should also reduce the potential for impacting rare species.

We do not agree with the statement that several species have been partially or totally extirpated from the CNF. The CNF provides some the last intact habitat for a variety of species whose habitat has been modified or destroyed on private lands. These species have experienced marked increases in their extent on the CNF most likely because of the extensive use of prescribed burning and lack of timber harvest in longleaf pine stands. For example, the Venus flytrap is documented at 22 locations on the CNF (2001 NC Heritage Program database). In the Plan, 17 of these occurrences are in areas where active management, other than prescribed burning, does not occur (Biological Evaluation, EIS). Seven are within natural areas, five are within designated old growth stands, five are within RCW nest sites, and 5 are within RCW forage areas. The biggest threat to this species is fire suppression. The Plan emphasizes prescribed burning in the ecotone habitats that support this species (Objective 2.5.2.2). The American alligator is a federally threatened species based on similarity of appearance to other rare crocodilian species. The American alligator, however, is not in decline and there is no viability concern for this species. There are 11 documented occurrences of the American alligator on the CNF. However, observations of this species occur on a frequent basis but have not been included in the NC Heritage Program database.

The Croatan crayfish was recently 'downlisted' by the Regional Forester from sensitive to locally rare. It is not near extinction but its range is restricted. There are six occurrence of this species documented as occurring on the CNF. However, recent observations documented in "Croatan National Forest Inventory of Mollusks, Crayfish, and Mammals", by John M. Alderman, Therese Conant, Thomas Henson, and Christopher McGrath, indicate the species to be more common. During this inventory, the Croatan crayfish was collected from a variety of habitats including roadside ditches and ponds. These are not uncommon habitats on the CNF.

KEY INTEREST: Roadless Area Initiative

COMMENT: There is no specific discussion of the merits of each roadless area as wilderness, and how the FEIS fits within the FS Roadless Initiative. The FS should include in the final EIS a comprehensive discussion of each area, and then turn to whether each area merits wilderness status. The FEIS should also discuss the consistency of the DEIS with the FS Roadless Initiative under which more potential national forest wilderness areas are to remain roadless.

COMMENT: The evaluation of roadless areas for potential wilderness designation in Appendix C of DEIS is cursory and overly general. The discussion does not focus on each roadless area and why each was rejected or included in the areas to be designated as additional wilderness. The FS should include in the final EIS a comprehensive discussion of each area, and then turn to whether each area merits wilderness status.

RESPONSE: Evaluations of the roadless areas and their merits as wilderness are in Appendix C of the DEIS. This discussion includes the need for each Roadless Area as Wilderness. The recommendation for all or portions of these areas to go into Wilderness Study Areas (Congress has to designate Wilderness) is made in the context of the Forest Plan. The discussion is concise but meets the national criteria for Roadless Area Evaluations. Roadless areas not recommended for wilderness designation will be maintained in natural and roadless conditions and will be covered by any future decisions made through a Roadless Initiative.

A.10. OTHER COMMENTS

KEY INTEREST: Layout and level of detail in Plan

COMMENT: The plan addresses different parts at different levels of detail, does not refer to all the other land use plans available, does not provide clear cross reference and does not use the traditional method of layout.

COMMENT: The level of detail attached to different parts of the plan varies enormously. Some very important topics received very meager coverage.

COMMENT: Trying to mesh the information in Chapter 2 (2.59-2.61) with Chapter 3 reference conditions and Appendix D/Figure D-1 and the "purpose of acquisition" is a daunting task. This section very much needs clarification.

RESPONSE: The format of the Plan has been redone to make the document clearer, and implementation easier. By reformatting, details for different resources are grouped together and should be easier to find. Information is better connected through the document. However, the Plan attempts to present a complex analysis process in an easy to understand and implementable format. This is generally not an easy task. The sections are better laid out and labeled which should make maneuvering through the document much easier.

COMMENT: All reference conditions in the Management Prescriptions section of Chapter 3.0 should be checked to ensure that they are no describing a condition that is less than ideal. If negative features are present in a site used as a reference condition, it needs to be clear in the text that the negative feature is not a desirable condition. For example, the reference condition (or "ideal condition" as the text describes) for Small to Medium Pocosin Patches described illegal OHV trails, which is much less than an ideal condition.

RESPONSE: A description of what a reference condition is referring to is included in Chapter 3.1 Introduction, "The reference condition is meant to describe what the desired effect of management will achieve. Since no two sites or features are identical, an attempt is made to show how features may vary from reference conditions. Therefore, the reference is one within a range of conditions. The range exists due to differences in the initial conditions' site capability and responses to management for each site. Sometimes reference conditions cannot always be achieved due to natural disturbances, such as hurricanes and wildfires." Reference conditions were edited to ensure that they were consistently and accurately represented across all management prescriptions.

COMMENT: The introductory table for Management Prescriptions and text helps to clarify the relationship between embedded prescriptions and management prescriptions. However, the relationship between the Black Bear HMA and the rest of the prescriptions is less than clear. Is it a larger category that encompasses many of the prescriptions? A point also needs to be emphasized that more restrictive prescriptions, or embedded prescriptions, take precedence where they overlap with the Bear HMA.

RESPONSE: Due to confusion with an overlapping, broad Black Bear Habitat Management Area, this designation was eliminated from the final Plan. The black bear habitat management prescription is still designated and will be managed for bear. In the Introduction to Chapter 3.0, the relationship of embedded prescriptions to other management prescriptions is described, "Within these prescriptions, finer scale features are recognized; smaller land features and management emphases for them are embedded in the larger landscape prescriptions. For example, the prescription of longleaf-pine savannas and flatwoods is a broader scale prescription, and within these prescriptions lie the finer scale longleaf old growth. Where embedded prescriptions apply, the more restrictive prescription should be enforced, except where Natural Areas overlap with Wilderness Areas. In those cases wilderness prescriptions will apply."

COMMENT: 1.2 Forest Description: It should be emphasized that the longleaf pine natural community type, with all its components, is globally rare. It has been reduced to less than 3% of its historic distribution, with old-growth examples even more rare, contributing to the decline of the RCW.

RESPONSE: This suggestion is added to the Introduction of the Plan in Chapter 1.0.

COMMENT: The Heritage Resource designation occurs twice in the text, once as a prescription and once as an embedded prescription. One is called Heritage Resource Interpretation and the other Heritage Resources. This is confusing.

RESPONSE: The Heritage Resource Interpretation areas are included with the water-based recreation due to the coincidence of these two areas and the opportunity to interpret heritage resources in these areas. Many heritage interpretation opportunities exist within areas that may be emphasized for water-based recreation also. The SIA (Heritage Resource) Zones are designated, recognized areas by the archaeology program and managed for protection.

COMMENT: The Figure displaying Management Prescriptions is confusing since the management prescriptions listed are not inclusive of the all the prescriptions (management and embedded) included in the text. Somehow the reader should be referred to other maps that display more restrictive prescriptions such as old growth and natural areas. The names used in the Key to Features do not match the names used for prescriptions in the text.

RESPONSE: The management prescription map has been updated and improved to better depict all of the management prescriptions, except the embedded prescriptions. The embedded management prescriptions are not shown on the map since those are smaller, more localized areas. To depict all of the designated management prescriptions, including the embedded ones, on one map was confusing due to all the symbols required. The names used in the legend now matches the names used in Chapter 3.0 or the Plan.

COMMENT: The traditional method of printing the text across the 8.5" length of the page is easier to read and preferred to across the 11" length of the page.

RESPONSE: The new Plan is formatted and printed in a standard portrait alignment.

COMMENT: The notices should be published in the Carteret County News, Sun Journal, and the Daily News in Jacksonville. The Daily News circulates in all three counties. This would cover the entire areas of the Croatan.

RESPONSE: Since the Regional Forester signs the Record of Decision for the FEIS, , the notice is published in the major Atlanta paper, and the Federal Register. A media announcement will also be made in the local area of the Croatan National Forest as to the availability of the final documentsPlan.

KEY INTEREST: Standards and guidelines

COMMENT: The differences between standards and guidelines are confusing, they need some definitions in an introductory section, and need to be quantitative as well as qualitative.

COMMENT: The DLRMP frequently utilizes the term "standard" when what is actually being listed is a guideline.

COMMENT: We prefer the traditional approach where standards and guidelines are provided on a numbered basis.

COMMENT: While the Forest Service supplies definition of standards and guidelines in an appendix of the DEIS, the Forest Service should provide definitions in an introductory section in the text of Chapter 2 of the DLRMP, and clearly number each standard and guideline.

COMMENT: NFMA requires that forest plans include both Standards and Guidelines, and that these be quantitative as well as qualitative. Unfortunately, the proposed plan includes many qualitative standards, but not guidelines, and few quantitative requirements (except for RCW habitat standards). This "feel good" approach to forest plans leaves far too much discretion in the hands of Forest Service managers, who have repeatedly demonstrated a penchant for timber sales over other forest values.

RESPONSE: Since a guideline is defined as a "broad description of a preferred or advisable course of action (1995 36CFR 219.2)", they are more appropriately included in Forest Service direction (manuals, handbooks, letters) and not in Land and Resource Management Plans. The final Plan does not contain guidelines. Standards are "limitations on management activities that are within the authority and ability of the agency to meet or enforce (1995 36CFR 219.2)." Since standards place well-defined, clear limits on what can and cannot take place on a National Forest, they are included in the Plan. Guidelines are incorporated into the Plan by acknowledging in the text that management still must follow other guidance documentation (Chapter 4.0 Introduction).

The standards are now compiled into one Chapter (4.0) and organized by program area (i.e. Soil/Water/Air, Wildlife/Fish/Botanical, Fire, Recreation, etc.). Within each program area, the standards are divided into forest-wide standards and prescription standards. The standards are numbered. Forest-wide standards have a 0 as the third digit and prescription standards have a 1 as the third digit. The first digit refers to the Chapter 4. The second digit refers to the program area and the final digit is simply a sequential numbering system.

Listed in the introduction to Chapter 4.0 are how standards are defined, how they are to be used, how the standards are organized, and what other sources may contain standards to be followed. Some of the standards are quantitative (Standard 4.2.1.6 Conduct nest checks at 7-10 day intervals…), and others are qualitative (Standard 4.5.0.11 In all fire operations, emphasize the use of naturally occurring barriers, or existing human created structures, such as roads, canals, or utility corridors.).

KEY INTEREST: Small to Medium Pocosin Patch description and delineation

COMMENT: In the reference condition description, loblolly is mentioned as being a historical component of the bay rims. This is doubtful. Many of the areas mapped as small to medium

pocosin patches are different than the reference condition description. These differences should be described.

COMMENT: The GIS layer that delineates the boundary of the small to medium pocosin patches contains errors. Some of these areas are incorrectly identified. Specifically, the area of nonriverine wet-hardwood forest in and around Gum Swamp bottomland hardwood registered natural heritage area is designated as pocosin-pond pine, when it should be identified and managed as hardwoods.

RESPONSE: The small to medium pocosin patch management prescription is now combined with the RCW HMA to create a landscape scale management prescription consisting of a matrix with patches and corridors. The reference condition for the RCW HMA management prescription is written to include the pocosin patches and mixed pine forests. It no longer includes a reference to loblolly pine as an historical component of bay rims.

The area mapped around Gum Swamp was incorrectly included in the small to medium pocosin patches due to an error in the soil classification. It is now included in the RCW HMA, but has the embedded prescription designation of SIA (Natural Area) and will be managed under those standards.

KEY INTEREST: Havelock Bypass

COMMENT: The Plan and DEIS contain neither a discussion of the implications of construction of the Bypass on Plan objectives (biological diversity and management/recovery of RCW), nor the environmental effects of this potential loss of important national forest land.

RESPONSE: The Havelock Bypass proposal is considered a site-specific proposal covered through the NEPA process at that level. However, due to the high level of public concern about this project, the analysis of the Havelock EA were incorporated by reference in the FEIS, Wildlife Section to assess the risks to achieving goals and desired conditions of planning alternatives.

COMMENT: The proposed Havelock Bypass (NCDOT 1998) would result in the partial destruction of a natural heritage area ("Southwest Prong Flatwoods"). In addition, this road would cause the destruction of hundreds of acres of longleaf pine (much of which is high quality), as well as the partial destruction of the Croatan's largest spring flowering goldenrod populations. This proposal leaves us very concerned that the Standards and Guidelines in the DLRMP will not adequately protect natural heritage areas.

RESPONSE: The Plan does not recognize the Southwest Prong Flatwoods as a registered natural heritage area. Therefore, the natural area protection measures would not apply. The Plan, Section 3.12, lists the designated SIAs (natural areas). Throughout Chapter 4.0 in the final plan, standards are specified that regulate the management and protection of SIA (natural heritage areas). The Havelock Bypass is mitigated to avoid, as much as possible, the *Solidago verna* population. Those plants that are not avoided are being relocated to suitable habitat areas to the northeast of the bypass corridor. Additionally, in the FEIS, Plant Communities, it shows that

more than 70 percent of rare species would occur in the designated SIAs (natural areas), thus providing core areas for most species.

COMMENT: The Wildlife and Fish Habitats section in Chapter 2.0 should address the problem already caused by 4-lane US70, plus the additional barrier to animal movement that will happen when the Havelock Bypass is built. What is the cumulative effect to black bear as a result of the existing Highway 70 and the proposed Havelock Bypass? What will be done to mitigate effects of animal movement as a result of these conditions? How does the CNF plan to work with DOT to provide alternatives for animal movement where these barriers occur?

RESPONSE: The FEIS, Wildlife section incorporates by reference the bear analyses in the Havelock Bypass EA. Additional direct mortality would likely occur. And bear travel patterns could be altered due to the bypass. However, bridges are being installed over East Prong Slocum Creek, and Southwest Prong Slocum Creek, which mitigates animal movement as well as wetland mitigation. Additional mitigation for these effects would be stipulated in an easement agreement. Future projects would require adherence to standards. Standard 4.2.0.15 in the final Plan regulates activities or developments that would substantially alter black bear natural movement patterns, and requires that there are no net losses to black bear habitat.

COMMENT: The Plan needs to include a discussion regarding the potential negative impacts that the U.S. Hwy 70 Bypass may have on RCW. The FS should thoroughly address how the proposed construction the Highway 70 Bypass (which will destroy over 700 acres of longleaf); the fragmentation of additional longleaf to the east of the bypass (including current and historical RCW habitat); and the restrictions on prescribed burning that will come as a result of the new road placement (thereby further adversely affecting RCW habitat through fire preclusion) will affect RCW conservation, and how the FS will respond to these adverse effects.

RESPONSE: The FEIS, Wildlife Section has been supplemented with potential effects on RCW and the likelihood of achieving desired conditions called for in the plan. With only foraging habitat affected by the bypass, risks are low that population goals could not be achieved in any of the planning alternatives.

COMMENT: We are very concerned about the proposed land exchanges including the substantial loss of National Forest land that may result from the proposed U.S. 70 Bypass. While the plan places great emphasis on the restoration of longleaf forests and the importance of longleaf forests to the RCW, land dispositions currently under consideration would result in the direct loss of hundreds of acres of existing longleaf forests.

RESPONSE: Any land exchange proposal with NCDOT would be subject to site-specific NEPA procedures, as well as, Forest Service policies and procedures for land exchanges. At this time, no analysis of a land exchange due to the Havelock Bypass has been initiated. Therefore, the project you are concerned about has not become ripe for a decision. If a land exchange were proposed and analyzed, it would need to be consistent with the Forest Plan.

KEY INTEREST: Relationship of Croatan Plan to other Plans

COMMENT: It would be appropriate for the "Relationships to Other Plans" section to also include a discussion of the expected impacts of the U.S. 70 Havelock bypass on the Croatan. The Forest Service should discuss the relationship of the TIP Plan U.S. 70 Bypass with the Forest Service Plan.

COMMENT: The USFS has detailed knowledge of NCDOT plans for highway construction across CNF lands and anticipated impacts of those highways on many aspects of the environment. We could find no discussion of these plans or anticipated impacts in the Plan or the DEIS. This should be done in the final Plan/FEIS.

COMMENT: The relationship of this Plan with the various Thoroughfare Plans developed by DOT should be stated, specifically the anticipated effects on the RCW from the Havelock Bypass, and the Black Bear from the proposed bypass through the eastern portion of the Croatan.

RESPONSE: The NCDOT TIP Plans were not included in the Relationship to Other Plans section because they are subject to change radically. The Forest Service is involved in project development through the NCDOT planning process, and participates in NEPA analysis of project proposals. Discussion specific to the Havelock Bypass is included in the response to comments in the previous Key Interest heading.

COMMENT: In "relationships to other plans", the Forest Plan refers to the (CAMA) Craven County Land Use Plan, but does not mention the Land Use plans for the other two counties - Carteret and Jones.

RESPONSE: A summary of the Carteret County Land Use Plan is included in the final Plan. Jones County was unable to be reached to glean information on a Land Use Plan, if one exists for the County.

KEY INTEREST: KV budget

COMMENT: The appendix holds the KV budget for cooperative work at a constant. It is our understanding that as timber sale revenue increases, a corresponding increase in KV dollars should be available.

RESPONSE: The KV dollar figure is increased in the final Plan, due to the expected timber management activities. The dollar amount is estimation at this point, since KV plans are written and submitted based on each timber sale. The amount in Appendix L is double what the current level is since the amount of timber harvested is expected to be approximately double.

KEY INTEREST: Editorial changes

COMMENT: Describe more fully the appendices on farming agreements. Somewhere in the Plan or Appendices there should be a summary of the "farming cooperative agreement". We wonder what it says. Apparently Croatan lands are being farmed? Why, for what species, and for how many acres. This item is not apparent in the annual budget (Appendix L). How much does it cost? How will the target species fare on pine savanna landscapes?

RESPONSE: Farming agreements are managed as special use permits. A fee is collected for this use. Other than administration of the special use permit, no funds are expended. Currently there is one active farming agreement on the Croatan for approximately 150 acres in 3-4 blocks in the Long Point/Hayfield area. These fields are planted in support of dove hunting. This farming agreement is an historical use and has been in the same family for generations.

COMMENT: For species names, scientific names should also be given to avoid confusion. Several places in the Plan, whorled loosestrife is used, when it should be rough-leaved loosestrife, which is the difference between not rare and federally listed.

RESPONSE: Corrections have been made where rough-leaved loosestrife was incorrectly labeled. Since most of the species discussed in the Plan are well known by their common name (longleaf pine, loblolly pine, black bear, RCW), no scientific names are used. In the Biological Evaluation and Biological Assessment, scientific names are used initially and are cross-referenced to common names in the table listing species considered during analysis.

COMMENT: 1.12, 5. Fire mgmt – You need to add to your second goal, "vegetation *and wildlife* management goals."

RESPONSE: This was added to the issue statement for Fire.

COMMENT: Identify and Protect Natural Areas: Under the second obj, you should specify that you plan to use prescribed fire to mimic natural processes where they no longer occur at the same frequency as they did historically. For the third obj, do you mean "monitor" instead of "access" the effects of natural disturbance?

RESPONSE: SIAs (Natural Areas) that are included in fire dependent ecosystems will be included in the prescribed burning program as a portion of a larger block. Objective 2.1.2.2 was included so that natural disturbance regimes that may occur, including fire, would not be stopped and management intervention would not occur unless other resources required it (e.g. RCW within Natural Areas). The third objective (2.1.2.3) now says, "Evaluate the effects of natural disturbances on native plant communities and rare species in SIAs (natural areas)."

COMMENT: Under Wilderness Rx, Standards for Fire – the phrase, "most current fire management plan for recommended wildernesses, Croatan National Forest" is confusing. Do you mean recommended for wilderness?

RESPONSE: The standards for fire have been rewritten to clarify meaning and to respond to several changes in National policy. These standards can be found in Chapter 4.5 Fire Standards.

COMMENT: Editorial change on p.2.27 – The first sentence, second paragraph needs clarification – would read better as "Existing wilderness will continue to remain free of human-caused disturbances and natural processes will determine conditions there." Also add trail construction as another exception to the "no human-caused disturbance" clause.

RESPONSE: This section (Chapter 2.3.1) was rewritten for clarification.

COMMENT: 3.4 Lakes – Add that lake shores will be retained in forest cover wherever it exists, with the possible exception of planned recreational developments.

RESPONSE: This statement is not necessary since pocosin lakes are not suited for timber production (Standard 4.4.1.2). Limited exceptions exist for trees being cut in areas not suited for timber production (Standard 4.4.0.14). Portions of the shoreline are included in the management prescriptions Wilderness, Hardwood Cypress Wetlands, and Black bear habitat. Within the Hardwood Cypress wetlands management prescription, trees may be removed in a salvage operation, but those trees must be down already and the salvage unit cannot be smaller than an acre, which prevents removal of downed, scattered trees (Standard 4.4.1.4). Neither Wilderness nor Black bear management prescriptions have exceptions.

COMMENT: 3.6 Wilderness – Two apparent typos – change "wildlife suppression" to wildfire suppression".

RESPONSE: This was corrected.

COMMENT: 3.47-3.51 (Page 3.48) Fourth paragraph, last sentence – Add "trash and OHV riders" as exceptions to the "primitive experience".

RESPONSE: This section was rewritten.

COMMENT: Under the Natural Areas embedded prescription standards for Plant Communities, change the second standard to read, "All restoration proposals will be developed in coordination with the Natural Heritage Program."

RESPONSE: Proposals for restoration in natural areas will be guided by the ecological classification system and by NC Natural Heritage Program site descriptions (Standard 4.2.0.1) Environmental analysis will be conducted prior to implementation which includes consulting with state and federal agencies.

COMMENT: We have concerns about the ability of the CNF to carry out the programs envisioned by the draft Plan and EIS due to a lack of staff biologists and other specialists (20 added).

RESPONSE: A new wildlife biologist/planner is being hired for the Croatan and Uwharrie National Forests. This position will guide the implementation of the final Plan in conjunction with the Silviculturist and Fire Management Officer currently on staff. The Croatan recently hired new fire fighter positions as well. As the Plan is implemented, any new staffing needs that are identified will be evaluated.

COMMENT: Reference in the Plan in Chapter 2.0, Section 1.0, Appendix D and the Land Adjustment map.

RESPONSE: A reference was added to Chapter 2.7.1 where land ownership adjustments were directly discussed.

COMMENT: 4.23: One item in the table "longleaf pine savanna in stands < 61 years old" looks odd. Given the "restoration" objectives for MA1, one would expect several hundred acres for this item. Why is there not an item for longleaf pine 1-10 years old to reflect the results of activities during the decade? This table does not give an adequate picture of either the current habitat conditions or a picture for 10-years in the future.

RESPONSE: This table is not included in the final Plan. Acreage figures changed in Alternative E which invalidated the calculations in the table referred to.

COMMENT: "DEHNR" should be changed to "DENR" throughout the document.

RESPONSE: This was corrected.

COMMENT: Appendix I: Somewhere in the Plan/DEIS there should be a breakdown of all lands suitable for timber production according to vegetative community and seral stage. Perhaps it could be built into this table – or perhaps a graph or pie chart could be added. Table 1-1: It is not clear from this table how old growth fits into the analysis.

RESPONSE: Table 3.20 in the EIS Plant Communities section depicts vegetation communities by seral stage. In Appendix I, old growth would be included under 8A. Lands Not Suited for Timber Production, but all the lands classed as such are not listed in this Appendix. Standard 4.4.1.2 lists all management prescriptions that are classed as not suited for timber production.

A.11 STATE AND GOVERNMENT AGENCY COMMENT LETTERS

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Raleigh Field Office
Post Office Box 33726
Raleigh, North Carolina 27636-3726

June 14, 2002

RECEIVED
JUN 17 2002

Mr. John F. Ramey
160A Zillicoa Street
Post Office Box 2750
Asheville, North Carolina 28802

Dear Mr. Ramey:

The U.S. Fish and Wildlife Service (Service) has reviewed your letter of April 9, 2002 and biological assessment (BA) evaluating the biological effects of implementing the Land and Resources Management Plan (LRMP) for the Croatan National Forest. Based on the information contained in the BA, the US Forest Service (USFS) has determined that implementation of the LRMP is not likely to adversely affect the red-cockaded woodpecker (*Picoides borealis*, RCW), rough-leaved loosestrife (*Lysimachia asperulaefolia*) or southeastern bald eagle (*Haliaeetus leucocephalus*) and will not affect the red wolf (*Canis rufus*), eastern cougar (*Felis concolor couguar*) or sensitive jointvetch (*Aeschynomene virginica*). Our comments are provided in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 USC 1531 et seq.).

A major element of the LRMP will be to direct the USFS effort to conserve and recover the RCW. The RCW recovery effort would be directed by guidelines contained in the USFS's RCW Final Environmental Impact Statement for the Management of the Red-cockaded Woodpecker and it's Habitat on National Forests in the Southern Region and the Service's Technical/Agency Draft Revised Recovery Plan for the Red-cockaded Woodpecker. In accordance with the proposed LRMP, the RCW population on the Croatan National Forest will continue to be monitored with the use of color bands to mark individuals. Although not specifically discussed in the BA, it appears that Level IV RCW monitoring will be applied, as described in the Service's Technical/Agency Draft Revised Recovery Plan for the Red-cockaded Woodpecker. This monitoring level provides the best information on population trends, reproductive effort and success. Level IV b is suggested in the BA, since all individuals on the Croatan National Forest would be marked.

According to the BA, the LRMP to be implemented will include steps to recover and sustain a viable RCW population through the establishment of a RCW habitat management area (HMA) encompassing approximately 69,000 acres within the Croatan National Forest. The BA states a long-term population objective for the Croatan National Forest of between 151 and 169 active clusters. The USFS would establish 20 to 26 new clusters within the first 10 years of implementation and 50 to 63 clusters in the following 30 years. The Service's interest in the Croatan National Forest exhibiting a higher initial growth rate in the number of breeding pairs was discussed between Mr. John Hammond of this office and Ms. Kim Kennedy of the USFS (May 29, 2002). It appears that efforts to convert loblolly pine (*Pinus taeda*) to longleaf pine *(Pinus palustris*) will account in part for this population growth rate. The rate of conversion to longleaf described in the LRMP is expected to be optimal for minimizing impacts to the existing RCW groups.

The LRMP will include plans to restore longleaf pine (*Pinus palustris*) on 2,650 to 3,600 acres within the Croatan National Forest, where appropriate soils are found. Two-aged shelterwood cuts would be used to convert stands currently forested in mature loblolly pine (*Pinus taeda*) to longleaf pine. The USFS estimates that clearcutting might be necessary on 500 to 750 acres which are expected to have a low probability of successful conversion using the two-aged shelterwood treatment. Between 1,800 and 2,100 acres of existing pine plantations will be thinned for improving suitability as RCW habitat. As described in conversations between Mr. Hammond and Ms. Kennedy (June 10, 2002), the USFS intends to promote conversion to longleaf pine via prescribed burning and other methods that will favor survival of longleaf regeneration over off-site species with minimal impacts to the forest floor.

According to the BA, the USFS plans to register with the State of North Carolina 5,800 acres of new natural areas identified by the North Carolina Natural Heritage Program. Prescribed burning would be applied on appropriate fire return rotations in pond pine woodlands, pocosin, longleaf pine and other fire-adapted natural community types. Approximately 15 to 20 miles of system roads will be removed from use by off-highway vehicles and designated as hiking, biking or horse trails.

The LRMP would provide the general public with additional recreational opportunities on the Croatan National Forest and the USFS will conduct environmental review on each proposed recreational project. Pine straw raking would be authorized on a limited basis within a total of 600 acres of the Croatan National Forest. The USFS would prohibit pine straw raking near rare species element occurrences, wet savannas, flatwoods, natural areas, old growth patches, and within 1/4 mile of active RCW cluster sites.

The USFS proposes to work with neighboring property owners to consolidate national forest holdings for protecting natural resources including rare species habitat and riparian ecosystems, and to improve recreation management. As with planning for recreational activities, environmental reviews for these proposed actions will be conducted on a project by project basis.

The Service considers the prescribed burning activities presented in the BA for the LRMP to be generally favorable to rare and federally-listed species, with overall benefits accrued by the ecosystems present on the Croatan National Forest. As stated in our February 22, 2002 letter, the Service remains interested in potential fire effects to undetected RCW groups/clusters that may exist in pond pine woodlands and pocosins. The BA indicates that the USFS plans to establish yearly goals to survey habitat, including habitat that was not previously considered suitable for RCW

2

foraging or nesting. We are interested in how yearly goals, in terms of acreage, would be determined as well as what criteria the USFS will use to determine which areas will and will not be surveyed.

In executing prescribed burning activities, the Service urges the USFS to seek opportunities to work with the North Carolina Natural Heritage Program as well as other partners as appropriate, to conserve rare species that occur naturally in the Croatan National Forest's fire-maintained communities but also require pockets of infrequently burned habitat. One such species is the Arogos skipper (*Atrytone arogos arogos*). This cooperation will likely help preclude the need to list such species in the future.

The BA indicates that management actions described in the LRMP should be favorable to the bald eagle. Presently, one nest is known for the Croatan National Forest. Complimentary management would include extended timber rotations and protection prescribed for sections of the White Oak River and Brice's Creek.

The sensitive jointvetch is known to occur Beaufort and Hyde Counties, with historic records of the plant in Craven and Lenoir Counties. The BA identifies suitable habitat along the White Oak River north of Long Point, at the Mouth of Hancock Creek, and along lower Brice's Creek. It appears that the actions proposed in the LRMP would potentially favorable to conservation of this species.

Suitable habitat exists for the red wolf in the Croatan National Forest, however, the species is currently considered extirpated in Carteret, Craven and Jones Counties. Suitable habitat will be maintained under the LRMP, enabling future recovery efforts as determined. The suitable habitat is most likely contained in designated wilderness areas in the Croatan National Forest. USFS directives limit alterations to these habitats except for the purpose of restoring more natural conditions. As for the red wolf, suitable habitat for the eastern cougar will also be maintained.

The Service looks forward to working with the USFS to review recreational projects, land consolidation and other undertakings as they are proposed for the Croatan National Forest. We appreciate the opportunity to assist the USFS as the LRMP is implemented. Based on the information contained in the April 2002 BA, the Service believes that this project is not likely to adversely affect the bald eagle, RCW, rough-leaved loosestrife, or any other federally listed species, their formally designated critical habitat, or species currently proposed for federal listing under the Endangered Species Act, as amended. We believe that the requirements of section 7(a)(2) of the Act have been satisfied. We remind you that obligations under section 7 consultation must be reconsidered if: (1) new information reveals impacts of this identified action that may affect listed species or critical habitat in a manner not previously considered; (2) this action is subsequently modified in a manner that was not considered in this review; or, (3) a new species is listed or critical habitat determined that may be affected by the identified action.

If you have any questions regarding this matter, please contact Mr. John Hammond at (919) 856-4520 (Ext. 28). Thank you for your continued cooperation with our agency.

Sincerely,

Garland B. Pardue, Ph.D.
Ecological Services Supervisor

cc: Ralph Costa, FWS

United States Department of the Interior

OFFICE OF THE SECRETARY

OFFICE OF ENVIRONMENTAL POLICY AND COMPLIANCE

Richard B. Russell Federal Building
75 Spring Street, S.W.
Atlanta, Georgia 30303

March 28, 2000

MAR 31 2000

ER-00/58

Elizabeth Estill, Regional Forester
Southern Region
1720 Peachtree Road, NW
Atlanta, GA 30367

Dear Ms. Estill:

The Department of the Interior has reviewed the Draft Environmental Impact Statement for the Revised Land and Resource Management Plan for Croatan National Forest in Carteret, Cravan, and Jones Counties, NC.

We support the USFS in implementing the preferred alternative in the LRMP; however, we do not concur with the determination that the proposed action would not likely adversely affect federally-listed species. The U. S. Fish and Wildlife Service (Service) has several concerns about the procedures proposed to accomplish the preferred management alternative, and request additional information and clarification of portions of the proposal in the final EIS before any determination can be made.

The USFS proposes to revise the existing LRMP, dated 1986, for the CNF by updating the management goals, objectives, standards, and monitoring requirements, including new management areas and prescriptions, for the planning period 1998-2012. According to the DEIS, new management direction is developed for recovering the red-cockaded woodpecker (*Picoides borealis*)(RCW), recreation site developments, restoration of longleaf pine (*Pinus palustris*), fire, and access management. The DEIS describes five alternatives for managing the land and resources on the CNF, and describes the affected environment and discloses environmental effects of the alternatives considered.

The preferred management direction alternative, labeled C, includes restoration of longleaf pine, expansion of existing RCW populations, managing habitat for black bear (*Ursus americanus*) and neotropical birds, and improving fuels management in the wildland-urban interfaces. This alternative provides for restoration of natural communities using even- and two-aged silviculture systems, and expanding the RCW population by restoring longleaf pine to sites currently occupied by loblolly pine. In addition, fuel loadings would be reduced in wildland-urban interfaces, and recreation would be further developed as being primarily nature-based, emphasizing the CNF as a unique natural setting with a variety of recreational opportunities. The modified portion of the preferred alternative, labeled C Modified, includes the proposal of enlarging Pond Pine Wilderness for wilderness designation. This designation provides a biological linkage around Great Lake between the Sheep Ridge Wilderness to the north and the Pocosin Wilderness to the south.

The preferred alternative proposes converting mature loblolly pine (*Pinus taeda*) to longleaf pine. Longleaf pine would be on a 120-year rotation inside the RCW Habitat Management Area (HMA), and on a 80-year rotation outside the HMA. Pond (*Pinus serotina*) and loblolly pine would be on 80-year rotations inside the HMA, and on 60-year rotations outside the HMA. Prescribed burning of 25-50,000 acres per year is proposed, as burning parameters permit.

The preferred alternative proposes following management direction found in the final EIS for the management of the RCW and its habitat on national forests in the southern region (RCW EIS), emphasizing establishing suitable habitat for the recruitment of new RCW clusters. CNF is identified with Camp Lejeune (U.S. Marine Corps) and Holly Shelter Game Lands as restoring one viable population of RCW. The CNF long-term RCW population objective is 151-169 clusters within a 46,656 acre RCW HMA over 30 years. There are approximately 63 clusters of RCWs currently on the CNF.

GENERAL COMMENTS

We have concerns about the continued urban development around the CNF, and how this development will impact the successful completion of the goals proposed by the USFS. For example, the USFS has not discussed the establishment of buffer zones surrounding the forest lands. It would appear necessary to establish these buffer zones to successfully manage the natural resources on the forest lands. Buffer zones can be established by simple land acquisition or through conservation easements on nearby forested property (i.e., Weyerhaeuser forested lands). We recommend the buffer zone proposal be considered and addressed in the final environmental documentation. Other alternatives and strategies that may assist the CNF in accomplishing their long-term management goals should also be considered.

SPECIFIC COMMENTS

Endangered Species Act

Appendix E-1 of the DEIS considers potential project impacts on federally-listed species. The DEIS concludes the proposed project is not likely to adversely affect the RCW, bald eagle (*Haliaeetus leucocephalus*), rough-leaved loosestrife (*Lysimachia asperulaefolia*), and American alligator (*Alligator mississippiensis*). The DEIS also concludes the proposed project will have no effect on the red wolf (*Canis rufus*), eastern cougar (*Felis concolor cougar*), and sensitive jointvetch (*Aeschynomene virginica*).

Based on the available information, the Service concurs that the proposed project is not likely to adversely affect the bald eagle, American alligator, and rough-leaved loosestrife. In addition, the Service concurs that the proposed project will have no effect on the red wolf, eastern cougar, and sensitive jointvetch. However, the Service cannot concur with the determination that the proposed action is not likely to adversely affect the RCW. Several factors necessary for the successful recovery of the RCW outlined in the RCW EIS have been modified in the USFS's proposed management plan. For example, the proposal to change foraging habitat guidelines is not consistent with the guidelines of the referenced EIS or the Service's policies. Research must be completed that demonstrates what effect varying levels of substrate will have on RCWs before site-specific foraging guidelines are accepted. No such data were found in the DEIS and LRMP.

Before we could conclude the section 7 consultation, we request the USFS address the following issues related to the recovery of the federally-protected RCW in the final EIS:

- The proposed reduction of forage requirements from 8,400 to 6,000 ft^2 of basal area for each territory.
- The proposed reduction of forage requirements from 6,350 to 4,000 stems.
- The proposed deviation from closing all unauthorized roads in nest areas.

Further explanation is required to understand how these recovery plan deviations might be accomplished and still provide adequate habitat contributing to the successful recovery of the RCW. Only with additional information describing the potential affects these modifications might have on the species could the Service attempt to concur with the determination that the proposed project is not likely to adversely impact the RCW.

Additionally, the following corrections, inconsistencies, and issues relating to the RCW in the LRMP and DEIS need to be addressed in the final EIS:

- Define and use language consistent with species terminology. For example, are "nest areas" the same as clusters in relation to the RCW?
- The plan to move from MIL 3 (Management Intensity Level) to MIL 2 is not consistent with direction in the RCW EIS (ref., LRMP 2.4-2.5).
- Silviculture methods related to final cuts are not completely consistent with options available in the RCW EIS. For example, the CNF will not be able to remove all overstory trees in MIL 2 or 3, and cannot retain a residual basal area of 10 in MIL 3; 25-30 is the minimum.
- Pocosins cannot be assumed to be unsuitable habitat for RCWs. Emerging information and knowledge regarding RCW occupancy of pond pine forests proves that this habitat must be considered as an issue in RCW management (e.g., helicopter surveys on Holly Shelter Game Lands, lands surrounding Camp Lejeune and CNF, Tyrell Co., Dare Co. Bombing Range, Alligator River NWR, etc.)
- Need to describe how many suitable timber management pine acres are not included in the RCW HMA, and why they are not included, because more pine acres could equal more RCWs. Although this is particularly important for longleaf pine, we need to know for all pine acreage.
- LRMP reports approximately 30 percent of the CNF (53,000 acres) is currently included in the RCW HMA, but indicates elsewhere that acres of varying amounts not equaling the total RCW HMA will be maintained. These figures are confusing and should be organized for better interpretation (ref., LRMP 2.3, 2.4, and elsewhere)
- Explain spatially how it is possible to regenerate ~400 acres per year (a portion of which is >30 years old for foraging habitat) without impacting the foraging requirements for active and planned recruitment clusters.

Fish and Wildlife Coordination Act

The LRMP and DEIS proposes a three-pronged approach to maintaining biological diversity on the CNF. This includes the management of habitat for RCWs, black bear, and neotropical birds. The issues relating to RCW habitat management have already been addressed. The Service's concerns relating to black bear and neotropical birds management are described below.

We have several concerns about the management of early successional habitat within the boundaries of the proposed natural areas, especially as it relates to mechanized habitat alterations in pocosins. The current bear population on the CNF is reported as moderate to high, and it is supposed that this population is supported by the current forage availability in the pocosin habitat. It is unclear if the CNF's intent is to increase the bear population beyond the current level by creating early successional habitat that exceeds the natural distribution of that habitat type. Furthermore, the basis for these planned early successional habitats is uncertain. We request the long-term projections for the bear population be clarified in the final EIS, and evaluate the existing early successional habitats before artificially creating new early successional habitat.

The proposed plan's objective includes reducing disturbance by motor vehicles in bear habitat management areas by reducing the miles of open roads. We are concerned with the construction of new roads in and around bear habitat, and the use of future and existing illegal off-highway vehicle (OHV) roads. New road construction should be prohibited and existing roads should be removed when feasible, especially in sensitive habitat management areas. Existing roads and right-of-ways should be kept at a minimum width to prevent habitat fragmentation and reduce edge effects on

wildlife resources. All unauthorized OHV roads should be closed, posted, gated, revegetated, and a strict enforcement program initiated to further reduce potential impacts to natural areas and wildlife resources. A monitoring plan should be implemented to assess the impact vehicular traffic has on the surrounding portions of the CNF, and an effective response plan designed and implemented to react to negative impacts on the wildlife resources. A brief, but thorough, description of the proposed limited access plan should be included in the final environmental documentation.

Lastly, we recommend the following be addressed in the final EIS and LRMP to further clarify the potential impacts on fish and wildlife resources.

- Use scientific and common names at first reference of a species in the text. Using only common names can be challenging when reviewing documents of this nature since common names are not always recognized or accepted.

- Establish prescribed burning cycles that minimize disturbance to wildlife and avoids burning all of a particular habitat type. Invertebrates should be considered when prescribing burns during certain times of the year because the dormant life cycle of some species decreases their mobility and prevents escape from the burn. In addition, complete habitat burns further eliminate refugia (ref. LRMP Sec.1, V., B., pg. 2.41).

SUMMARY

We believe the USFS has not completely or adequately addressed the issues of potential impacts to the RCW to determine that the proposed action is not likely to adversely affect this species. In addition, we believe the proposed habitat management plan for black bear, neotropical birds, and other fish and wildlife resources needs additional clarification to accurately determine the potential impacts on these resources. We recommend the preceding issues be addressed in the final environmental documentation.

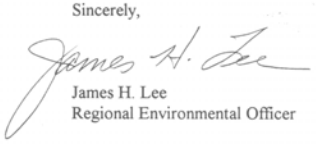
For those species in which the Service concurs that the proposed project is not likely to adversely affect, we remind you that obligations under section 7 consultation must be reconsidered if: (1) new information reveals impacts of this identified action that may affect listed species or critical habitat in a manner not previously considered; (2) this action is subsequently modified in a manner that was not considered in this review; (3) a new species is listed or critical habitat determined that may be affected by the identified action.

In addition to the above comments and recommendations, we recommend the final EIS be organized such that all topics are discussed collectively under each management plan alternative. Unfortunately, the current format is cumbersome and difficult to interpret, which leads to miscalculations of data and complications in accurately assessing impacts to fish and wildlife resources. We recommend the components of the environmental document, including RCW recovery management, longleaf pine

restoration, and fire and access management, be presented as a complete section under each alternative. Furthermore, a description of the affected environment and environmental effects of the alternatives should be included.

Thank you for the opportunity to provide comments on this Draft EIS. If you have questions related to fish and wildlife resources, please contact Bruce Bell at 404/679-7089.

Sincerely,



James H. Lee
Regional Environmental Officer

CC: John F. Ramey, Forest Supervisor
National Forests in North Carolina
160A Zillicoa Street
Asheville, NC 28801

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

APR - 3 2000

Copies sent to PLN + Ranetta

March 31, 2000

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Mr. John F. Ramey
Forest Supervisor
Croatan Management Team
U.S.D.A. Forest Service
P.O. Box 2750
Asheville, NC 28802

SUBJ: EPA Comments on the USDA Forest Service (FS) Draft Environmental Impact Statement (DEIS) for the Revised Land and Resource Management Plan for the Croatan National Forest; Carteret, Craven and Jones Counties, NC; CEQ No. 990488

Dear Mr. Ramey:

Pursuant to Section 102(2)(C) of the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, the U.S. Environmental Protection Agency (EPA) has reviewed the subject DEIS for the revised Land and Resource Management Plan (revised Plan) for the Croatan National Forest (CNF). EPA principally supports the revised Plan's goals, which include promoting the recovery of the red-cockaded woodpecker (RCW) and its longleaf pine habitat traditional to the area.

We offer the following comments on the DEIS for your consideration during the development of the final Plan in the Final EIS (FEIS):

o Alternatives

The DEIS discusses five management alternatives -- A, B, C, C-Modified (C-Mod.), and D -- with Alternative C often being lumped with C-Mod. as C/C-Mod. in the DEIS. The alternative selected by the FS in the DEIS is Alternative C. In general, Alternative A is the no-action alternative that would allow continuance of the current management plan, Alternative B is a low-impact timber management proposal emphasizing nature-based recreation and resulting in a relatively slow expansion of RCW habitat; Alternative C emphasizes conversion of loblolly pine (harvesting) to longleaf pine and thereby promoting the recovery of RCW in a relatively short timeframe; Alternative C-Modified (C-Mod.) is the same as C except that it provides for the expansion of the Pond Pine Wilderness; and Alternative D emphasizes more human accessibility and use of the CNF. As such, the management directions of these action alternatives tend to

maximize one of various interest themes voiced by the public (i.e., B - conservation; C/C-Mod.-harvesting, conversion & RCW recovery; and D: public use and access).

Of the alternatives presented, EPA favors aspects of Alternatives C/C-Mod. and B and does not favor Alternatives A or D. We offer the following specific comments:

▸ Alternative A - Given the many goals of the revised Plan listed on page I-1, it is reasonable that the existing (no-action) plan should not be continued without modification.

▸ Alternative B - This alternative limits the amount of CNF management by significantly reducing the amount of lands suitable for timber production (10,890 acres compared to the existing condition: 24,985 acres) and promotes uneven-aged restoration, closure of logging roads (50 miles), and designation of White Oak River and Brice Creek as wild and scenic rivers. No clearcutting is proposed as a harvesting methodology. Environmentally, EPA supports these management objectives. However, Table S-7 indicates that Alternative B does not restore any longleaf acreage important for RCW recovery compared to the existing plan (60 ac/yr), C/C-Mod. (400 ac/yr) and D (23 ac/yr), and proposes no old growth management areas. Accordingly, RCW recovery would take some 50 years as opposed to 30 years.

▸ Alternative C - This FS-preferred alternative provides extensive restoration of longleaf pine communities (400 ac/yr) which is to result in relatively rapid RCW recovery within 30 years. It also provides for logging road closures (30 miles); old growth management areas; more habitat for black bears, neotropical birds, and turkeys; primarily nature-based recreation that would include off-highway vehicles (OHV) but shift such use to areas with less sensitive plant species; and the designation of White Oak River and Brice Creek as wild and scenic rivers. However, the Alternative C would also slightly increase the amount of lands suitable for harvesting (26,774 ac compared to the existing plan: 24,985 ac), reforest through even- and two-aged restoration, and allow extensive annual clearcutting (273 ac/yr) to provide areas for longleaf pine restoration for RCW recovery. The timbering (primarily loblolly pine) would also provide more logging jobs and harvest income than the other alternatives. Environmentally, EPA supports many of these management objectives but does not necessarily support the additional harvesting or the harvesting by clearcutting, and prefers uneven-aged over even- or two-aged reforestation to promote biodiversity.

▸ Alternative C-Mod. - This modification of Alternative C would add the environmentally attractive feature of enlarging "...the Pond Pine Wilderness to the east and [providing] a biological linkage around Great Lake to the Sheep Ridge Wilderness to the north and Pocosin Wilderness to the south" (pg. S-4). Based on the information provided, EPA would support such a wilderness extension with wildlife corridor connection.

▸ Alternative D - This alternative promotes additional human access and use of the CNF. Environmentally, this usually involves additional impacts to national forests and may diminish the very aesthetic values of a national forest that are being toured or recreated by the visiting public

and that therefore should be protected within a national forest.

o Additional Comments

▸ Consistency - Based on discussion with the U.S. Fish and Wildlife Service (FWS), the revised plan may not be consistent with the FWS Final EIS (FEIS) on RCW management. We request that the RCW FEIS be revisited and the final revised plan be made consistent with it for all of the presented management alternatives. EPA will principally defer to the FWS in this regard and encourage your further coordination with the FWS.

▸ RCW Recovery Concept - It is unclear how some of the alternatives can manage for RCW recovery in 30 years (including C/C-Mod.) while others manage for recovery within 50 years. It is our understanding that RCWs prefer over-mature pines, so that conversion of loblolly to longleaf pines through clearcutting would seem to require a finite amount of time to achieve a mature stand regardless of the rotation applied. Is a 30-year-old longleaf pine mature enough to be considered suitable/preferred habitat for RCWs or would 40-50 year old trees be required?

Under Alternative C/C-Mod., which proposes clearcutting, conversion and increased harvesting, it is also unclear if the harvesting of loblollys and conversion to longleafs is being done to benefit RCW recovery. It would seem to us that the reverse should be the management goal, i.e., the selected revised Plan should promote the recovery of the RCW while still allowing timber harvesting -- but only at a level consistent with such recovery as outlined in the RCW FEIS. Initially, alternatives such as C could actually be counterproductive to RCW recovery due to the proposed clearing of mature loblolly habitat that is presumably suitable for nesting and foraging. In addition, the effects of harvesting on other protected as well as common species is also of concern in the Revised Plan.

▸ Water Quality - The management goals on page I-1 do not specifically mention water quality, although general reference to compliance with state and federal Best Management Practices for "wetlands, timber harvesting, soil disturbance, and pesticide use" is made on page III-24. Accordingly, we are concerned about the revised Plan's level of risk for water quality degradation within the CNF. Specifically, we believe that the revised Plan should insure that wetlands and other waterbodies are buffered from any clearcutting activities and their associated impacts such as sedimentation. All such waterbodies within the CNF should therefore be separated by a natural riparian buffer strip that is a minimum of 100-ft wide from any harvesting or land clearing activities in order to minimize water quality impacts. Although relevant to all waterways, buffers are particularly important for any pristine waterbodies (e.g., wild and scenic rivers) and any seriously degraded ones listed as impaired waterbodies pursuant to Section 303(d) of the Clean Water Act. The FEIS should specifically discuss any 303(d) waterbodies in the CNF and the selected revised Plan should preclude harvesting in these areas, particularly if impairment is already due to sediment loading.

In addition to preserving riparian buffers along streams and other waterbodies, we are concerned that urban/suburban development and its associated water quality and other impacts is encroaching on the boundaries of the CNF. Acquisition of a reasonable buffer zone separating the CNF from existing or potentially developed areas should be considered to preserve the integrity of the Croatan ecosystem. Alternatively, remaining open areas adjacent to the CNF could be zoned by Carteret, Craven and Jones Counties for compatible uses.

▸ Harvesting and Conversion Acreage - Table S-7 indicates that Alternative C/C-Mod. proposes 273 acres per year of clearcutting and 400 acres per year of conversion from loblollys to longleafs. Intuitively, we would expect that the two acreages might be more similar. Apparently, existing open areas such a CNF savannas would also be converted to longleaf pines to attain the 400 acres per year. If so, what environmental effects would forestation of savannas have on the overall ecology of the CNF? The FEIS should clarify.

▸ Road Closures - Road closures proposed by some alternatives should not only physically close roads to the public and loggers (gated), the abandoned roadway alignments should also be restored (disced and temporarily grassed) to control erosion and thereby improve CNF water quality, and to allow opportunistic species to initiate the successional process.

Also related to this issue, the FEIS should discuss the consistency of the DEIS with the FS Roadless Initiative under which more potential national forest wilderness areas are to remain roadless. Was, for example, the modification of Alternative C into C-Mod. in response to this Initiative?

▸ Pocosin/Pond Pine Patches - Table II-12 on page II-28 lists various CNF areas (prescriptions) that would be managed specific to the characteristics of that prescription. One such area of particular concern to EPA is the "Pocosin/Pond Pine Patches" prescription. The management approach taken by the alternatives for this area (over 13,000 ac) should be further discussed in the FEIS. For example, it is unclear if the difference in the pocosin/pond pine patches acreage listed for Alternative B (14,229 ac) and Alternative C (13,377 ac) implies that more pocosins would be *managed* under B or if the difference would be *harvested or filled* under C. The FEIS should discuss. In regard to the management of these areas, EPA would not agree with routing logging roads through such wetlands or their logging. We also understand from the FWS that pocosins are potential RCW habitat and therefore should furthermore not be disturbed.

▸ Water-Based Recreation - EPA wishes to emphasize that water recreational activities in the CNF should be limited to "swimming, canoeing, fishing, and camping along rivers" (pg. S-2) as opposed to inclusion of motorized vehicles such as power boats and jet skis.

▸ Military Exercises - It is unclear if any military exercises are occurring within the CNF (e.g., Camp LeJuene; Cherry Point). If so, such missions should be reconsidered or controlled within the final Plan. The FEIS should clarify.

▸ Invader Species - Page III-62 indicates that (old field) broomsedge (*Andropogon virginicus*) is an invader species of disturbed pocosins. Based on our experience with jurisdictional determinations, it is *Andropogon glomeratus* (FACW) rather than *A. virginicus* (FAC) that is one of the primary sere floristic species along with *Carex cherokeensis* that colonize pocosin wetlands. *A. virginicus* is associated with non-wetland succession.

The invader species were also characterized on page III-62 as "often weedy." Should the listing of the Virginia chainfern (*Woodwardia virginica)* in this subsection imply that it is a "weedy" species, it should be noted that EPA would not characterize the chainfern as a weedy species.

o Summary

Although we principally agree with the goals of the revised Plan, we believe that Alternative C preferred by the FS should be more consistent with the FWS FEIS on the RCW and that it could potentially clearcut too much timber too rapidly for conversion to longleaf pine and consequently be counterproductive to RCW recovery. We also believe that water quality should be more emphasized in the management goals of all the revised Plan in general and the management alternatives specifically.

Of the alternatives presented, EPA favors aspects of Alternatives C/C-Mod. and B, and does not favor Alternatives A or D. We believe that Alternative C/C-Mod. should be further modified or that a hybrid alternative that blends various components of C-Mod. and B should be developed by the FS. Such an alternative should provide conversion of loblolly to longleaf pine to promote RCW recovery and timber, but not as aggressively as C/C-Mod. but more accelerated than B (e.g., 40 yr timeframe). We also strongly recommend that the selected harvesting methodology and its magnitude be consistent with the options in the FWS FEIS on the RCW. Also, any clearcutting should be a mosaic of small acreages and only in areas with low soil erosion potential. We further believe that old growth areas should not be logged and that OHV use be limited to the level proposed in B and shifted to areas of less sensitive plant (and hopefully also animal) species as proposed in C/C-Mod. In general, we believe the management alternative selected or developed by the FS should propose a revised plan that promotes the recovery of the RCW while still allowing timber harvesting -- but only at a level consistent with such recovery as outlined in the RCW FEIS.

Because the FWS administers the Endangered Species Act, their comments on the management alternatives -- particularly their preferred alternative -- are critical. If the FWS requires a more rapid and extensive (in terms of number of RCW clusters) recovery than the EPA-proposed hybrid might provide (and 30-year-old trees are indeed mature enough to be considered suitable/preferable RCW habitat), EPA could concur with Alternative C/C-Mod. with the stipulations of greater emphasis on buffers and water quality, more limited OHV use, controlled and spatially-distributed clearcutting, and closer consistency with the RCW FEIS.

o EPA DEIS Rating

EPA rates this DEIS as EC-2. That is, although we overall support the goals of the revised Plan, we have some environmental concerns with the FS-preferred Alternative C related to the amount of harvesting, harvesting methodology, and consistency with the RCW FEIS. We also request additional information in the FEIS for this proposed project in the form of a revised Plan that further modifies Alternative C/C-Mod. or hybridizes Alternatives C-Mod. and B.

We appreciate the opportunity to review this DEIS. Should you have questions regarding our comments, you may wish to contact Chris Hoberg (404/562-9619) or Ben West (404/562-9643) of my staff.

Sincerely,

Heinz Mueller

Heinz J. Mueller, Chief
Office of Environmental Assessment
Environmental Accountability Division

cc: FWS - Raleigh, NC

North Carolina
Department of Administration

James B. Hunt, Jr., Governor

Katie G. Dorsett, Secretary

April 3, 2000

Mr. John Ramey
USDA Forest Service
P.O. Box 2750
Asheville, NC 28802

Received APR 10 2000 AF

Dear Mr. Ramey:

Re: SCH File # 00-E-0000-0312; Draft Environmental Impact Statement Proposed Land and Resource Mangement Plan for the Croatan National Forest

The above referenced project has been reviewed through the State Clearinghouse Intergovernmental Review Process. Attached to this letter are comments made by agencies reviewing this document.

Should you have any questions, please do not hesitate to call me at (919) 807-2425.

Sincerely,

Chrys Baggett
Ms. Chrys Baggett
Environmental Policy Act Coordinator

Attachments

cc: Region P

116 West Jones Street Raleigh, North Carolina 27603-8003 Telephone 919-808-2425
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NORTH CAROLINA STATE CLEARINGHOUSE
DEPARTMENT OF ADMINISTRATION
INTERGOVERNMENTAL REVIEW

STATE NUMBER: 00-E-0000-0312 H09
DATE RECEIVED: 01/11/2000
AGENCY RESPONSE: 03/29/2000
REVIEW CLOSED: 04/03/2000

Ms. Renee Gledhill-Earley
Clearinghouse Coordinator
Dept. of Cultural Resources
Archives-History Bldg.
Raleigh NC

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Dept. of Transportation
Eastern Carolina Council

PROJECT INFORMATION
APPLICANT: USDA Forest Service
TYPE: National Environmental Policy Act
ERD: Draft Environmental Impact Statement
DESC: Proposed Land and Resource Mangement Plan for the Croatan National Forest

Craven

The attached project has been submitted to the N. C. State Clearinghouse for intergovernmental review. Please review and submit your response by the above indicated date. If additional review time is needed, please contact this office at (919)807-2425.

AS A RESULT OF THIS REVIEW THE FOLLOWING IS SUBMITTED:

- [x] NO COMMENT
- [ ] COMMENTS ATTACHED

SIGNED BY: Renee Gledhill-Earley

DATE: 1/28/00

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NCDENR

JAMES B. HUNT JR.
GOVERNOR

BILL HOLMAN
SECRETARY

NORTH CAROLINA DEPARTMENT OF
ENVIRONMENT AND NATURAL RESOURCES

March 28, 2000

John F. Ramey, Forest Supervisor
National Forests in North Carolina
160 A Zillicoa St.
Asheville, NC 28801

Dear Mr. ~~Ramey~~ John:

The NC Department of Environment and Natural Resources has reviewed the Draft Environmental Impact Statement (EIS) for the revised Land and Resources Management Plan for the Croatan National Forest. These and the attached comments from divisions of this department are offered to assist in your effort to develop a Final EIS and conduct appropriate management activity on this important public resource.

This department has a long history of supporting progressive management of the National Forests we are fortunate to have in this state. We have joined the Forest Service in advocating multi-purpose management and the provision of diverse public use on and economic opportunities from our Forests. Simultaneously, we have encouraged the integration of the Forests with regional ecological patterns, as well as the changing needs and expectations of surrounding communities. More specifically, this department has consistently advocated for wilderness and river designations of outstanding areas within the forests, to meet the needs of our growing population for this type of natural resource and use opportunity. Likewise, we have been a proponent of protecting roadless areas for their potential as future wilderness areas. Further, we have advocated for appropriate trails development and maintenance, the expanded use of controlled burns as a management practice, and protection of water quality through the use of BMPs. Over the years we have been pleased with the Forest Service's openness to these positions and willingness to respond to our concerns.

With respect to the Croatan Draft EIS, this department supports Alternative C-Modified. It appears to achieve the balance necessary to best satisfy the multiple objectives required to meet the needs of this developing State and the Nation.

The Draft EIS is by its nature, both a sounding board and a generalized proposal. As you progress toward the issuance of a Final EIS, please consider the attached comments for possible refinements in the documentation. To the extent that some of these comments are at a finer level of detail, please integrate them into your more site specific management planning processes.

We appreciate the opportunity to comment on the Draft EIS. Do not hesitate to contact me or any of the commentors if there are questions or a desire for further discussion.

Sincerely,

Bill Holman

Attachment

Thanks for briefing our staff on the Croatan Plan!

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STANFORD M. ADAMS
DIRECTOR

NORTH CAROLINA DEPARTMENT OF
ENVIRONMENT AND NATURAL RESOURCES

DIVISION OF FOREST RESOURCES

2411 Old US 70 West
Clayton, NC 27520
March 17, 2000

MEMORANDUM

TO: Melba McGee, Office of Legislative Affairs

FROM: Bill Pickens, NC Division Forest Resources

SUBJECT: DEIS for the Land Resource Management Plan for Croatan National Forest

PROJECT #: 00-0312

The North Carolina Division of Forest Resources has completed a review of the DEIS for the revised Land and Resource Management Plan for the Croatan National Forest. Overall the LRMP adequately address the issues identified the scoping process and the forest management goals and objectives for each of the major issues. We support the forest wide standards that will be used to implement the plan. Our comments to specific issues or standards are provided below.

Most of our questions and concerns apply to specific management activities that will be used to carry out the desired condition identified in the LRMP. These are site specific and as such cannot be addressed in the LRMP. Subsequent environmental assessment for a specific activity will allow the opportunity to address these concerns.

We support the Land and Resource Management Plan and the preferred Alternative C developed to address the issues and provide management strategy for the Croatan National Forest.

1. We like the ecosystem classification system used to develop the Croatan National Forest LRMP. It allows for accurate assessment of a species suitability for certain sites and identifies environmental conditions on which to base appropriate management decisions.

2. The restoration of longleaf pine is an important issue to the North Carolina Division of Forest Resources. In the past too many acres of historically longleaf forests were converted or reverted to loblolly pine. The restoration plan outlined in the LRMP fits well with Division's Longleaf Initiative. The management activities used by the CNF to restore longleaf will help with the restoration effort

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across the state on both public and private lands. Clearcut harvest of existing timber type, intensive site preparation, and the use of prescribed fire or herbicides to control vegetative competition are essential for establishment. The LRMP outlines the necessary management activities to successfully establish longleaf pine.

3. The activities proposed in the LRMP that address the wildland-urban interface concerns have the full support of North Carolina Division of Forest Resources. Efforts to fireproof forestland adjacent to high value private property through hazard reduction prescribed burns and mechanical fuel reduction to create a defensible zone are encouraged. We concur with the designation of WUI area and the standards and probable management practices developed for these areas.

4. Prescribed fire is an extremely useful and environmentally beneficial tool for the forest manager. It is critical for the maintenance of fire ecosystems found on the CNF. Longleaf pine is a good example of such an ecosystem. The LRMP outlines an aggressive prescribed burn program that we support. However, we are concerned about the use of prescribed fire in pocosins. The highly volatile fuels, organic soil, large contiguous tracts, and restrictions on management activities within wilderness designated areas contribute to the difficulty of conducting prescribed burns in this ecosystem. Smoke management guidelines severely limit number of acres that can be burned with the fuel loads typical of a pocosin. More research to determine soil moisture levels that minimize organic soil ignition and restoration of the hydrology is needed before a prescribed burn program is initiated.

5. Prescribed burns in bear HMA is restricted in section 3.40 of the LRMP so that no burns are allowed during bear inactivity from Dec 1 to March 15. A great deal of HMA appears to include pocosins or pond pine forests with dense understory dominated by pocosin vegetation. High fuel loads are likely in those areas that have not been burned recently. A dormant season burn may be needed to reduce this fuel load. The above restriction would not allow burning in the dormant season.

6. Numerous references are made in the LRMP as to the role natural fire had in the maintenance of the pre-settlement vegetation desired on the CNF. While we have no objection to the goal of restoring the CNF to pre-settlement vegetative conditions through the use of fire, there is a growing belief that fire set by native Americans likely played a more significant role in the composition of southern forests than natural, lightning caused fires.

7. Little mention of management efforts directed at the restoration or establishment of Atlantic White Cedar is found in the LRMP. The range of this species is estimated to be 10% of its former range. It is likely that many site suitable for Atlantic White Cedar establishment are present on the CNF.We feel the restoration and management of this unique ecosystem should be included in the LRMP. At a minimum management and perhaps expansion of existing populations should be considered.

8. Appendix E describes the silvicultural methods that will be used to regenerate forest species for various site conditions. We strongly support the methods as sound and proven forest management that will result in successful stand establishment. The use of herbicides to is another silvicultural tool that can help with seedling establishment. Herbicide use for establishing longleaf, particularly on those sites with abundant herbaceous competition, is not included in the LRMP. We feel that the use of herbicides for site preparation or herbaceous weed control should be included as an option for establishment. Well-written standards for herbicide application exists that provide for worker safety and minimize any adverse effect to the environment.

We appreciate the opportunity to comment on the DEIS and LRMP for the Croatan National Forest. We look forward to continued close cooperation on issues of common interest to both agencies. I can be contacted at 919-553-6178 is you have any questions.

cc: Stan Adams
Derryl Walden
Ralph Cullom
Warren Boyette

DIVISION OF PARKS AND RECREATION

March 17, 2000

MEMORANDUM

TO: Melba McGee, Bill Flournoy

FROM: Ann Prince

SUBJECT: DEIS-Management Plan, Croatan National Forest

REFERENCE: 00E-0312

Overall, we support the C-modified alternative, the modification providing for designation of Pond Pine Addition B as Wilderness, with revisions to encompass our concerns, as summarized below and detailed in the attachment. While further revisions are needed, the proposed plan revision has made an excellent attempt to address the myriad natural resource, recreational, and other objectives of the Croatan National Forest.

We have some additional concerns based on recent information received from Jeff Walters, a biologist formerly employed under contract to the US Forest Service to create a 25-year plan for recovery of red-cockaded woodpeckers on the Croatan National Forest. According to Mr. Walters, the plan was apparently followed by the Croatan NF from 1987 to 1997, resulting in an expansion of red-cockaded woodpecker populations. It is unclear to us how this plan relates to the current proposed plan and why it is not discussed in the document. Has there been a recent (since 1997) decline in red-cockaded woodpeckers? Does the proposed plan revision support or diverge from the management direction of the 25-year plan? If the proposed plan revision diverges from recommendations made in the 25-year plan, what is the basis for this divergence? Mr. Walters specifically mentioned concerns about the Management Areas selected and others specifically not selected for red-cockaded woodpecker recruitment efforts, and about Management Areas where longleaf restoration efforts occur in the vicinity of areas targeted for red-cockaded woodpecker population increases. The plan revision needs to address these concerns.

The attached document provides detailed comments. Because they are extensive, the following table summarizes our comments and highlights our key concerns. The page number refers to the page of our comments. The number in parentheses after the key point refers to the page number of the Croatan plan revision.

- Use of red-cockaded woodpeckers, black bear, and neotropical migrants as indicator species not truly indicative of underlying ecosystem health (1.11-1.12)

- Definitions of Sensitive and Locally Rare species unclear and listings not sufficiently inclusive (2.6 and 2.55)
- Creation of early successional habitat in Masontown and Union Point Pocosin potentially damaging to natural resources (2.12)
- Revision of list of bird species utilizing riparian habitat needed (2.15-2.17)
- Recreational opportunities should not be increased at expense of biological resources (2.23-2.24)
- Prescribed burning of Wilderness strongly recommended to perpetuate natural fire regime (2.26)
- Inclusion of indicator species linked with high quality herbaceous layer in pine savanna and flatwoods needed (2.34)
- Optimal prescribed fire frequency and seasonality for longleaf pine savannas and flatwoods of three years in growing season (four or five inadequate) and prescribed burn planning for invertebrate populations, particularly those which are rare 2.40-2.41)
- Land acquisition priorities and tools, Croatan linkage with other public lands, and suitability of new acquisitions for timber management (2.47-2.48, 2.59, 2.60, 2.61)
- Natural revegetation of firelines (2.53)
- Targeting basal area densities to mimic natural stand densities (2.57)

All of the comments here are ones that we would like to see included in the prescriptions. The majority of our recommendations address omissions or lack of clarity. Our strongest concerns focus on the management prescriptions for the Wilderness, Pine Savanna and Flatwoods (RCW Habitat Management Area),, Wildland Urban Interface, Hardwood Restoration, Black Bear Habitat, Natural Areas, Old Growth, and OHV, since these areas together encompass or otherwise affect identified natural areas, those accepted for special designation as well as those which were not. In particular, we are concerned about :

- Damage to natural resources resulting from the prohibition on prescribed burning in Wilderness
- Need for adequate field assessment of proposed longleaf restoration sites in Pine Savanna and Flatwoods (RCW Habitat Management Area) to determine historic composition and methodology for restoration, since some of this encompasses significant natural areas not accepted
- Excessive emphasis on red-cockaded woodpeckers in prescription for Pine Savanna and Flatwoods (RCW Habitat Management Area) to the exclusion of other rare species and plant communities
- The lack of a detailed set of standards for the Wildland Urban Interface and a forecast of long-range impacts of this management designation on undisturbed national forest acreage

- Potential damage to natural resources of management other than prescribed burning for early successional species in the Black Bear Habitat
- Unclear restrictions on the allowance for red-cockaded woodpecker management in Natural Areas
- The need to further expand the Millis Road Savanna Natural Area to the south and east to incorporate additional rare species and rare communities concentrations
- The need to add the accepted Natural Areas and new Wilderness areas to the North Carolina Registry of Natural Heritage Areas as part of the plan finalization
- Lack of clarity in the management prescription for Old Growth and need for expansion of Old Growth designation on Holston Creek and on Hunters Creek, parts of which have been inappropriately designated as Pine Savanna and Flatwoods or Pine Restoration sites or, in the case of Holston, other designations
- The inadequate protection of portions of Union Point Pocosin and Masontown Pocosins proposed natural areas, designated as Old Growth, since Old Growth Wet Pine Forests are placed on a long rotation
- Increased vulnerability of Nine Foot Road-Broad Creek Pine Woods and Pringle Road Bay Rims natural areas to illegal OHV access and resulting damage due to proposed location of OHV routes

Chapter 4 and 5:.....Page 24

No major concerns in these chapters.

Appendix D.....Page 25
- Highest priority for acquisition of high quality longleaf stands (with native herbaceous layer), in part as replacement of 700 acres lost to Havelock bypass
- Specific comments on properties to be exchanged.

Appendix E.....Page 27
- Comments focused on Longleaf Restoration: Bedding and Fertilization, Clearcutting, Planting Method, Control of Loblolly Growth Following Planting, Control of Hardwoods, and Prioritizing Longleaf Restoration Projects; Longleaf Ecosystem Maintenance While Extracting Timber: Uneven-aged Management; and Pinestraw Raking.

Draft Environmental Impact Statement.....Page 31
- Assessment of economic effect of fourfold increase in timber harvest for limited period of time (S-1 through S-3)
- Assessment of rarity of Mesic Pine Flatwoods natural community type and resulting disqualification of some natural areas containing this community type (III-47 through III-48)
- Proposal to increase the number of wildlife openings, particularly within powerline rights-of-way which serve as important rare species habitat (III-104 and III-122).

/AP

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March 17, 2000

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/AP

Attachment: Detailed Comments on Proposed Croatan Management Plan Revision, 00E-0312

Chapter 1: The Need for Change

1.2, Forest Description: It should be emphasized that the longleaf pine natural community type, with **all** its components (canopy, shrub layer, and herbaceous layer) is globally rare. It has been reduced to less than 3% of its historic distribution, with old-growth examples even more rare, contributing to the decline of the Federally Endangered red-cockaded woodpecker.

1.6, Relationship with other Plans: The relationship of this plan with the various Thorofare Plans developed by DOT, specifically the anticipated effects on RCW HMAs of the projected Havelock Bypass and the anticipated effects of the projected US 70 bypass through the eastern Croatan on the Black Bear HMA there, should be stated.

1.11-1.12, 1. Biological Diversity: It is probably erroneous to too closely tie the success of CNF management to red-cockaded woodpeckers, black bear, and neotropical migrants. Red-cockaded woodpeckers are only indicative of the quality of the **canopy** of pine savanna and flatwoods; black bear populations are moderate to high on the Croatan and are **less rare** than many of the underlying habitat types they are using on the Croatan; and **a subset** of neotropical migrants rely on cypress-hardwood interior forests which represent a **portion** of your Old Growth habitat. In each case, monitoring the key indicator species selected will not guarantee that the underlying habitat types are in good condition. You need to both increase your cluster of key indicator species and determine how to otherwise supplement key indicator species monitoring so as to best track the health of the underlying ecosystem. There should be a discussion here of the natural fire ecosystem and many types of rich habitats found in the Croatan region in presettlement times and of how these habitats have been degraded by changes in fire frequency/seasonality and other factors (as in information provided by Cecil Frost).

Additionally, you need to specifically state that you are also preserving clusters of rare or high quality species and natural communities through designation of natural areas and old-growth. Although these are not "special land allocations", they are a significant way of capturing biological diversity not otherwise preserved through the indicator species approach.

1.12, 5. Fire Management: You need to add to your second goal,"...vegetation **and wildlife** management goals." In order to mimic natural fire, you will be considering the effects of the prescribed burn regime on both vegetation and wildlife.

1.12, 6. Access: You should also indicate that OHVs can irreparably damage some sensitive habitats (wetlands, rare species habitat, etc.).

Chapter 2: Forestwide Management Direction, Section 1: Forestwide Goals/Desired Conditions and Objectives

2.4-2.5, I, A: We have special concerns about how concentrated RCW populations appear to be in Management Area 4, with only one cluster east of US 70. If Management Area 4 was impacted by a major hurricane, pine beetle outbreak, or disastrous wildfire, 70% or more of the RCW clusters could be affected. It is essential to greatly increase RCW numbers east of US 70 in order to decrease the vulnerability of RCW populations across the CNF.

In Figure 2, the plan should indicate which RCW management areas or portions thereof the Forest Service plans to dispose of as part of the Havelock Bypass.

2.6-2.7, I, B, B1: The breakdown of species into "Sensitive" and "Locally Rare" categories seems to be arbitrary and not clearly justified. In the definition of Sensitive species, you indicate that these are at risk of "extirpation" (local extinction), but many of the Locally Rare species (especially those with S1, S2 rankings) are at risk of extinction within the state. You also indicate that Locally Rare species are not showing downward population trends throughout their ranges. But, many of the species listed as Locally Rare are associated with Pine Savanna habitats, which, as this plan also indicates, are in decline throughout their range. It would seem that many of the species considered to be Locally Rare are actually Sensitive according to your definition. Why is Eastern Painted Bunting (FSC, SR, S3B, SZN, G5T3T4) not on either list?

At Island Creek and a few other rich mesic sites along the northern edge of the Croatan, there are numerous species that are absent from most of the Croatan (*Hepatica americana* is a good example). Most of the species are common in the Piedmont of the state, but are rare/very local in the outer Coastal Plain. They are not found on any State rare lists, because they are not rare for the state as a whole. Why don't these species qualify for "Locally Rare" status? They are native plants and add to the diversity of the Croatan.

For species names, scientific names should be given also to avoid confusion. For instance, do you mean "whorled loosestrife" or "roughleaf loosestrife" (whorled loosestrife is not rare, while roughleaf loosestrife is Federally Endangered). These changes should be made throughout the document. We would like to know the location of the 25 acres of existing maritime forest habitat and the restorable 10 acres of maritime forest. What is the purpose of artificially maintaining the existing forest in a variety of successional stages? Why do you need to artificially create successional stages if the processes that create these stages (hurricanes, flooding, salt spray) is still in effect?

2.9, I, B, B2: Under the second objective, you should specify that you plan to use prescribed fire to mimic natural processes where they no longer occur at the same frequency as they did historically. For the third objective, do you mean "**monitor**" instead of "**access** the effects of natural disturbances..."?

2.12-2.13, I, C, C1: We have significant concerns about potential methods of creating early- and mid-successional habitat, especially within the boundaries of the proposed natural areas, Masontown Pocosin and Union Point Pocosin. While this portion of the document and management prescriptions elsewhere in the text are less than clear about methodology, it is implied in this section that drumchopping and small clearcuts may be necessary to create bear habitat, based on the research available.

We question first whether bringing mechanized equipment into the pocosins to create clearings is necessary if prescribed burning is implemented on a more widespread basis in the pocosins, and secondly whether the costs, particularly in terms of potential impacts to the high quality Low Pocosin and High Pocosin communities, are worth the risk of lasting damage.

We understand that, due to current prescribed burning limitations, you may feel that the amount of early successional habitat for bear forage is less than you would wish it to be. However, you indicate elsewhere in the text that bear populations on the Croatan are currently moderate to high. Presumably, this population level is supported by the current availability of forage in the low pocosin/high pocosin habitat, and by other early successional gaps that occur elsewhere in the forest. Is it your intent to increase the bear population beyond the moderate to high level, to create early successional habitat that exceeds the natural distribution of that habitat type in pocosins? What are your 10-year targets and long-term targets for the size of the bear population on the Croatan? What is your basis for the early successional habitat targets you have proposed?

To what extent is existing early successional habitat taken into consideration when planning to create additional early successional habitat? All of these questions need to be clarified within the document.

You indicate that you intend to increase the amount of prescribed burning in these pocosins. If current forage for bears is insufficient, won't the increase in prescribed burning provide the increased early successional habitat?

If it is absolutely necessary to artificially create early successional habitat in pocosins through drumchopping and clearcuts, it should occur only in places where it does not impact other high quality natural resources. Masontown and Union Point Pocosin have been identified as Significant Natural Heritage Areas by the Natural Heritage Program, based on the quality and rarity of the natural community types. The only criteria stated in this draft plan revision for excluding them from the wilderness evaluation was noise disturbance due to planes from Cherry Point flying over the pocosins. The resources in their current undisturbed state provide a mosaic of successional stages suitable for bear habitat and do not need to be manipulated to enhance bear habitat. Any value that would be gained from artificially manipulating the habitat would be gained at the expense of natural community types which are more limited to North Carolina than bear populations and therefore more vulnerable to loss.

We request that you reconsider any widespread use of drumchopping or clearcutting in pocosin habitat. If it is used as a temporary method until prescribed burning can be implemented in pocosin habitat, we ask that you confine the practice to pocosin habitat outside the boundaries of Masontown and Union Point Pocosins, aiming to manage those areas through prescribed burning to the fullest extent possible. We additionally ask that you confine the practice to small areas along existing roads, rather than creating any roads for these purposes. We also request that you establish a historic basis for your early successional habitat targets (i.e., proof that pocosins historically contained this mix of early successional habitat). Finally, we ask that you evaluate the current availability and distribution of early successional habitat before artificially creating new habitat.

This section should address the problem already caused by four-lane US 70, plus the additional barrier to animal movement that will happen when the Havelock Bypass is built. How does the CNF plan to work with DOT to provide alternatives for animal movement where these barriers occur?

2.15-2.17, I, C, C2: Of approximately 38 species of neotropical migrants that breed in the Croatan, it has been indicated based on census work on the Croatan that no more than 14 occur primarily in riverine hardwood systems (including the slopes). Many occur in open pine systems. Some like the worm-eating warbler (*Helmitheros vermivorus*) are associated primarily with Pond Pine Woodland. The black-throated green warbler largely shuns riverine systems; it is not generally a good indicator for the "oak-cypress-gum group" (see also 4.2). Species to consider adding to the list of birds benefitting from riparian habitat (if you include adjacent slopes in this grouping) are yellow-billed cuckoo, Acadian flycatcher, wood thrush, red-eyed vireo, northern parula, and prothonotary warbler. The plan revision should specify what neotropical migrant species benefit from the proposed riparian management and how the needs of neotropical migrants in areas other than riverine hardwood systems will benefit.

2.19, I, D, Background: The paragraph seems to excessively emphasize value for recreational fishing. Following the statements about the limited fisheries value, you need to add a statement to this effect: "While lakes and small ponds have limited value for recreational fishing, they may contain rare species and, due to their limited distribution and variability across the landscape, can be considered rare natural community types." Additionally, fishing ponds should not be placed in areas with other significant natural resources.

2.23-2.26, II, A and B: You should indicate under goals that the trail system will be provided while avoiding or minimizing impacts to the forest's natural resources. This is stated under background information, but needs to be part of the goals. The same goes for campgrounds, picnic areas, fishing platforms and ponds, boat access sites, rifle ranges, trailheads, horse trails, mountain bike systems, hunting, fishing, and any other recreational improvements. Reviewers of this plan should be given opportunity to review specific locations of any recreational improvements proposed. It should be kept in mind, for all recreation objectives, that the value of the resources potentially impacted outweighs the need for human recreation. High quality longleaf pine stands and limesink ponds are becoming rare in the lower Coastal Plain. They lie at the northern end of this vegetation type (areas to the north tend to be smaller and more fire-suppressed). A considerable amount of new recreation is proposed for some of these areas. Recreational activities can be routed to other areas where their impact is less significant, and the impact on the recreationalists is minimal. In contrast, high quality significant habitat on the Croatan can not be relocated and it is **irreplaceable** once impacted.

2.26, III, A: We strongly urge the Superintendent of the National Forests to pursue an allowance for prescribed burning within Wilderness areas on the Croatan National Forest. The plan should specifically address the issue of prescribed burning in the existing wilderness areas and any other wilderness area that may be designated. We understand that current Forest Service regulations require special approval and special justification for prescribed burning in wilderness areas. We believe that this special approval is justified in the case of all of the existing Croatan National Forest wilderness areas and all of the additional areas that would qualify. The pocosins that make up most of the wilderness areas burned naturally and fires are kept out of them now only by artificial means.

Prescribed burning done with sensitivity to the wild character of these areas would improve the quality of the natural communities, would naturally improve wildlife habitat, and would coincidentally improve recreational use and reduce wild fire hazard. It would result in less evidence of human alteration than the current state of fire suppression alternating with emergency fighting of wild fires. Any prescribed burning should be required to meet rigorous requirements for minimum impact of control lines and ignition methods. This would likely involve aerial ignition and possibly aerial control, use of artificial lines on the edges of the wilderness areas, or if necessary minimum impact line preparation. While methods of safely burning pocosins are still being developed and it may be some time before they can be applied to the large wilderness pocosins, the plan should prepare for the possibility. In addition, there are small non-pocosin areas near the edges of the wilderness areas that could be burned at present.

In the currently proposed Alternative C, you are recommending artificial manipulation of pocosin habitat to maintain a mosaic of early- and mid-successional habitat for bear populations. Prescribed burning would create this mosaic, and would accomplish it in a way that more closely duplicates natural processes.

We support C-modified, adding Pond Pine Addition B to the Wilderness designation, as well as the 691-acre addition proposed in Alternative C. Pocosins are extremely rare outside the boundaries of North Carolina, and high quality examples are rare within the state. The Croatan National Forest has one of the most extensive and high quality concentrations of pocosin habitat in the state.

If any portion of the proposed 691-acre wilderness addition is currently not designated as registered, we would want it to be. If any additional areas are designated as wilderness, we would also want them to be designated as registered.

2.34, IV, B: The table here lists habitat indicators for various species. The prairie warbler would be found in pine savanna, but probably not any more frequently than in early successional habitat of other types. The red-cockaded woodpecker is indicative of mature longleaf trees, but is able to nest in other pine types and

in longleaf when it occurs in otherwise poor quality habitat (golf courses, etc.). For pine savanna, the CNF needs to use other species which are more specific to pine savanna and are indicative of a **high quality herbaceous layer** in order to truly indicate natural community quality. In order to determine the quality of the longleaf pine savanna and flatwoods natural communities, it would be useful to evaluate the presence of the following indicator species: Bachman's sparrow (*Aimophila aestivalis*), little metalmark (*Calephelis virginiensis*), Georgia satyr (*Neonympha areolatus*), wiregrass (*Aristida stricta*), and deertongue (*Carphephorus odoratissimus*) The two invertebrate species are even more closely tied to savanna and flatwood habitat and are differently sensitive to prescribed burning factors. The butterflies (little metalmark and Georgia satyr) are common and visible enough that they can be used by USFS personnel, and are often tracked as part of butterfly counts (both species are potentially out at the time of the annual 4th of July count). Natural Heritage Program has good baseline data for some of the CNF savannas and elsewhere on the coastal plain where these butterflies occur. Both plant species mentioned are common and easy to identify.

Bachman's Sparrows were undoubtedly numerous nearly throughout what is now the Croatan NF in presettlement times, but are now essentially limited to the southwest Croatan (Carteret County) where suitable habitat is the most extensive and least fragmented. The Bachman's Sparrow for Management Indicator species--is on State and Federal lists, has special habitat requirements that may be influenced significantly by implementation of the Forest plan (excellent quality indicator of the savanna ecosystem, especially the herbaceous flora), is a non-game species of special interest (many birders regularly visit the Croatan in search of this species--the Croatan is the northeasternmost site where it is regularly found), has a very high Partners-in-Flight concern score (30). It is easy to survey for Bachman's sparrows, since they sing throughout much of the day from March into the summer and are easy to recognize by the song (from the roads). There is also rather good data on its current distribution within the Croatan, allowing baseline levels to be identified. The Bachman's Sparrow (a ground nester) is an even better indicator of savanna structure [including how extensive (i.e. unfragmented) they are] and is an excellent indicator of the health of the herbaceous layer. The Natural Heritage Program can assist CNF in determining ways to efficiently monitor the presence of the indicator species recommended.

2.40-2.41, V, B: In your discussion of improvement of longleaf timber stands, we support the objective to apply **growing season fire** every 2 to 4 years. It should be noted that the fire frequency stated elsewhere in the document is 3 to 5 years. Regardless of how it's stated, the optimal fire frequency is probably around 3 years.

As you indicate, patchy burns are ideal. It should also be stressed that certain groups of species, such as invertebrates, are particularly vulnerable to local catastrophic disturbance. They are not as highly mobile, generally occupying more restricted portions of the landscape. They may also be particularly vulnerable at certain times of the year, when a dormant life stage further decreases their mobility. Additionally, some rare insect species are dependent on a rare or limited habitat type, which further increases their vulnerability to localized loss of habitat. When planning and conducting prescribed burns, the needs of invertebrate populations needs to be assessed. Burns should be timed to avoid periods of invertebrate dormancy and to avoid burning all of any particular habitat type within the vicinity of the burn. If there are known rare insects in the vicinity of a burn, it is particularly crucial to ensure that refugia containing the insect's required habitat type are left unburned.

2.46, VI, B: The objectives stated here are all worthwhile, but it has been emphasized to us by numerous management agencies that gates, ditching, and signage alone will not be effective, even in combination with establishing designated OHV trails. We have heard that monitoring and enforcement are the key to effective closure of illegal access, and recommend that these be added to your objectives.

2.47-2.48, VII, A: The goal of acquiring additional land to consolidate your natural resources and provide linkage to nearby natural areas is laudable. Highest priority should be given particularly to acquisition of remaining longleaf pine stands and other upland areas, especially since 700 acres of this habitat type on the CNF will be lost to the Havelock bypass. Considering the emphasis of the plan on the significance of the longleaf pine ecosystem, and the degree to which pine savanna habitat on the Croatan adjacent to development is threatened, placing a high priority on acquisition of longleaf pine savanna habitat is justifiable. Another worthwhile goal would be to generate funding for or accept the donation of easements on managed forests adjoining CNF (to keep them perpetually undeveloped, in managed forest condition). Some timber corporations have expressed an interest in this. We would like you to also emphasize in this section that CNF is seeking to acquire lands between the CNF and Camp LeJeune, Holly Shelter, and Hofmann Forest.

Chapter 2: Forestwide Management Direction, Section 2: Forestwide Standards

2.53, I, Prescribed Fire: It seems best to minimize use of firelines as much as possible and, when they have to be used, allow them to become revegetated with herbaceous species native to the site (certain rare species sometimes thrive in the wetter habitat created by fire plowlines). It is stated that impacts on heritage resources or endangered, threatened, or sensitive species will be "mitigated", but it is not clear what this means.

2.55-2.56, II : See comments under 2.6 pertaining to Sensitive vs. Locally Rare species. You have headings here for Plant Communities, Rare Species, Wildlife and Fish, but no mention of specific natural area designations. It should be made clear here that these are forest-wide specifications, but that more stringent guidelines may apply to specific zones, such as Wilderness, Natural Areas, Wild and Scenic Rivers, etc. Under Rare Species, it is particularly misleading to indicate that NHP review of research proposals is restricted to research on marl outcrops and limesink ponds. We would expect review of research proposals for research proposed within any designated natural area. Under Plant Communities and Rare Species, it should be indicated that designated natural areas have specific management prescriptions requiring coordination with NHP. See our comments under III-104 pertaining to powerline rights-of-way.

2.57-2.58, III, Forest Products: What basal areas are suitable both for natural regeneration of longleaf pine and for maintenance of a viable herbaceous layer? What basal areas most closely match those found in nature? The answers to these questions should determine what are suitable basal areas to maintain within the longleaf pine ecosystem. See our comments pertaining to planting density and uneven-aged management under Silvicultural Appendix E. See our comments pertaining to clearcutting and pinestraw harvesting under Silvicultural Appendix E.

2.59-2.61, III, Priority One Acquisitions: Acquisition of private lands containing significant natural areas, often savanna habitat, should be Priority 1 even if these lands do not contain Endangered and Threatened species. Because many of them are upland areas, they are particularly vulnerable to subdivision and alteration. "...land needed for protection of administratively and Congressionally-designated areas" includes natural areas which are not completely within USFS ownership should include natural areas as defined through the plan revision. You indicate that new acquisitions are suitable for timber management if they are in the black bear habitat or red-cockaded woodpecker habitat designation. The statement is not true for bear habitat where timber production is not allowed, or for red-cockaded woodpecker habitat where timber production is restricted. It would probably be better to refer the land manager to the management prescription for that type and for any embedded prescriptions. Throughout the document, however, you need to come up with a phrase that clearly separates timber production from restoration forestry, or forestry for

wildlife management purposes. Phrases like "timber management" or "timber harvest" imply "timber production" to most readers.

2.61, III, Special Uses: What is the USFS position on giving special-use permits that allow for alteration of wetlands?

Chapter Three: Prescriptions: Management of Key Landscape Features...

3.1, Introduction: The reference condition is described as an "ideal...condition". However, in a number of cases, features are described which are not ideal, such as illegal OHV trails (see Patsy Pond for Natural Areas and Pringle Road for Small to Medium Pocosin Patches). All reference condition descriptions need to be checked to ensure that they are not describing a condition which is less than ideal. If negative features are present in a site used as a reference condition, it needs to be clear in the text that the negative feature is not a desirable condition.

3.3, Prescriptions, Introduction: I like the table and the clarification about the embedded prescription having precedence. However, the relationship between the Bear Habitat Management Area and the rest of the prescriptions is less than clear. It is a larger category which encompasses many of the prescriptions. It should be made clear in the paragraph about the Bear HMA that more restrictive prescriptions or embedded prescriptions take precedence where they overlap with a Bear HMA.

LAKES

1) Under STANDARDS, Water/Hydrology/Soils, indicate that the natural hydrology of the lake should not be altered by pumping, dams, etc., except when unavoidable in an emergency. The natural chemistry of the lake should not be altered by liming or other methods.

2) Under STANDARDS, add Wildlife and Fish with indication that the native fauna should be maintained and that non-indigenous species should not be introduced.

WILDERNESS

1) We request that new areas proposed for wilderness designation also be identified as natural areas, and added to the registry concurrent with finalization of the plan.

2) Under STANDARDS, Water/Hydrology/Soils, the statement pertaining to canals conflicts with the natural area prescription which states: "Stop water flow of existing canals and ditches except where necessary along forest roads". Most of the wilderness areas (proposed and existing) are natural areas. In either wilderness or natural area, the goal should be to restore natural hydrology when possible. We recommend that the statement be revised to "...Stop water flow of existing canals and ditches, except where restricting water flow is necessary along forest roads, so as to restore natural hydrology." If you are concerned about the number of ditches you need to block and your ability to do so, set some priorities (first within designated natural areas, secondly those which are most obviously affecting flow). Some ditches do not affect flow and so do not need to be blocked.

3) Under STANDARDS, Fire, the phrase "most current fire management plan for recommended wildernesses, Croatan National Forest" is confusing. Do you mean recommended for wildernesses?

4) Under STANDARDS, Fire, the first point should be revised to state "Allow prescribed fire for fuel reduction, enhancement of habitat for rare species, or to maintain fire-dependent natural communities." In some cases, rare species habitat may be quite extensive, in others, quite limited. The goal of fire management should be to mimic natural fires which occurred across the landscape, not just in the vicinity of rare species populations. The broader natural community types are the fire-maintained units which historically burned at a certain characteristic range of frequency and intensity. Emphasis on natural communities is essential to ecosystem-based fire management.

5) Under STANDARDS, Wildlife and Fish, the statement should be revised to clarify "artificial structures". These structures should be designed as a substitute for some natural feature no longer available or not as available in the landscape, such as nesting habitat for red-cockaded woodpeckers. Efforts should be made to avoid impacting other rare species, rare natural communities, and high quality natural communities within the wilderness.

6) We have concerns about the presence of a Wildland Urban Interface in the northwest corner of Catfish Lake/Catfish Lake South Wilderness. Our concerns are presented under the **WILDLAND URBAN INTERFACE** section.

8) Under STANDARDS, Probable Management Practices, it should be clarified that any construction of barriers to limit access along Great Lake will avoid impacts to rare species, rare natural communities, and high quality natural communities.

WILD AND SCENIC RIVERS

1) Holston Creek is a tributary of the White Oak River. Its proposed designation is a combination of Pine Savanna and Flatwoods for the uplands and Old Growth-Other for the bottomlands. We question whether the Pine Savanna and Flatwoods and Old Growth-Other areas within Holston Creek are correctly mapped, based on our field survey information. This point will be more fully discussed under the Old Growth management prescription and an alternative mapping designation will be suggested. We additionally question whether the current designation offers greater protection for Holston Creek than Wild and Scenic River designation. It was noted that Wild and Scenic designation was given to a portion of the tributary to the south. Would this designation afford a greater measure of protection to Holston Creek? What characteristics does the tributary to the south have that Holston Creek does not which give it Wild and Scenic status?

2) Under STANDARDS, Water/Hydrology/Soils, the second point should be revised to indicate that surfacing of access points, dispersed recreation sites, or pedestrian access should occur if the area appears to be heavily used or erosion/sedimentation appears to be a problem. Lightly used access points probably do not require surfacing. It should be specified that only USFS-designated access points, dispersed recreation sites, or pedestrian access should be surfaced, and that these higher use areas should be limited in number and located in areas where they avoid impacts to natural resources. If surfacing materials which are impermeable are used, surface runoff could be increased, altering the hydrology of the river. It should therefore be specified that, when surfacing is needed, gravel or other materials which do not create an impermeable ground surface will be used.

3) Under STANDARDS, Water/Hydrology/Soils, the third point should be revised to state "Remove log jams or debris jams in the stream channels when necessary to allow minimum passage by small boats. Since woody debris is an essential component of habitat structure for aquatic organisms, removal of woody debris should be minimized." The statement under Probable Management Practices and the first point under

STANDARDS, Water/Hydrology/Soils conflicts with the third point under STANDARDS, in that a stream allowing minimum passage is not necessarily completely "free-flowing".

4) Under STANDARDS, Water/Hydrology/Soils, the fourth point should be revised to state "...Stop water flow of existing canals and ditches, except where necessary along forest roads, so as to restore natural hydrology."

5) Under STANDARDS, Fire, if fire historically occurred in the natural community types occurring along Brice Creek, prescribed burns should be allowed to spread from the uplands into the wild segments of Brice Creek.

6) Under STANDARDS, Forest Products, you indicate that "tree harvesting is permitted in segments classified as recreational only to maintain or enhance the unique resource values of the area." This statement lacks clarity. Are you talking about recreational resources or natural resources? If you are talking about natural resources, what natural process no longer in effect is selective harvest of trees mimicking? Are you restoring a forest type that has been altered in some way? If you are talking about recreational resources, what recreational objectives would justify tree harvesting? Improved access, a view from the road, etc.? We would support a statement that indicated that tree harvest in recreational segments should only be used if necessary to allow access for boats or foot traffic at designated access points, or where restoration of forest type is needed.

7) Under STANDARDS, Special Uses, the statement should be revised to indicate that utilities should ideally avoid scenic and recreational river segments. If avoidance is not possible, efforts should be made to minimize impacts through choice of location, distance and width of crossing, and construction method. We support the proposal to not permit utilities in river segments classified as wild.

8) We would like to receive information about the proposed location of any USFS-designated canoe/foot trails, dispersed recreation sites, or boat access points on the White Oak River and Brice Creek. The developed sites are indicated on our GIS layer, but we have no detailed information about the location of lower impact visitor use areas.

HARDWOOD AND CYPRESS WETLANDS

1) The black-throated green warbler shuns riverine swamps.

2) Some areas along Holston Creek and other areas qualify as Hardwood and Cypress Wetlands based on natural canopy cover. Were these not included and, in the case of Holston Creek, designated as No Prescription or Old Growth II because these management prescriptions provide a greater degree of protection? Similarly, this habitat type occurs elsewhere in the forest--is the GIS layer complete, or have you chosen to omit certain areas to provide them with a greater degree of protection? If this is a conscious decision, we would ask that you extend that same decision to the Hardwood and Cypress Wetland that occurs within the boundaries of our proposed (not accepted) Hadnot Road Ponds SIA/RNHA. We would like a greater degree of protection for this area than the management prescription provides.

3) Why is the Black Swamp Creek used as the reference condition when it does not show up on the map as being a Hardwood and Cypress Wetland?

4) Under STANDARDS, Water/Hydrology/Soils, you indicate that herbicide use is allowed if the herbicides are labeled for use over water when within 150 feet of perennial streams or water bodies. For what management purpose would herbicides be applied in a Hardwood and Cypress Wetland? We would recommend that you add roadside ditches to protected aquatic habitats, since these could transport herbicides, and specify that broadcast application of herbicides should not occur at all.

5) Under STANDARDS, Forest Products, the second statement indicates that "when salvage occurs, regeneration efforts will include site preparation for natural regeneration". Is site preparation necessary for regeneration? What activities are included under site preparation? We have concerns about invasion of exotic species if areas undergo site preparation.

6) Under STANDARDS, Water/Hydrology/Soils, a second statement should be included which limits the removal of woody debris in channels to the minimum amount necessary to allow small boat passage.

PINE SAVANNA AND FLATWOODS (RCW HABITAT MANAGEMENT AREA)

1) Under Variations from Reference Condition: It should be noted that some of these sites are or were historically dominated by mixtures of pines or, in some cases, by pond pine. Pine savannas on loamier soils (mainly in the northern Croatan) may support somewhat different floras from those typical of the southern Croatan. Spring-flowering goldenrod (*Solidago verna*) for instance is virtually absent from the southern Croatan. Near Bogue Sound, dry pine savannas may include several species that commonly occur in maritime forest, such as live oak (*Quercus virginiana*), yaupon (*Ilex vomitoria*), etc. Such areas are referred to as Coastal Fringe Sandhill.

2) Under STANDARDS, Fire, we would like you to revise the fifth statement to read as follows: "Establish a prescribed burning cycle of 2-5 years, burning optimally every 3 years. Most extant examples of canebrake are in pine savannas, and depend on frequent fire for their perpetuation. Special consideration should be given to reestablishing frequent fire in the vicinity of canebrakes. In identifying burn units, the fire manager should plan burn units so as not to negatively impact habitat for animal species, particularly for those species which are rare, highly specific in their habitat needs, and/or not highly mobile in part or all of their life stages. A fire management committee should be established, with representatives of the Natural Heritage Program, Wildlife Resources Commission, or other entities with specific knowledge about these animal species, to assist USFS staff in developing fire management procedures which maintain and enhance habitat for animal species."

Several sources have indicated to us that burning at a frequency of 4-5 years may not be frequent enough to maintain the savanna habitat, especially on wet mineral soils.

3) Under STANDARDS, Fire, we would like you to revise the sixth statement to read as follows: "Fire should be allowed to spread, when possible, from uplands into adjoining habitat. Natural firebreaks should be used whenever possible to reduce the impacts of constructing fire lines. When fire plow lines must be constructed through wetlands, they should be constructed perpendicular to the wetland boundary to minimize impacts to the wetland-upland ecotone." This statement should apply to any other habitat type where you are conducting prescribed burns on the uplands and using wetlands as natural firebreaks.

4) Under STANDARDS, Forest Products, we have concerns about how these standards apply to red-cockaded woodpecker clusters/ recruitment stands/replacement stands or foraging territories which are embedded in natural areas. Under STANDARDS, Forest Products for natural areas, it is indicated that these lands should be managed as not suitable for timber production. Under STANDARDS, Rare Species, you

indicate that active management in RCW territories is allowed, including tree harvest if necessary, according to standards in RCW EIS. Does this mean that timber would only be cut in a natural area if it was absolutely necessary to retain an extant cluster? Does this mean that timber might be cut to establish replacement or recruitment stands? Does this mean that timber could be cut to improve foraging territories? In a natural area which is already a multi-aged mosaic, with some even-aged regeneration occurring in natural gaps, no active management through timber harvest should be needed. Is this the position you support? This needs to be clarified in both the PINE SAVANNA AND FLATWOODS section and in the NATURAL AREAS section. We have concerns that undue emphasis could be placed on RCW habitat enhancement regardless of the management needs of other rare species, rare natural communities, and high quality examples of common pine savanna communities occurring in natural areas.

5) Under STANDARDS, Forest Products, you indicate that even-aged silviculture may be utilized in foraging areas after MIL level 2 is reached. On page 2.4, you indicate that you would like to use even-aged management as soon as possible, especially on mesic sites, because this allows you to reach your long-term RCW population objectives sooner. What is it about even-aged management that allows you to obtain RCW objectives sooner? While it is commendable to increase RCW populations on the Croatan, it should be accomplished in a way that mimics ecosystem function. Otherwise, you are potentially harming other components of the ecosystem.

Even-aged longleaf pine patches occur naturally where a gap has been created and longleaf pine seedlings are released. However, these patches do not correspond in size to large clearcuts. Larger clearcuts may be effective in restoring an area which is dominated by loblolly, but contains some longleaf regeneration. But in a forest currently dominated by longleaf, smaller natural gap-sized harvest patches (1/4 to 1 acre, as indicated in your uneven-aged silvicultural methods description in Appendix E) will more closely mimic natural processes. We support a harvest regime which creates a multi-aged mosaic of even-aged patches, with old-growth units retained in natural areas and/or old-growth areas. You allow for 25- to 40-acre clearcuts within portions of this area, and the 40-acre clearcut exceeds U.S. Fish and Wildlife Service recommendations. It is not adequately explained to what extent you will practice uneven-aged management, and to what extent you will be using 25- to 40-acre clearcuts as regeneration cuts. Is the 25-acre cut size the maximum allowed in commercial under U.S. Fish and Wildlife Service guidelines? If so, what justifies the 40-acre clearcut size on certain soil types? It is not essential for establishment of the RCW population.

You have indicated in meetings with us that it is your intention to leave old-growth and natural areas alone and to predominantly use thinning in most of the remaining forest, reserving more active manipulation for restoration sites. If this is the case, it needs to be more clearly indicated in this management prescription and elsewhere in the document.

6) On page 2.3, you indicate that approximately 30% of the CNF (53,000 acres) is included in the RCW habitat management area and that "most of it is currently pine savanna and flatwood". But you indicate on page 2.4 that 3200 acres of mature/old-growth and 1700 acres of less mature (under 61 years) longleaf will be maintained. If these add up to 4900 acres, how can "most" of the RCW habitat management area currently be pine savanna and flatwood? Since the distribution of longleaf forests on the CNF is 30% of its historical extent, I assume you want to have a target longleaf acreage of 15,000 to 20,000 acres. Your presentation of acreage figures here and elsewhere in the document for current and projected longleaf habitat distribution on the CNF is confusing. We request that you clearly present this information in a table.

7) Under STANDARDS, Forest Products, you indicate that no more than 30 square feet of basal area in the dominant and codominant trees should be removed in any single thinning operation. We would like you to

also place a limit on the time period before another thinning operation is allowed within the same stand; we would recommend at least a ten-year time interval between thinnings in any one stand.

8) Under STANDARDS, Forest Products, you indicate that certain species-specific rotation ages will be used except in "pine restoration" (former hardwood-dominated) sites as listed. The way that this is written, it sounds like you have some loblolly pine and pond pine restoration areas. Is that true? If not, you should clarify that these are longleaf pine restoration areas. Are the pine restoration areas under a longer or shorter rotation?

9) Under STANDARDS, Forest Products, you indicate that longleaf pine restoration will be targeted for land types phases 1022, 1124, and 1225. These correspond to soil series and it appears that all areas of the chosen series are mapped as these land types. This includes Onslow, Marvyn, and even Kureb, a widespread sandhill soil. They must be considered candidates for conversion rather than actual targets, because not all of those soil series is now in hardwoods. I have confirmed that there are places mapped as these ltps that are already in good quality longleaf or mixed pine. These ltps relate to our natural areas as follows:

Patsy Pond, Hibbs Road, Nine Foot Road/Broad Creek Pine Woods, Southwest Prong Flatwoods, Little Road Pine Savannas (RHA), Pettiford Creek Open Flatwoods, and Hadnot Creek Ponds have areas mapped as one of these ltps which is already good quality pine and does not need conversion.

The greatest concern is at Holston Creek Natural Area, where areas of Marvyn and Onslow soils on the bluffs on the south side of the creek are mapped in these ltps. These are on fairly steep north-facing slopes, where topography and mesic microclimate would shield them from the fires that naturally swept most of these soils. These areas do not appear to have been longleaf pine. They currently have mature hardwoods and should remain in hardwoods. They include lower slope areas right on the edge of the swamp, some of them downhill from other soil units that are not targeted for hardwood removal. These portions of the natural area were not accepted by the Forest Service and probably fall outside the riparian buffer. (The northeast part of the site includes areas of Onslow soil which are already in good quality Mesic Pine Flatwoods rather than hardwoods).

A small portion of the Island Creek RHA, on Craven loam, is included in these ltps. It is probably hardwood and should not be converted.

A small portion of the north side Hadnot Creek Natural Area (itself a small area on the forest) is in the ltps. I am unsure of its current composition and don't know what it should be.

There is an area on the east side of the Catfish Lake extension mapped as these ltps on Onslow soil. I would be surprised if it is currently hardwoods, but if so, conversion would be appropriate.

10) We understand the need for an emphasis on red-cockaded woodpeckers in this section. However, the focus on red-cockaded woodpeckers should not completely overshadow the management needs of other plant and animal species within longleaf forests, or the ecosystem processes necessary to maintain longleaf forests in a condition which closely mimics nature. You have a Plant Communities and Rare Species headings in which the information is totally dominated by RCW-based management. There are other plant community and rare species concerns within this community type. We would like you to rewrite these sections and we would like a second opportunity to review.

WILDLAND AND URBAN INTERFACE

1) On the GIS layer for this management designation, there are a number of questions we have about why certain areas were designated as Wildland Urban Interface. Why is there such a broad zone between Masontown and Union Point Pocosins? Why is the northwest corner of a Wilderness area, Catfish Lake/Catfish Lake South Wilderness designated as WUI? We also have concerns about how this designation will increase as developed areas increasingly surround USFS-owned lands. It seems that more and more forest land would be altered for the purpose of WUI, decreasing the amount of less disturbed interior. Have you projected how the % CNF land used for WUI will change as more and more land adjoining the CNF is developed? Are there any plans to insure that a WUI buffer is acquired by the USFS whenever development is planned adjacent to USFS land? What are the pink patches excluded from Old Growth (appear to be Leon soils--should be restored to longleaf flatwoods)?

2) If Old Growth I and WUI overlap (between pocosins), what does this mean? Old Growth I is the more restrictive prescription and should take precedence. Some of this area between pocosins would be appropriately targeted for pine savanna restoration.

3) Not enough information is available in Chapter 2 to suffice as a substitute for a detailed set of standards. The standards should include: a) minimum and maximum widths of the WUI, b) a preference for using mechanical methods of fuel reduction whenever possible rather than chemical methods, and for using prescribed fire instead of mechanical when fuel loads are reduced to a level where fire management becomes feasible, c) when chemical methods are used, drift of chemicals outside the zone should be avoided, d) efforts at fuel reduction should concentrate primarily on midstory reduction, rather than overstory reduction, especially in areas which are also designated as Old Growth, e) when prescribed fire is used, efforts should be made to use backing fires to create a black line, f) natural firebreaks should be used whenever possible, g) when fire plow lines crossing wetlands are necessary, they should be constructed perpendicular to the upland-wetland transition zone, and h) where mineral soils historically supported longleaf pines, areas within the WUI should be targeted for longleaf restoration. We request the opportunity to review these standards.

4) We request that the Croatan National Forest work closely with the Wildlife Resources Commission to ensure that wildlife passages between Masontown Pocosin and Union Point Pocosin are maintained

5) In the portion of your WUI near Havelock, Cecil Frost had part of this area mapped as pond pine savanna habitat. If you attempted restoration of this habitat type within the WUI, it would reduce fuel loading while restoring a natural habitat. Full restoration might require prescribed burning to restore the herbaceous vegetation, after the fuel load was reduced mechanically, or perhaps a burn under wet conditions.

WATER BASED RECREATION AND HERITAGE RESOURCES INTERPRETATION

1) The Heritage Resource designation occurs twice in the text, once as a prescription (3.27) and once as an embedded prescription (3.79). One is called Heritage Resource Interpretation (3.27) and the other Heritage Resources (3.79). I find this confusing.

2) Under STANDARDS, Water/Hydrology/Soils, the statement should be revised to indicate that surfacing of access points, dispersed recreation sites, or pedestrian access should occur if the area appears to be heavily used or erosion/sedimentation appears to be a problem. Lightly used access points probably do not require surfacing. It should be specified that only USFS-designated access points, dispersed recreation sites, or pedestrian access should be surfaced, and that these higher use areas should be limited in number and located in areas where they avoid impacts to natural resources. If surfacing materials which are impermeable are

used, surface runoff could be increased, altering the hydrology of the river. It should therefore be specified that, when surfacing is needed, gravel or other materials which do not create an impermeable ground surface will be used.

2) Under STANDARDS, Recreation, the second point should be modified as follows: "Interpret selected sites through signing and limited development, while protecting the natural resources, which may be associated with the site."

3) Under STANDARDS, we would like CNF staff to coordinate with us on future management of Hancock Creek Forest, Flanners Beach, and Island Creek. Flanners Beach and Island Creek are SIAs, Registered Natural Heritage Areas, and Heritage Resource Areas. Hancock Creek Forest, in the proposed plan, is a Heritage Resource Area, but is not otherwise designated. As is true of Flanners Beach and Island Creek, Hancock Creek Forest has natural resources which merit protection when planning any active management.

MIXED PINE FORESTS

1) Under Reference Condition, the reference site is said in the text to consist of loblolly and pond pine. However, the accompanying figure (from Frost 1996) says the site is loblolly, pond, and longleaf pine. And the same site described in Frost (1996) is said to be longleaf and pond pine.

2) Looking closely at several of the areas mapped as Mixed Pine Forest, it looks like most of them do not follow the Frost classification. According to this classification, some were naturally dominated by longleaf pine (I might add that I know of at least 2 that are currently dominated by longleaf), some were probably dominated by longleaf or a mixture of longleaf-pond, one site near Brices Creek may have been a mixture with the 4 pines native to the region (longleaf-pond-loblolly-shortleaf). I realize that the scale of the Management Prescriptions Map is not that detailed. However, even when you take this in to account, you must conclude that for many areas in this category (i.e. Mixed Pines = pond and loblolly only) the mapping is inappropriate. For instance, virtually all of the northernmost site mapped as Mixed Pine Forest (near the mouth of Brices Creek) was likely to have been originally predominantly longleaf pine (Lynchburg, Goldsboro), based on the Frost study.

It seems that this category is at least in part NOT based on ecological considerations but on others. Many of these areas are silviculturally productive and are located such (isolated tracts for instance) that carrying out regular prescription burns would be difficult. It seems that the proposed plan revision has given these areas a classification that will make it possible to conduct more intensive forestry at these sites. If the primary reasons for this category are based on management problems with prescribed burning and other reasons why the sites aren't restorable, it should be clearly stated in the plan.

3) Under Variation from Reference Condition, all the variation that occurs within areas mapped as Mixed Pine Forests (like areas currently dominated by longleaf, etc.) should be described.

4) Under STANDARDS, Water/Hydrology/Soils, we support restoration of hydrology when possible as indicated. We recommend addition of a standard to avoid any new alteration of hydrology, through bedding, new ditches, or raised roadbeds, for instance.

SMALL TO MEDIUM POCOSIN PATCHES

1) Under Reference Condition, it is doubtful that the bay rims historically harbored loblolly pine, so this should not be mentioned as part of the desired reference condition. Many of the areas mapped as Small to

Medium Pocosin Patches are very different from the reference condition described here, and this variation should be described.

2) We recommend the addition of STANDARDS, Fire, as follows: Prescribed burning will occur, when feasible, every three- to five-years. The historical fire frequency of pocosins is not known, but it is suspected to be similar to that of adjoining uplands. The areas will be burned as part of a larger unit containing both upland and wetland areas. Fire will be allowed to spread from the upland into the wetland. Natural firebreaks will be used when possible. When construction of fire plow lines is necessary in a wetland, they will be constructed perpendicular to the upland-wetland transition zone.

Because pond pine woodlands have been historically fire-suppressed, canebrakes have not tended to persist in this habitat type. In order to restore canebrakes, land managers should ensure that fires occur frequently in adjacent uplands and are allowed to spread into pond pine woodland.

3) In terms of boundary delineation, we have noted that some of the areas showing up in GIS as Small to Medium Pocosin Patches are not correctly identified. The area of Nonriverine Wet Hardwood Forest in and around the Gum Swamp "Bottomland Hardwoods" RHA is designated as Pocosin-Pond Pine. While that designation is generally true for the soil type that this area is mapped as, it does not appear to be true for this area. This immediate area should be managed as hardwoods.

HARDWOOD RESTORATION

1) In your description of the canopy components of the reference condition, you indicate that "swamp white oak" (Quercus bicolor) is one of the canopy species. This is probably an error in common name use which should be changed to "swamp chestnut oak (Quercus michauxii)".

2) In Reference Condition, the black-throated green warbler does not occur in the upland hardwood habitat described here. Some other birds in this list are not likely to increase as a result of the described restoration. Some bird species that should increase eventually are yellow-billed cuckoo, Acadian flycatcher, blue-gray gnatcatcher, wood thrush, red-eyed vireo, northern parula, ovenbird, and hooded warbler.

3) Under Probable Management Activities, you indicate that "Creation and maintenance of long, narrow wildlife openings..." and "Creation and maintenance of permanent grass and forb openings..." are likely to occur. However, under STANDARDS, Wildlife and Fish, you state "Prohibit construction of new wildlife openings." We support adherence to the standard as indicated. The descriptions of creating new openings under Probable Management Activities should be changed to reflect the standard.

4) Under STANDARDS, Water/Hydrology/Soils, you indicate that herbicide use is allowed if the herbicides are labeled for use over water when within 150 feet of perennial streams or water bodies. For what management purpose would herbicides be applied in a Hardwood Restoration area? We would recommend that you add roadside ditches to protected aquatic habitats and specify that broadcast application of herbicides should not occur at all.

5) Under Standards, Forest Products, the described areas are mesic to xeric. It is assumed that you are thinking of other areas when you mention planting water tupelo and bald cypress.

6) It should be noted that some of the areas slated for hardwood restoration do naturally have some pines within them. There is often a greater diversity of nesting birds in hardwoods that have a few old pines within

them as opposed to areas that are pure hardwoods. Restoring natural stand composition, rather than removing all pines, should be the objective of hardwood restoration.

BLACK BEAR HABITAT

1) Under Reference Condition, it is doubtful that there is Atlantic white cedar in the described area southeast of Havelock.

2) We fully support and greatly appreciate the clarification included in the first paragraph of this section and in the added paragraph about embedded prescriptions. Where this designation overlaps with an embedded prescription **or** another designation, (wilderness, wildland urban interface, etc.), that other designation should take precedence. In cases where this designation does not overlap with any other designation, this land should not be managed for timber production, as you have indicated.

3) It should be clarified under Probable Management Practices and in Standards that any "timber harvesting and tree planting" which does occur will be for bear habitat maintenance **only**. We request that the text specify that management for early successional habitat, such as drumchopping and creation of small clearcuts, will not occur in the Union Point and Masontown Pocosins, since these have been identified as significant natural heritage areas, are sensitive to ground disturbance, and would qualify for wilderness designation (except perhaps for the noise disturbance from military flyovers). Outside of Union Point and Masontown Pocosins, we additionally ask that you confine the practice to small areas along existing roads, rather than creating any roads for these purposes. We also request that you establish a historic basis for your early successional habitat targets (i.e., proof that pocosins historically contained this mix of early successional habitat). Finally, we ask that you evaluate the current availability and distribution of early successional habitat before artificially creating new habitat.

4) It should be specified under an Access heading that new road construction should generally be avoided when possible within Union Point and Masontown Pocosins, due to the negative effects on the high quality natural communities, on bear populations, and on the recreational use of this habitat for a remote wilderness experience. Outside of Union Point and Masontown Pocosins, road construction should be avoided when possible because of its detrimental effects on bear populations.

5) Under STANDARDS, Special Uses, you should specify that intense or high use activity by the military is only permitted in January and February. It should also be specified that other special uses incompatible with conservation of the bear population are prohibited. Within Masontown and Union Point Pocosin, special uses which are incompatible with their status as high quality natural areas should be avoided.

DEVELOPED AREAS

1) While we do not see any problems with the proposed developed areas, we would like more information about exactly what is proposed for the north shore of Catfish Lake.We do not see any problems with proposed developed areas.

ADMINISTRATIVE AND ELECTRONIC SITES AND SPECIAL USES

1) Under STANDARDS, you should include sections on Plant Communities and Rare Species (or cluster them under Natural Resources) and indicate that every effort will be made to avoid impacts to high quality natural communities and rare species populations during selection of sites. Additionally, every effort will be made to minimize fragmentation of the landscape. Utility corridors add significantly to fragmentation

of natural landscapes, even if they are added to the width of existing roads. While it is commendable to locate utility lines at the outer edges of national forests, some of your highest quality natural areas are located at the periphery. Every precaution needs to be taken in site selection and, subsequently, in implementing the project so as to minimize fragmentation.

3-2: SECONDARY PRESCRIPTIONS

Title should be **EMBEDDED PRESCRIPTIONS**, since "secondary" implies lesser. You should additionally make it clear at the beginning of this section that the embedded prescription, being more restrictive or specific, applies where two prescriptions overlap.

NATURAL AREAS

1) The nationally significant SIA/RNHA, Patsy Pond Natural Area, is being used as a reference condition for natural areas. Recent efforts have been made by district staff to include portions of the natural area as an exchange property for natural areas along the White Oak River. It should be emphasized that natural areas (SIAs and/or RNHAs) designated as such during the planning process should not be considered suitable for exchange, sale, or transfer. They are the highest quality portions of the national forest, in terms of diversity and intact natural structure. They are deemed worthy of protection through the internal US Forest Service plan revision and through a separate agreement with the NC Department of Environment and Natural Resources. For each natural area, there is a history, often lengthy, of concerted efforts on the part of state and USFS staff, conservation organizations, and university researchers, to identify and preserve the natural area's resources. To even consider removing these natural areas from US Forest Service ownership is a waste of current, as well as past, time and effort. US Forest Service lands can be buffered with new USFS acquisition properties or with lands owned by state agencies or conservation entities. There are numerous sources of funding which can be tapped to achieve these goals. Trading away high quality natural areas should not be considered as a feasible alternative.

2) For reference condition, we request that the description of Patsy Pond Natural Area from the Natural Heritage Program natural areas proposal (June 28, 1996) be utilized to update and improve the description you use on page 3.14-3.16. Additionally, we request that two sites be used for reference condition rather than one, preferably two sites which are markedly different in habitat type. We recommend that Island Creek be used as the second site and request the opportunity to review the description.

Additionally, we request that references to OHV trails be omitted from any descriptions of natural area reference conditions. The reference condition is meant to describe an ideal or model situation. While model natural areas are sometimes troubled by less-than-model conditions, you should avoid describing OHV use (or other unallowed activities) as part of the reference condition.

3) Under Probable Management Practices, you indicate that "fuel treatments including prescribed burning" are likely. What other fuel treatments are possible other than prescribed burning? If there are other fuel treatments, such as hardwood control, you need to mention them here and specify how they will be conducted under STANDARDS. If other fuel treatments are unlikely, you need to remove the term "fuel treatments".

4) Under Probable Management Practices, you need to modify the term "thinning" to indicate "thinning to restore natural community structure where needed..."

5) Under STANDARDS, Water/Hydrology/Soils, we recommend that the second statement be revised as follows: "Stop water flow of existing canals and ditches if it appears that doing so will restore natural hydrology. Retain canals and ditches where necessary along forest roads. If blocked ditches create a impassable barrier, it may be necessary to create crossing opportunities for animal movement."

6) Under STANDARDS, Fire, we recommend that the statement be reworded as follows: "No new fire plowlines should be constructed in ecotones between pine savannas and pocosins. Plowlines should generally not be used to separate habitat types. A journey-level biologist and staff from the Natural Heritage Program should be consulted in the process of planning location of plow lines."

7) Under STANDARDS, Fire, a second point should be added as follows: "Prescribed burning should be conducted for community types at the following frequency:

cane brakes	approximately every 10 years
pocosins	insufficient knowledge, but need to mimic natural frequency if possible
pine savanna	approximately every 3 to 5 years, averaging 3

Burns should not be forced and can be patchy. When conducting a fire in pine savanna or other upland habitat, fire should be allowed to spread into adjacent riparian hardwood forest, pocosin, or other bottomland habitat. Backing fires are a suitable method for allowing the fire to spread in a controlled manner.

Because pond pine woodlands have been historically fire-suppressed, canebrakes have not tended to persist in this habitat type. In order to restore canebrakes, land managers should ensure that fires occur frequently in adjacent uplands and are allowed to spread into pond pine woodland."

8) Under STANDARDS, Fire, a third point should be added as follows:
"Every effort should be made to avoid burning all of a particular habitat type at one time. Unburned habitat provides a refuge for animal species, particularly for those which are not mobile at the time of the burn. Ideally, habitat types should be divided into at least three burn units, and no more than one of these units burned at a time."

9) Under STANDARDS, Plant Communities, the second statement should be revised to indicate that "All restoration proposals will be developed in coordination with the Natural Heritage Program."

9) Under STANDARDS, Plant Communities, insert a statement between the first and second statement as follows: "Ensure that active management contributes to the perpetuation of rare and high quality natural communities. Natural community descriptions are provided in the site descriptions from the North Carolina Natural Heritage Program."

10) Under STANDARDS, Plant Communities, we support studies about the effects of hurricane blowdowns, but it should be stressed that blowdowns are one of the natural processes affecting natural areas. It is highly unlikely that any subsequent changes in vegetation or ground disturbance would result in changes in natural area status. Such a study is a worthwhile research project, but the goal of such a research project should be clearly stated.

11) Under STANDARDS, Rare Species, a statement should be included which indicates that only RCW management which is required and essential according to standards outlined in the RCW EIS should be permitted. Management should only include what is necessary for the perpetuation of existing, recruitment, and replacement clusters. It should be specified that the US Fish and Wildlife Service, the Natural Heritage

Program, and CNF staff should meet on-site to discuss RCW management needs, if it appears that active management is necessary within a natural area. It should be specified that RCW management will take into consideration the management needs of other rare species, rare communities, and high quality communities within the natural area. It should also be stated that trees harvested will be cut and left in place.

12) Under STANDARDS, Rare Species, a statement should be added, as follows: "Ensure that active management, including prescribed burning and restoration management in adjoining areas, provides for the perpetuation of all rare plant and animal species within the natural area. Rare species information is provided in the site descriptions from the North Carolina Natural Heritage Program. 'Rare species' includes federally listed, federal species of concern, state listed, state species of concern, and rare species.

"In particular, planning of prescribed burns within natural areas containing rare invertebrate species, especially the Arogos skipper (*Atrytone arogos arogos*) or the Venus flytrap cutworm moth (*Hemipachnobia subporphyrea*), should be carefully planned. The Arogos skipper population is the only one in the state, and one of two between New Jersey and Florida. The Venus flytrap cutworm moth is endemic to North Carolina. Both are likely to be listed as Federally Endangered. Invertebrates are less mobile during certain life stages and therefore may be more vulnerable to management effects. For a variety of reasons, the rarity of invertebrates is often not fully assessed. Timing of burns need to take into consideration life cycle stages of rare insects. Location of burns needs to ensure that refugia containing the necessary habitat types for rare insect species are retained within the landscape, by dividing the natural area into several burn units and burning them at different times. Monitoring should occur to determine the effects of the prescribed burn on these two extremely rare species in particular."

"Restoration efforts need to particularly give high priority to site-appropriate restoration of suitable habitat for rare invertebrate species adjacent to existing habitat. It is particularly essential that areas around existing habitat for the Arogos skipper and the Venus flytrap cutworm moth be restored, allowing the populations to expand."

13) Under STANDARDS, Rare Species, a statement should be added as follows: "All rare species management proposals require the review and approval of the Natural Heritage Program."

14) Under STANDARDS, Rare Species, the second statement lacks clarity. Does this statement hold for any rare species, plant or animal, regardless of degree of rarity? Or are you making a general rule when you are really primarily talking about red-cockaded woodpeckers? It is often difficult to determine, directly after site disturbance, whether a rare animal, or particularly plant, species continues to occur in that habitat. How many surveys will you conduct before you determine that a population is not longer extant and is unable to recover on its own? I think we would be more comfortable with this statement if you confined it to RCW management. Even under these circumstances, we would ask you to add the following statement: "Any site modification or species translocation proposals require the review and approval of the North Carolina Natural Heritage Program."

15) Under STANDARDS, Recreation, the first statement should be modified to read as follows: "Recreation is generally confined to passive activities, such as hiking, bird-watching, and other activities associated with the appreciation of natural areas. Any active management proposed to support passive recreation should be reviewed and approved by the North Carolina Natural Heritage Program.

16) Under STANDARDS, Recreation, the third statement should be modified to read as follows: "Dispersed camping is allowed. However, if any impacts from dispersed camping are evident, the natural area should

be closed to camping. Camping within 100 feet of limesink ponds in the Patsy Pond Limesink Complex and Nine Foot Road/Roberts Road Limesink Pond Natural Areas is prohibited."

17) Under STANDARDS, Scenery, what forms of active management do these scenery objectives allow? Scenic management should not take precedence over natural area objectives.

18) Under STANDARDS, Forest Products, the second statement should be modified as follows: "Allow salvage of hazard trees adjacent to trails or access areas for the purpose of public safety. Hazard trees should be cut and left rather than salvaged to provide habitat for animal species which depend on downed wood for food and shelter."

19) Under STANDARDS, Forest Products, the third statement should be modified as follows: "Prohibit pine straw raking except on an experimental basis. Experimental proposals require the review and approval of the North Carolina Natural Heritage Program."

20) Under STANDARDS, Land Adjustment, a statement should be inserted as follows: "Sale or transfer of natural areas or lands that are important as immediate buffer to natural areas should be prohibited. Acquisition of portions of natural areas which are private or of private lands which buffer natural areas should be given high priority."

21) Under STANDARDS, Special Uses, the statement should be modified as follows: "Prohibit any special uses which are not compatible with natural areas protection, including solid waste disposal, liquid waste disposal, landfills, and powerline rights-of-way."

22) Under STANDARDS, Access, the statement should be modified as follows: "Prohibit construction of new roads and remove existing roads when feasible. Existing roads and adjacent rights-of-way should be kept at minimum width to avoid fragmentation. Any active management pertaining to access should be reviewed and approved by the North Carolina Natural Heritage Program. Eliminate illegal OHV access to natural areas through signage, gating, and strict enforcement."

23) Under each of the STANDARDS sections, a statement should be included pertaining to monitoring (effects of fire, condition of rare species populations and natural communities, OHV use, recreational use, etc. US Forest Service staff need to monitor the health of natural areas on the national forest. The Natural Heritage Program can assist the your staff in developing monitoring methods.

24) We recommend that **registry** of the natural areas occur concurrently with finalization of the plan. **The Natural Heritage Program will submit a registry agreement to the USFS as soon as remaining boundary issues are resolved.**

25) The Millis Road Savanna natural area expansion does not adequately incorporate rare species population concentrations or high quality habitat. We strongly recommend that the area boundary be expanded further to the south and east, as described in the attached letters and shown on the attached map. This change in the boundary would add examples of several rare community types (Pine/Scrub Oak Sandhill, Mixed Oak Variant; Wet Pine Flatwoods, Wet Spodosol Variant; and Pine Savanna), several occurrences of Carolina goldenrod (*Solidago pulchra*), State Endangered, Federal Species of Concern, G3, S3 and other several other rare species.

OLD GROWTH FOREST

1)Following meetings with you, it is our understanding that small- and medium-sized patches of longleaf will be officially designated as old-growth (mapped as Old Growth II). The remaining old-growth, mapped as Old Growth-Other, is of the remaining types: Cypress/Tupelo Swamps, Upland Mesic Hardwood, and Southern Wet Pine Forests, Woodlands, and Savannas. The forest-wide standards require that you maintain **at least** one-third of these as old-growth at any one time, a standard which allows you to place these "old-growth" stands on a very long timber rotation. However, you have indicated to us in meetings that, in fact, Cypress/Tupelo Swamps and Upland Mesic Hardwoods will not be cut at all, except for very occasional restoration efforts. The remaining, and largest, category, Southern Wet Pine Forests, Woodlands, and Savannas (30,000 acres) will actually be on the long-term rotation.

When the Old Growth-Other layer is examined on the map, it appears to overlay a number of designations other than those mentioned in the text, including Pine Savanna Restoration (a confusing name which does not agree with the name of the management prescription in the text - - Pine Savanna and Flatwoods (RCW Habitat Management Area)), Black Bear Habitat, Mixed Pine Forest, and Pocosin/Pond Pine. You don't have an actual management prescription for Pocosin/Pond Pine, unless it corresponds to Small to Medium Pocosin Patches.

Since part or all of many of our proposed natural areas were less officially granted protection through this Old Growth-Other designation, we need to have a very clear prescription within this section.
We would recommend the following changes:

a) It should be indicated that longleaf in this category is removed from timber production due to its official status as federally designated old-growth. Information from your old-growth criteria should be stated to clarify how this official designation differs from any other.

b) It should be stated that Cypress/Tupelo Swamps and Upland Mesic Hardwoods within this Old Growth-Other designation are removed from the timber base, and the exact reason indicated in the text.

c) If there are limited circumstances under which trees can be selectively removed from either Longleaf Pine Forests, Cypress/Tupelo Swamps, or Upland Mesic Hardwoods for old-growth enhancement or restoration, these should be clearly described within the prescription.

d) It should be clearly indicated what it means if the Old Growth-Other designation overlays another designation, especially Pine Savanna Restoration (= Pine Savanna and Flatwoods . . .), Black Bear Habitat, Mixed Pine Forest, and Pocosin/Pond Pine. Most or possibly all of these management prescriptions probably fall within the Southern Wet Pine Forests, Woodlands, and Savannas designation. According to your Old Growth-Other prescription, only ⅓ of these might be managed as old-growth at any one time. However, for some of these designations, Old Growth-Other is not the more restrictive embedded prescription. Black Bear Habitat does not allow management for timber production. Pine Savanna and Flatwoods has specific criteria which limit timber production. This should be made clear in the Old Growth-Other management prescription.

e) As was indicated in our comments on the Black Bear Habitat management prescription, we have strong concerns, in particular, that neither the Old Growth-Other or Black Bear Habitat management prescriptions provide adequate protection for Union Point or Masontown Pocosin. The Old Growth-Other prescription allows timber production on a certain percentage of pine-dominated sites, and the

Black Bear Habitat prescription allows creation of early successional habitat through methods other than prescribed burning. You have mapped the centers of the pocosins as Black Bear Habitat and the peripheral zones as Old Growth-Other. So, potentially, you could be creating small clearcuts or drumchopping in the center of the pocosins, and managing for timber in the outer zones. Under either prescription, these natural areas are not adequately preserved.

2) The designation of Old Growth II and Old Growth--Other on the GIS coverage we have been provided appears to be fairly complete. We recommend that the mapping of riparian old-growth on Holston Creek be expanded (see attached map 1), and that the mapping of riparian old-growth on Hunter Creek (see attached map 2). These areas are currently mapped inappropriately as either Pine Savanna and Flatwoods or some other designation.

3) For reference condition, it would be better to provide several examples. Since much of the acreage included under Old Growth--Other is pond pine woodland, it would be good to include a pond pine woodland reference condition description.

4) Under Probable Management Practices, you should modify statement to indicate "occasional timber harvesting to restore old-growth structure through gap creation, thinning, and provision of large woody debris."

5) Under STANDARDS, Forest Products, the first point should be revised to state: "Timber will not be harvested in the upland pine communities (mapped as Old Growth II), since they have already achieved old-growth structure. If the midstory is too dense or too mature to be controlled by fire, the midstory can be controlled through cutting and direct application of herbicides." This clearly defines the nature of restoration efforts within this old-growth forest type.

6) Under STANDARDS, Forest Products, the second point should be revised to state: "Timber may be harvested in old-growth community types other than upland pine communities if the structural characteristics of the forest clearly indicate a need for restoration forestry. If multi-age structure is already present in the stand, there is not need for timber harvest. If the forest is artificially dense, shading out natural or artificial regeneration, overstory trees may be removed in groups of 1/10 acre or less to create gaps. If the midcanopy or canopy codominants are exceptionally dense, thinning of the midcanopy or low-thinning of canopy codominants can be conducted to enhance growth of dominant trees."

7) Under STANDARDS, Forest Products, the third point should be: "For any old-growth forest type, timber harvest may occur to reduce risks to adjacent stands from insect attacks or disease conditions."

8)Under STANDARDS, Forest Products, the fourth point should be: "In a multi-age old-growth stand, natural treefall should be sufficient to provide woody debris to support aquatic habitat structure. In stands which have not yet achieved old-growth structure, where insufficient woody material has entered the stream, individual overstory trees may be felled and allowed to enter the stream."

9)Under STANDARDS, Forest Products, the fifth point should be: "If forests are either thinned or gaps created, leaving scattered large woody debris on the ground provides food and shelter for many animal species." The sixth point about prohibiting permits for removal of old trees, snags, or downed logs if they will alter old-growth structure is fine as is.

10) Assuming that these standards apply to habitat types other than upland longleaf (Old Growth II?), you should have a Fire section in STANDARDS. The section should contain information which is fairly similar to the fire management section as we recommended under **NATURAL AREAS**.

11) Under STANDARDS, Fire, we recommend that a statement be included as follows: "No new fire plowlines should be constructed in ecotones between pine savannas and pocosins. Plowlines should generally not be used to separate habitat types. A journey-level biologist should be consulted in the process of planning location of plow lines."

12) Under STANDARDS, Fire, a second point should be added as follows: "Prescribed burning should be conducted for community types at the following frequency:

cane brakes	approximately every 10 years
pocosins	insufficient knowledge, but need to mimic natural frequency if possible
pine savanna	approximately every 3 to 5 years, averaging 3

Burns should not be forced and can be patchy. When conducting a fire in pine savanna or other upland habitat, fire should be allowed to spread into adjacent riparian hardwood forest, pocosin, or other bottomland habitat. Backing fires are a suitable method for allowing the fire to spread in a controlled manner.

Because pond pine woodlands have been historically fire-suppressed, canebrakes have not tended to persist in this habitat type. In order to restore canebrakes, land managers should ensure that fires occur frequently in adjacent uplands and are allowed to spread into pond pine woodland."

13) Under STANDARDS, you should add a section on Access. "Prohibit construction of new roads and remove existing roads when feasible. Existing roads and adjacent rights-of-way should be kept at minimum width to avoid fragmentation. Eliminate illegal OHV access to old-growth through signage, gating, and strict enforcement." Minimizing fragmentation of old-growth is essential to retaining its function.

OHV SYSTEM:

1) We recommend that monitoring and enforcement to prevent OHV use of unauthorized areas should be included as one of the objectives under Access. We have been informed by various state agencies that monitoring and enforcement are keys to prevention of illegal OHV use.

2) The mapped location of proposed OHV areas shows two areas, one to the west of Pringle Road Bay Rims and one between Nine Foot Road-Broad Creek Pine Woods and Pringle Road Bay Rims. The two areas are linked by Pringle Road, and you are anticipating that this road will be used as an OHV-connector road. The third area is well north of these areas in a degraded portion of the pocosin habitat.

During our previous discussions with you, you indicated that the area to the west of Pringle Road Bay Rims and the northernmost area were being considered as potential OHV access areas, but did not indicate that there would be an a third area between two natural areas, and joined by a road which transects a natural area. We have strong concerns about locating an OHV area between Pringle Road Bay Rims and Nine Foot Road-Broad Creek Pine Woods, and encouraging OHV use of Pringle Road which transects a natural area. The habitat surrounding the road is very open and is likely to become more so as prescribed burning increases. Fire lanes located along this road are likely to be used for illegal OHV access to adjacent natural areas. Considering past problems with illegal use of the Patsy Pond natural area, and inability to sufficiently enforce OHV regulations there, it seems to be asking for trouble to route an OHV trail across a natural area

which can be easily accessed from the road. Is it possible to instead keep designated OHV areas to a location more peripheral to the natural area cluster?

3) Additionally, from the GIS layers, it appears that the OHV area actually overlaps with one of the natural areas. Mapped boundaries should be checked to ensure that there is no overlap.

Chapter 4: Management Areas and Chapter 5: Monitoring and Evaluation

4.12-4.13, Table 4.0.b : It should be indicated how you divide pond pine woodland from pocosin, and, more importantly, pine savanna from flatwoods. Is the difference between pine savanna and flatwoods a structural one, or are you referring to pine savanna and pine flatwoods as management prescriptions (pine savanna = RCW Habitat Management Area and pine flatwoods = Mixed Pine Woods). How does the land types usage her correspond to your classification system elsewhere? See our comments pertaining to Management Indicator Species under 2.34. Additionally, note the following:

1) Wild Turkey. The maritime forests of the Croatan are so limited, it may be the case that turkeys will never occur there. Based on the old literature, wild turkeys were common in open pine communities with frequent fire--thus it would be a good MIS for areas mapped as Pine Savanna and Mixed Pine Forest (pine flatwoods).
2) Pileated Woodpecker. This should be listed for maritime forest, pond pine woodland, pine savanna, and pine flatwoods. (Pileateds frequently take over old RCW cavities.)
3) Black-throated Green Warbler. This species occurs in headwaters areas, in communities like Nonriverine Swamp Forest, Wet Hardwood Flats, Bay Forest, and mature Pond Pine Woodland. They shun riverine systems, which is the main reason there is so much concern about them (very high Partners in Flight concern score); the majority of their original habitat is gone. In this table, oak-gum cypress is not really appropriate, because they do not occur in most examples of this habitat type. Oak-beech is entirely inappropriate. Pond Pine Woodland is OK.
4) Prairie Warbler. Should be listed for Pine Flatwoods.
5) Prothonotary Warbler. Should not be listed under pocosin. Should also be listed under Pond Pine Woodland.

4.24, MA 1, Recreation Opportunities: We would like the opportunity to review the location of the 150-person parking lot on Brice Creek .

4.52, MA 3, Recreation Opportunities: Is there a large enough land base at Cedar Point to increase visitor facilities without impacting the maritime forest there? We request the opportunity to review any plans for visitor facility improvement at Cedar Point.

4.60, MA 4, Fire: Although a three- to five-year rotation is what is usually recommended, it should be stressed that the optimal rotation period for most longleaf pine stands is probably around every three years.

4.64, MA 4, Recreation Opportunities: The proposed construction of 1-3 alkaline fishing ponds needs to be carefully evaluated to determine whether environmental impacts outweigh the benefits. It is our understanding that CNF plans to construct the ponds on peripheral land not yet acquired. However, we request the opportunity to review a proposal showing mapped location for these fishing ponds.

4.98, MA7, Wildlife and Fish : See our comments under III-104 regarding powerline rights-of-way.

5.8, Monitoring Questions, Table 5-1: A table here indicates that CNF staff will be monitoring the number of acres of natural areas managed through prescribed fire, timber harvest, and salvage. The term "timber

harvest" implies timber production, and natural areas are not suitable for timber production. Most of these areas are uneven-aged and should not require timber management to enhance their suitability as RCW habitat. It would be preferable to describe it as RCW habitat maintenance, and to regard it as something that is done only when absolutely essential.

FIGURES: Figure 4.2 is somewhat confusing. The management prescriptions listed here in the key are not all-inclusive. They only include the non-embedded prescriptions, which are not necessarily the most restrictive. So somehow the title of the map and the key should refer the reader to the other maps for more restrictive prescriptions such as old-growth and natural areas. Secondly, the key names do not match the prescription names in the text, as follows:

Text:	Map Key:
Black Bear Habitat	Black Bear/Semi-Primitive Recreation
Developed Areas	Developed Sites
Small to Medium Pocosin Patches	Pocosin/Pond Pine
Water-Based Recreation/ Heritage Interpretation	Heritage Resource / Water-Based Recreation
Pine Savanna and Flatwoods	Pine Savannah Restoration

APPENDICES

D. Land Adjustment:

Areas Targeted for Acquisition: Your proposed acquisitions of private land seem to address land acquisition needs for most of the identified natural areas on the CNF, and for important habitat from a landscape perspective. We wish to emphasize that proposed acquisitions north of Holston Creek (identified by CNF as a recreation acquisition) and of Walkers Millpond/Black Creek (identified by CNF as a consolidation acquisition) have natural resource values as well, and would probably be proposed for natural area status in a future plan revision.

The only land acquisition addition we would propose are the rich mesic slopes associated with Otter Creek (Flanners Beach area) and any other areas between Flanners Beach and Fishers Landing, to tie these two pieces together. Additionally, if any land is available in the vicinity of the Cedar Point area, to increase CNF acreage of Coastal Fringe Evergreen Forest.

For the remaining area selected for acquisition, **highest priority** should be given to CNF acquisition of any high quality longleaf stands (with intact herbaceous layer) on private lands, such as north of NC 24 and perhaps along US 70. While it is commendable to increase the longleaf forests on current Croatan ownership, some of the lands selected for restoration may not have a viable herbaceous layer. It is important to acquire existing high quality natural areas, particularly those containing longleaf, in the vicinity of the CNF. Some of these natural areas are not being currently managed through prescribed burning, and would benefit from CNF ownership and management.

The map should show the anticipated loss of land for the Havelock Bypass. The text should address the expected number of acres lost, acres of longleaf pine types lost, etc. to this project, as well as mitigation. What types of land is the CNF expected to receive from DOT as mitigation? Will the 700 acres of longleaf habitat on the CNF lost to the Havelock Bypass be replaced? These are changes anticipated to occur within the 10-year scope of the plan, and should be addressed.

We would like you to also emphasize in this section that CNF is seeking to acquire lands between the CNF and Camp LeJeune, Holly Shelter, and Hofmann Forest, and we strongly support those efforts.

Areas Targeted for Potential Exchange:

Area west of Neuse River between two isolated CNF-owned areas (Flanners Beach and Fishers Landing), steep slopes associated with the Otter Creek drainage: If this area is exchanged, it would be appropriate to try to replace it with similar habitat in the Otter Creek drainage, possibly serving to increase the size of the Flanners Beach area, or to acquire riparian habitat along Island Creek.

Area to northeast of Sheep Ridge Wilderness, east and slightly south of tract currently owned by Weyerhaeuser and identified as "consolidation acquisition" tract: This tract seems to be worth retaining as buffer. It contains some longleaf and is not an isolated parcel. Retention of the tract may facilitate fire management in the future.

Area east of area described above, and northwest of Cherry Point: The tract contains an area of upland flats, mostly loblolly but also longleaf and pond pine. It is bordered by rich mesic slopes supporting numerous species not typical of the coastal plain, roadside populations of spring-flowering goldenrod (*Solidago verna*), and floodplain swamps. The east end of the tract includes some tidal brackish to fresh marsh. The tract will be separated from the rest of the CNF by the Havelock Bypass. We would recommend that every effort be made by CNF to retain the tract and to acquire the connecting tract (of about 1000 feet width) between Goodwin Creek and the Cherry Point Marine Base boundary.

Tract located on both sides of US 70 from about 0.3-0.7 mile north of SR 1129. This tract is contiguous with a large area of USFS-owned land to the west, including Masontown Pocosin, the southeast edge of which is only about 2000 feet from this tract. Development of this tract would further erode the ability of CNF staff to manage their lands in this portion of the CNF. The portion of the tract west of US 70 should be retained by CNF.

The three tracts in the vicinity of Cedar Point should be evaluated to determine whether they have restoration potential in order to verify whether they are suitable for exchange.

The remaining tracts identified for exchange are probably suitable. The habitat they contain is not exceptional and they are mostly isolated and do not function as buffers for significant habitat within CNF ownership.

E. Silvicultural Methods: Forestry management, either for restoration purposes or to extract timber when it reaches a certain level of maturity, should ideally be conducted on the Croatan National Forest in such a way as to most closely mimic natural processes. While some of the methods selected represent the best current state of knowledge, others seem to reflect standard commercial forestry practices. Through our earlier conversations with Leon Neel (Red Hills forester, 919/226-8432); Bob Mitchell (Joseph W. Jones Ecological Center in Newton, Georgia; 912/734/4706); Keith Moser (Tall Timbers, Florida; 850/893-4153); and Greg Seaman (TNC Tallahassee NW Florida Land Steward; 850/643-2756), it seems that some land managers

outside of North Carolina are successfully using methods for longleaf forestry and restoration which may be more suitable than our own. The Appalachicola National Forest and Ouachita National Forest are two we have heard of that may be using advanced methodology. We have not thoroughly researched the topic, instead calling one person and being referred to other experts on the topic. But we strongly believe that the Croatan can refine their silvicultural methodology to reflect the best of what is currently practiced.

Based on our conversations with those foresters, we would propose the following changes. However, we would additionally encourage CNF and planning staff to contact these experts and others to access the best information available. Using that information, CNF and planning staff should meet with experts in the state on-site to determine site-specific longleaf restoration methodology.

Longleaf Restoration

1)Bedding and Fertilization: We do not support bedding and fertilization as a site preparation tool for the wet savannas and flatwoods landtype. The proposal for bedding and fertilization are effective for maximizing tree growth, but have substantial ecological consequences, and should not be used where ecological restoration is the goal. Bedding, even on the fairly wide spacing suggested, severely disturbs a significant portion of the soil surface. Any remaining natural herbaceous vegetation will be severely impacted, making recovery of the herbaceous layer slower and more difficult. While native herbs can spread back into disturbed soil from adjacent undisturbed areas to some extent, shrubs and weedy herbs generally respond more quickly, and are likely to become the dominant ground cover. Bedding should definitely be avoided in restoring sites that retain good or fair quality natural ground cover vegetation.

Bedding also alters the site in the long term. In the flat terrain of the Coastal Plain savannas and flatwoods, the beds produce changes in height above the water table that are quite significant for plants in the herb layer as well as the planted trees. Bedding opens the site to plants of both wetter and drier communities, resulting in ground cover vegetation that may be quite different from the natural community that should be the goal of restoration. Beds are capable of lasting for many years under tree canopy, probably essentially indefinitely unless mechanically smoothed or knocked down by equipment during harvest. Any future removal of beds will require drastic disturbance to the ground cover vegetation, reversing what recovery has occurred.

These wet sites may naturally support a lower density of longleaf pines than would be desirable from a forestry standpoint or support longleaf in a mixed stand with pond pine or loblolly. For instance, some of the sites you have selected are on Leaf, Lenoir, or Rains soil types, which naturally support mixed pine stands as opposed to those dominated by longleaf. Portions of these sites may have not supported much longleaf at all. For all of the proposed restoration sites, if your goal is true ecological restoration, you should be aiming to restore the approximate mix of canopy species likely to occur naturally. To determine whether selected sites are truly suitable for longleaf or mixed longleaf restoration, you should conduct a rapid on-site assessment of sites in coordination with Cecil Frost of the Plant Conservation Program, Department of Agriculture, Natural Heritage Program community ecologist Mike Schafale, and any other suitable longleaf experts. This should ideally occur before finalization of the plan, so that mapped boundaries can be revised as needed, and a different methodology can be developed as needed for restoration of mixed longleaf stands.

Fertilization also offers potential problems for ecological restoration. In naturally infertile soils, the natural vegetation consists of species well adapted to low nutrient levels. Ecological theory suggest that species richness is highest at low to intermediate levels of fertility. Experimental fertilization studies in pine savannas have demonstrated reduced species richness. Fertilization can be expected to favor weedy species

over the naturally occurring ground cover species that should be the goal of restoration. Its use should be limited to sites where tree growth rather than restoration is the goal.

The intent of fertilization in the 600 acres of pinestraw raking plots is, at least partially, to replace nutrients lost through removal of pinestraw. However, it is often used to also enhance tree growth. The effect on the herbaceous layer of the sudden removal of a nutrient source (pinestraw) and the sudden influx of nutrients through fertilization has not been well-studied, but it is anticipated that such treatment also impacts the herbaceous layer. If the goal of the CNF is to maintain and restore the longleaf ecosystem within their boundaries, there should be a greater understanding of the effects of fertilization, bedding, and pinestraw removal on **all components** of the ecosystem **before** these techniques are broadly applied.

2) Clearcutting: Clearcutting followed by planting of longleaf may not be the best way to restore the longleaf ecosystem. Clearcutting followed by planting still creates a plantation structure, which actually tends to fragment natural savannas. In longleaf plantations, weedy species such as raspberries (*Rubus* spp.) often become established, and loblolly seedlings often thrive. Thinning in conjunction with increased burning is probably better. The Ouachita National Forest has restored shortleaf pine/bluestem sites without clearcutting, using thinning, removal of midstory trees, and regular prescribed burning.

While the extent of longleaf restoration efforts in the next 10 years is not vast (4000 acres, of which 1000 are wet, 1500 have on-site longleaf trees to act as a seed source, and 1500 would be clearcut to remove non-longleaf stands) when you look at the entire acreage of the CNF, most of this effort is concentrated in a more limited area (MA3, MA1, and MA6). Even acknowledging that only a portion of the area to be restored will be clearcut, it seems likely that the amount of clearcutting in certain Management Areas could have a detrimental effect (at least temporarily) on the RCW populations within those areas. You have projected large 10-year increases in RCW populations within those M.A.s where longleaf restoration efforts are concentrated. Have you assessed the short-term impacts on RCW populations by management area? Considering these short-term impacts, would it be better to avoid clearcutting when possible and to thin, plant longleaf, and thin again to achieve historic canopy composition?

The current stand should be carefully harvested to avoid ground disturbance, ideally slowly converting the stand rather than initiating clearcuts. This technique avoids a sudden, and unnatural, removal of all of the canopy, and the effects of such removal on the herbaceous layer. To control subsequent growth of non-longleaf pine seedlings or hardwoods, and to encourage wiregrass growth, it is important to burn several times soon after harvest, and to keep burning the area regularly to control loblolly regeneration.

3) Planting Method: Longleaf seedlings should be hand-planted. Other land managers using this method of planting have found that volunteers or inmate work crews can supply the labor. Containerized seedlings have typically been used, especially for restoration of dry sites. The containerized seedlings have a survival rate of about 70-80%. A planting density of 250 seedlings per acre, followed by 20-30% mortality, seems to mimic natural density averages of 140 seedlings per acre. While this mortality rate is average for most site types, it may be higher on sites with exceptionally low productivity. It may be beneficial to monitor mortality of seedlings at a particular site, and to determine whether future plantings should occur at greater densities. The CNF staff needs to establish a planting density target, which may vary somewhat depending on the site, and targets for the future condition of the stand (based on planting density and condition of ground layer at time of planting, what is the target for the condition of the stand and herb layer in 10 years? In 20 years?). To mimic a natural pattern of distribution, planting at random start locations in a spiral pattern is advisable. Land managers who have used this pattern indicate that planting crews learn the pattern easily. Planters are advised to allow roughly 3 to 4 steps between seedlings planted. Within the broader area to be restored, these spiral plantings are clustered, leaving some areas relatively open for subsequent

natural seeding or for subsequent clustered plantings to establish an uneven-aged stand. If the spiral planting method seems too cumbersome or makes subsequent thinning difficult, trees may be planted in rows.

4) Control of Loblolly Growth Following Planting: The longleaf should be allowed to establish and grow (about 12-14 months), then the restoration area should be burned to control loblolly regeneration. The area should be burned again within a year, and then burned regularly to avoid loblolly regeneration.

5) Control of Hardwood as Part of Restoration Process: Manual removal of some large hardwoods within longleaf pine communities may also be necessary, at least initially before fire successfully limits their growth. Ideally, this should be accomplished through hand cutting and removal of large hardwoods, allowing some clusters of large hardwoods to remain as mast species. (Please note that within active or recruitment clusters, hardwoods may occupy no more than 10% of the canopy cover and 10% of the cover below canopy). Cutting of hardwoods should ideally occur during the dry season to avoid soil disturbance. Selective direct application of herbicides to cut stems directly after cutting (ideally an hour behind and no more than a day behind) may also be necessary to limit resprouting. This pattern of hardwood removal would more closely mimic the natural distribution of hardwoods in a landscape where fire is usually patchy. Prescribed burning should eventually be sufficient to control hardwood growth. Hardwood tops should be scattered on the ground, preferably in smaller pieces to prevent unnatural accumulation of woody debris. Piling of tops should be avoided as piling typically results in soil disturbance. Large piles of tops also create an unnatural distribution of woody debris, burning with greater-than-natural intensity in subsequent prescribed burns. Disturbance of the ground layer should be avoided during removal of hardwood logs.

6) Prioritizing Longleaf Restoration Projects: Restoration of areas adjoining existing natural areas or old-growth should be given highest priority. In particular, restoration of the natural area supporting populations of the Venus flytrap cutworm moth (*Hemipachnobia subporphyrea*) and the Arogos skipper (*Atrytone arogos arogos*) should be given especially high priority (see section pertaining to Natural Area management prescription standards, 3-2, Rare Species).

Longleaf Ecosystem Maintenance While Extracting Timber:

1) Uneven-aged Management: We support broader use of the uneven-aged method used for longleaf pine on Wet Savannas and Flatwoods (09), Mesic Savannas and Flatwoods (10), Dry Mesic Savannas (11), and Xeric Savannas (12) Landtypes, as opposed to the use of the shelterwood method. Both are described in the Silvicultural Appendix, but it is not clear to what extent each will be used. While the latter method is widely used in commercial forestry and may be needed on a case-by-case basis where regeneration is particularly poor, we have had discussions with land managers managing for ecosystem-based objectives who have successfully used the lower intensity uneven-aged method you have described. The uneven-aged methodology most closely replicates natural stand dynamics.

Several standard practices described under the shelterwood method seem particularly harmful, as follows:

> a) In your description of thinning under the shelterwood method, you include the following information: The preparatory cut reduces stand density to 70 sq ft basal area (if over 80 to begin with), 10 years prior to final cut. The seed cut takes place 5 years prior to final cut to reduce density to 30 sq ft basal area. **Comment:** For the forest maintained under this regime on a 80-year rotation, does that mean that for that 80 year period the basal area density of the stand can be over 80 for 70 of those years??? This practice does not seem beneficial to the herb layer!

> b) In the description of planting under the shelterwood method, you are recommending 6000 seedlings per acre prior to canopy layer removal (at seedling age 1 or 2), with the eventual goal of 500-750 seedlings per acre after harvest. The idea is that many of the seedlings are lost due to logging mortality. **Comment:** The planting density is incredibly high and will undoubtedly have impacts on the herbaceous layer. The goal after removal of the shelterwood is 500-750 seedlings per acre. This number is still artificially high, since the density in a natural stand following mortality averages about 140 trees per acre.

If you are going to predominantly use uneven-aged management on existing longleaf stands, the method we would recommend is as follows:

> Stands which are artificially dense may require thinning to enhance herbaceous layer growth and create gaps for regeneration of longleaf pine. The following guidelines should be followed. When the basal area of the stand reaches about 60 or more square feet per acre, thinning or creation of small gaps can be initiated to favor regeneration of longleaf pine, to provide sunlight to the herbaceous layer, and to extract timber (not lower than 40 in most places, not below 50 in RCW active and recruitment clusters). It should be kept in mind that occasional basal areas of 80 to 90 square feet per acre do occur in nature, at least on a small scale. Ideally, trees should be removed through individual or small group selection. Harvest and removal of trees should be accomplished in a way that minimizes impacts to trees retained and avoids disturbance to the herbaceous layer and soil.

Pinestraw Raking:

There are numerous questions remaining about the effect of pinestraw raking on fuel and nutrient availability and the actual mechanical impacts of raking on the herbaceous layer. On the surface, pinestraw raking looks like a way to maintain the longleaf forest while deriving revenue from its "waste" products, the longleaf pine needles. But pinestraw raking potentially has much more significant and long-term impacts to the longleaf forest than removing trees through individual or group selection. If it potentially changes the effects of fire through changes in fuel availability, alters nutrient availability so much that fertilization is required, and suppresses the herb layer through mechanical impacts, is it the lowest impact method of deriving revenue from the forest? We acknowledge that the effects of pinestraw raking have not been fully researched. Until they have been, and until the results have been evaluated by ecologists familiar with longleaf pine ecosystems, it does not seem wise to rake straw on longleaf stands with natural ground cover.

Any changes made within this portion of the document need to be addressed in any other portions of the document containing forestry methods information.

Appendix I, Table 1-1: It is not clear from this table how old-growth fit into the analysis.

Draft Environmental Impact Statement:

S-1, S-2, S-3, Issues Addressed: Any statements here to the effect that "people are concerned..." are not accurate, because some people are concerned and some aren't. For natural area designation, for instance, it is perhaps more accurate to state that there are some concerns about preventing resource use or limiting resource management options. In a balanced statement, you would also indicate that, without natural area designation, there are concerns that natural resources are abused or that resource management is too narrowly focused on individual species. These statements should not be biased to represent a single-sided view of the issue.

The theme of Alternative B is supposed to be "low impact, maximum preservation of natural resources through official designation" while the theme of Alternative C and C modified seems to be somewhat higher impact, preserving natural resources through a variety of strategies while maximizing flexibility for restoration efforts. But it is inaccurate to indicate that a reduced prescribed burning program would be "low impact" - - it would have devastating impacts on the natural resources. It seems like you could have a more aggressive prescribed burning program even if a greater acreage of the CNF was designated as natural area, and as wilderness if the CNF would request an exception from the prescribed burning prohibition in wilderness.

Similarly, it is not clear why increased designation of natural areas in B is paired with reduced restoration efforts and old-growth designation. From our point of view, old-growth and natural area designation can overlap, as can restoration efforts (where needed) and natural area designation.

Your longleaf restoration numbers continue to confuse me in this portion of the document. You indicate that Alternative C or C-modified provides for 26,774 acres total suitable for timber management (even-aged and two-aged) while Alternative B provides for 10,890 acres total suitable for timber management. If, as stated earlier in the document, 6,000 acres of mature longleaf already exist, that adds up to a total of 32,774 (which differs from the 30,000 acres total goal you mentioned on S-1). Under 2. Recreation Opportunities, for Alternative C, you indicate that 4200 of that 26,774 will be regenerated in the next 10 years through small group selection and, for Alternative B, that 2600 acres will be regenerated in the next 10 years through more intensive methods (clearcutting, shadetree, etc.), in each case about 20% of the total. Then in the longleaf restoration table, you indicate that 623 acres will be regenerated per year in the next 10-year period for Alternative C, and that 104 acres will be regenerated per year in the next 10-year period for Alternative B. This doesn't seem to agree with the figures previously indicated (623 x 10 = 6230, not 4200 and 10 x 10 = 1040, not 2600). I am not sure whether my math is bad, but a simple solution might be a single table or serires of tables rather than the proliferation of numerical citations which occurs throughout the document and requires cross-checking.

You indicate that the increased ability to harvest for restoration purposes in Alternative C will result in a fourfold increase in jobs. If 20% is restored each 10 years (as indicated above), the fourfold increase in timber-related jobs will be sustained for about 50 years. You indicate elsewhere in the document that the yield will be 2,093 cubic board feet the first decade, and will drop to 1,355 cubic board feet in decades 2 through 5. After the stands are restored, they will be presumably maintained on the 80-year rotation. What will happen to jobs then? While the dramatic short-term job increase may be viewed favorably by the forestry community, how will a dramatic decrease be viewed 50 years from now? Will the forest industry insist on retaining the high level of employment to which they've become accustomed over the previous 50 years? What will the dramatic increase in timber availability do to the local market for timber products? How will it impact timber corporations and private timber owners?

Your numbers under Comparison of Land Allocations by Alternative (II-28) conflict with numbers elsewhere in the document. Under your earlier analysis of Wilderness, the difference between land allocated for Alternatives C and C-modified was 2,980 acres (34,892 for C-modified and 31,912 for C). For the greater wilderness designation in C, part of the area designated as Bear HMA becomes wilderness instead. However, it was my understanding that the Bear HMA was an umbrella designation that incorporated wilderness and where the stricter provisions of wilderness applied. The language in this table for prescriptions should also be changed to match the management plan text (not primary and secondary, but ? and embedded). The emphasis in the paragraph following the table should be that the embedded prescription applies if it is more restrictive.

This section's map, showing the Alternative C proposed boundaries, has the same flaws in the map key as previously indicated.

DEHNR should be changed to DENR throughout the document.

III-15, Soils: In the section on Soils, you indicate that phosphate fertilizer will be applied if the soils are phosphorus-deficient as part of site preparation for longleaf restoration. Applied to beds at rate of 92 pounds per acre of P205. Beds are 7 feet wide. Within the Silviculture appendix to the plan, you indicated the distance between beds of 14 feet. This is relevant to determining soil impacts and should be mentioned here. See our comments on fertilization under Silvicultural Methods, Appendix E.

III-15 through III-17, III-25, III-26: See our comments on Silvicultural Methods, Appendix E.

III-24, Potential Environmental Effects of Probable Land and Resource Management Activities. You indicate that compliance with federal and state BMPs regarding timber harvesting and other practices would limit or eliminate environmental effects from these activities. It should be noted that the state Wetland BMPs are currently being revised and are likely to be released this year. Having participated in the process, I can also emphasize that BMP guidelines only partially address conservation of natural resources, and so it is worth instituting practices that **exceed** state or federal BMPs.

III-47 and III-48: Mesic Pine Flatwoods communities are rare throughout the state, though sites capable of supporting them and that presumably once did support them are common. There are 45 element occurrences of this community type in the state, 41 above D rank. Of these, the largest number of occurrences are small patches in the Sandhills region. In the vicinity of Croatan National Forest, there are 8 known occurrences, of which 6 are in the Croatan and 2 are in Camp LeJeune. Of the 15 occurrences ranked A or AB, 3 are in the Croatan.

The Croatan sites, in order of rank, are Southwest Prong, Pettiford Creek (2 occurrences), Little Road, Hadnot Creek Ponds, and Billfinger Road. Of these, one (Little Road) is currently registered and two (Hadnot Creek Ponds and one of the Pettiford Creek occurrences) were accepted for natural area status and will be registered. The best one (Southwest Prong) and two of the three best (Southwest Prong and one of the Pettiford Creek occurrences) were not offered natural area protection.

All of the unprotected occurrences of Mesic Pine Flatwoods were put in the Pine Savanna prescription. A part of one, Southwest Prong, is overlain by old-growth other, but the others are not.

Mesic Pine Flatwoods have a mixed pine canopy, with longleaf and loblolly pine, sometimes shortleaf pine, and sometimes forest oaks or sweetgum that became established in the past. Longleaf was probably more predominant within these stands in the past. In the Outer Coastal Plain, Mesic Pine Flatwoods occur on sandy loam or loamy soils in flat or rolling terrain where the water table is not too near the surface. They are rare because the soils are desirable for agriculture and pine plantation, and most were converted long ago. They rapidly deteriorate in the absence of fire, and this factor has contributed to their rarity.

During our meetings with CNF staff, the primary reason for not adding these as natural areas was that you believed the Mesic Pine Flatwoods community is not rare. We question your assessment of the community's rarity and your decision to disqualify certain natural areas on the basis of that assessment. The statistics above are our evidence of the rarity of this community type. We request an additional opportunity to discuss your reasons for not accepting these natural areas.

III-83, Effects to Rare Plant Species: It is not made clear in this analysis that the difference in acreage of natural areas between B and C is largely accounted for by two pocosins (Masontown and Union Point) proposed for natural area designation, and by several riparian hardwood areas. These were proposed for natural area status primarily based on the rarity and/or high quality of the natural community types within the natural areas. This point should be included in the analysis and you should indicate how you've addressed rare and/or high quality riparian hardwood forests (by wrapping them into the Old-Growth designation) and the rare and/or high quality pocosins, by designating them as Bear HMA. Otherwise, this description makes it sound like our proposal was based on thin air. It wasn't - - you just decided to conserve these areas using different tools.

III-96,Forest Health/Insects and Diseases, Affected Environment: Your guidelines for hurricane damage control sound reasonable for your timber production areas, but for areas (old-growth, natural areas, bear habitat management area) which are not managed for timber production, it should be kept in mind that hurricanes are a natural process and should be allowed to operate as they would without human intervention. If adjoining stands containing commercial timber are potentially affected by insect outbreaks, then action may need to be taken.

III-104, Habitat Past Action and Present Conditions and III-122, Alternative C/C-modified: The CNF currently maintain 255 acres of wildlife openings, in cooperation with WRC (.05 to 13.05 acres). You propose to increase these by 10 acres, and to establish these new food plots in turkey management areas. It is also my understanding that these may be used as "anchor points" for fire plow lines. You indicate that the CNF may also start managing approximately 100 miles of powerline rights-of-way as linear food plots.

You also indicate that the CNF plans to convert up to 50% of current special use agricultural fields to permanent wildlife openings. You indicate that conversion of wildlife openings within 500 feet of bottomland hardwood forests to permanent perennial openings (instead of planted in annuals?), and conversion of special use agricultural fields to old fields would reduce the incidence of cowbird parasitism on neotropical migrants.

We question the need for additional food plots (10 acres or especially use of linear food plots in powerline rights-of-way), considering the current availability of early successional habitat and the likelihood that additional early successional habitat will probably be created or enhanced by prescribed burning. The proposal to create food plots along powerline rights-of-way is particularly problematic, because: 1) powerline rights-of-way often include rare species habitat or potential rare species habitat and 2) 100 miles of linear food plots represents much greater fragmentation of the landscape by a less-than-natural herbaceous layer type than small, isolated food plots. While these areas currently may look and function like the surrounding habitat, except for the absence of canopy species, and therefore mimic natural gaps, linear food plots would not have the same function. Where these clearings run through pocosins or other damp areas, they mimic naturally occurring savanna habitat. The food provided in the wildlife food plot is very specific to certain species, usually game species, and would not be representative of native vegetation. Powerline rights-of-way should be managed by mowing timed to avoid impacts to any rare species (usually in the winter) every three years within the right-of-way or through growing season burns. If powerline rights-of-way are burned, they will provide excellent habitat for turkey brood range.

III-106-108: The section seems to overemphasize hunter's needs and not give sufficient emphasis to more passive nature-based recreation, such as birding, botanizing, etc. On III-107, it should be noted that the loggerhead shrike is not found on the CNF.

III-110: The tiger salamander is not known from CNF, nor from anywhere near there. They are known from the Sandhills, plus a site in Wake County.

III-117: See comments under 2.34.

III-120: The proposed plan revision states that "Early seral habitat . . . would not adequately meet the habitat needs for wildlife species dependent upon early successional plant communities..", mentioned under the Alternative B description. However, CNF needs to examine the availability of early successional habitat beyond its boundaries. In the Coastal Plain, there are hundreds of thousands of acres of pine plantation in private ownership, and, at any given time, a large percentage of these holdings are in early successional stages. The CNF does not need to be overly concerned with providing large acreages of early successional habitat for wildlife.

III-134: We request the opportunity to review the location of all proposed recreational development not specifically described in this plan.

III-137, Wild and Scenic Rivers: We don't understand the basis for designating various portions as "wild", "scenic", and "recreational", and would question why there is not a higher proportion proposed for designation as "wild".

III-160, Timber Harvest: See our comments under Silvicultural Methods, Appendix E.

I have not stopped to correct rare species names or to edit, but I am occasionally running across incomplete sentences or incorrect species names. The document needs to be checked for accuracy. When rare species names are listed in the document, it would be ideal to include the scientific name, because there is some confusion about which species you are referring to.


Map 2
Hunters Creek
Upland Forest
Nhp accepted
Nhp_proposed
Oldgw_other
Longeaf Pine Restoration prescription in proposed hardwood natural area
NC Natural Heritage Program
March 2000


Holston Creek/
Haywood Landing
Areas to add to
Natural Area
Nhp accepted
Nhp_proposed
Oldgw_other
NC Natural Heritage Program
March 2000

State of North Carolina
Department of Environment
and Natural Resources
Division of Marine Fisheries

James B. Hunt, Jr., Governor
Bill Holman, Secretary
Preston P. Pate, Jr., Director

NCDENR
North Carolina Department of
Environment and Natural Resources

March 21, 2000

MEMORANDUM

TO: Melba McGee, Environmental Coordinator
Office of Legislative & Intergovernmental Affairs

FROM: Michael W. Street

SUBJECT: Environmental Assessment
00-E-0312 – Croatan National Forest – Multi Counties

Attached is the Division's reply for the above referenced project. If you have any questions, please don't hesitate to contact me.

MWS/tn
permits\admin\jpcover.ltr

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State of North Carolina
Department of Environment
and Natural Resources
Division of Marine Fisheries

James B. Hunt, Jr., Governor
Bill Holman, Secretary
Preston P. Pate, Jr., Director

NCDENR
North Carolina Department of
Environment and Natural Resources

MEMORANDUM

TO: Melba McGee

THROUGH: Mike Marshall MDM

FROM: James Patrick Monaghan, Jr. JPM Jr.

DATE: March 20, 2000

SUBJECT: 00E-0312 Croatan National Forest

The Division of Marine Fisheries has the following comments regarding the Land and Resource Management Plan for the Croatan National Forest and the associated draft EIS. First, we applaud the Forest Service for identifying portions of the White Oak River and Brices Creek as suitable for designation as Wild and Scenic Rivers. We support the Service's commitment to protecting the qualities in these areas that make these rivers eligible for such designation until a final decision is made by Congress. Second, we support the Forest Service plans to not engage in ground disturbing activities that could result in erosion and stream sedimentation, application of pesticides or herbicides, application of fertilizer, and riparian tree harvest or land disturbance.

We support Plan C since this option maximizes the number of plant restoration acres. These acres to be restored are concentrated in marshes, maritime forests, treeless savannas, canebrakes, and longleaf pine savannas. However, we encourage the practices of plugging existing ditches to prevent runoff from entering tributaries and to restore portions of the natural hydrology. We support increasing species diversity and optimizing density in marshes and maritime forests, i.e. restoring these plant communities to their natural state. We appreciate the Forest Service's desire to increase fishing access, but remind them that increasing fishing access does not equate to protecting or increasing the resource.

We appreciate the opportunity to comment on the proposed plan for the Croatan National Forest.

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DIVISION OF LAND RESOURCES
LAND QUALITY SECTION
January 21, 2000

MEMORANDUM

TO: Kathy Ford
Office Work Unit Supervisor
Washington Regional Office

FROM: Floyd Williams
Regional Engineer
Land Quality Section
Washington Regional Office

RE: Intergovernmental Review
Project Number 00E-0312
USDA Forest Service
Croatan National Forest
Land and Resources Management Plan

Any forestry related activity must utilize Best Management Practices as required by the North Carolina Division of Forest Resources. Any land-disturbing not directly related to forestry activities may require an erosion and sedimentation control plan to be filed with the Land Quality Section of the North Carolina Department of Environment and Natural Resources, Washington Regional Office. Please contact the Land Quality Section at 252-946-6481 for information.

FRW:sc

NORTH CAROLINA DEPARTMENT OF
ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF COASTAL MANAGEMENT

MEMORANDUM

TO: Melba McGee, NC Division of Policy and Development
FROM: Steve Benton, NC Division of Coastal Management
SUBJECT: Review of SCH# 00-0312 DATE: 3/20/2000

✓ A COPY OF ALL COMMENTS RECEIVED BY THE SCH IS REQUESTED ___ REVIEWER COMMENTS ATTACHED

Review Comments:

✓ This document is being reviewed for consistency with the NC Coastal Management Program pursuant to federal law and or NC Executive Order 15. Agency comments received by SCH are needed to develop the State's consistency position.
Project Review Number (if different from above) DCM00-06.
A consistency position will be developed based upon our review on or before _____.

___ A Consistency Determination document ___is, or ___may be required for this project pursuant to federal law and or NC Executive Order 15. Applicant should contact Steve Benton or Caroline Bellis in Raleigh, phone (919)733-2293, for information on proper document format and applicable state guidelines and land use plan policies.

___ Proposal is in draft form, a consistency response is inappropriate at this time. A Consistency Determination should be included in the final document.

___ A Consistency Determination Document (pursuant to federal law and/or NC Executive Order 15) is not required.
___ A consistency response has already been issued.
Project Number _____ Date Issued _____
___ Proposal involves < 20 Acres and or a structure < 60,000 Square Feet and no AEC's or Land Use Plan problems.
___ Proposal is not in the Coastal Area and will have no significant impacts on any land or water use or natural resources of the Coastal Area.

___ A CAMA Permit ___is, or___ may be required for all or part of this project. Applicant should contact _____in _____, phone #_____, for information.

___ A CAMA Permit ___has already been issued, or___is currently being reviewed under separate circulation. Permit Number_____ Date Issued_____

___ Other (see attached).

State of North Carolina Consistency Position:

___ The proposal is consistent with the NC Coastal Management Program provided that all conditions are adhered to and that all state authorization and/or permit requirements are met prior to implementation of the project.

___ The proposal is inconsistent with the NC Coastal Management Program.

___ Other (see attached).

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North Carolina Wildlife Resources Commission

Charles R. Fullwood, Executive Director

March 30, 2000

MEMORANDUM

TO: Bill Flournoy
Office of Legislative and Intergovernmental Affairs

FROM: Franklin T. McBride, Manager
Habitat conservation Program

SUBJECT: Croatan National Forest Plan Revision

The North Carolina Wildlife Resources Commission has reviewed the Croatan National Forest plan revision. We find the plan to be well written and we submit the following comments for consideration.

Access Issues

- We favor the concept of road closures, at least on a seasonal basis, to minimize disturbances to core habitat areas during critical periods, allow for soft mast production areas along road shoulders, as well as provide linear wildlife openings.
- The plan appendix lists what is believed to be 20-30 miles of new OHV roads to be established in addition to the 36 miles already present. It is our contention that OHV roads are not a compatible use with habitat conservation, species management or other recreational uses. Therefore, we submit that all unauthorized roads need to be eliminated and new ones not developed. In addition, we believe that some of the currently authorized OHV roads are inappropriately located in environmentally sensitive upland sites, which does not restrict travel off the roads.
- Trail development for horses and mountain bikes are proposed for the wilderness areas. Any new development activity seems inappropriate for wilderness areas, while a focus towards a management based scenario may work towards providing access.
- Several references have been made to converting traditional and existing unauthorized trails to "officially sanctioned" horse and bike trails. It appears there is some policy inconsistency to close a road for one use, while opening it for another use which may as have equal or greater adverse impacts.

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Prescribed Burning

- Implementation of growing season burns is encouraged and from our perspective needs to be utilized more on the National Forest for hardwood control in pine savanna types. The plan designates only longleaf stands for growing season treatments. Mature pond pine or loblolly stands may benefit from growing season prescriptions as well, therefore, should not be excluded from consideration.
- The reference is made to fire prescriptions in hardwood stands. Specifically in Management Area 6, an objective is to burn 500 acres of hard mast-producing hardwoods. It has been our experience that with the intensity of burns normally conducted on Croatan, mast production and tree survival would be severely impacted following the burns, unless implemented with different methods then used currently.
- Additional acreage involving many new areas is proposed to come under a prescribed burning regime. Given the constraints of smoke management and an ever increasing urban interface problem complicating burning and decreasing the window available to burn, the goal may be unattainable.

Staffing

- Most of the proposed management actions have an attached monitoring protocol. This monitoring obligation will require a locally based biologist to guide and implement. In addition, project coordination responsibilities with WRC and private entities in cooperative agreements is needed, as well as obligations for T&E species to be fulfilled.
- Proposed road closures and redirection of traffic will even further expand the need for enforcement to monitor and regulate trail use and other recreational developments.

General Content

- Specific information on practice implementation is not present in the plan. For example, how will a sub-population of mimic glass lizard be established in Management Area 3? It is our perspective that Croatan field personnel look to the plan to provide them specific details. In addition several references are made to establishment of other species sub-populations. It is uncertain whether this is a practical or viable effort, and how it's outcome will be documented is unclear.
- Species assumptions directing some management actions may not be based on reliable information. For example American alligator and Croatan crayfish are listed as extirpated from several Management Areas, however, NCWRC contract survey work on Croatan in 1996, including the Croatan crayfish, and local observation indicate differently.

- While ambitious, the plan also needs to be realistic, for instance, one plan objective is to increase the suitable habitat for southern fox squirrel by 25 percent over the next 10 years. This is not seen as a realistic goal if suitable habitat is classed as seed-producing age longleaf pine with an open understory.

Administrative Action

- Imposing a motor horsepower restriction at Great Lake appears contradictory to the theme of increased recreational opportunity. The launch facilities and character of the lake limit boat size and engine horsepower. We are not aware of any basis for implementing this restriction.
- In order to accomplish wildlife opening planting goals specified, it will require reauthorization to utilize herbicides on the Forest for wildlife management purposes. Given the site productivity and weed seed banks present, plant cultivation efforts are predisposed to be unsuccessful without herbicide use.

Forest Management

- We endorse an effort to restore both longleaf pine and hardwood based upon site suitability, which were previously converted to loblolly pine plantation.
- A pine straw raking is operation is proposed to be initiated on 600 acres involving mesic savannas and flatwoods, as well as drier savannas. We question the feasibility of a raking operation on the wetter sites and how it is to be integrated with the wildlife habitat goals for the area.
- The designated rotation age for loblolly and pond pine is designated as 60 years, which precludes their potential use as red-cockaded woodpecker cavity recruitment sites. These areas need to be considered in forage allocation at the very least if they are not presently and as cavity recruitment sites if suitable age class longleaf pine is not available.
- The plan largely discounts the suitability of pond pine for red-cockaded woodpecker recruitment territories sites based upon a sample size of one, therefore, from what we can determine, fails to designate pond pine stands, in Management Area 5, as potential recruitment territories. Suitability of pond pine for red-cockaded woodpeckers is not the issue limiting success, rather, lack of habitat quality as illustrated by one-quarter of the population at Holly Shelter Game Land and that at Dare County Bombing Range sustained in pond pine pocosin.

Public Use Facilities

- The plan proposes to construct 20 hunter use bridges across drainage canals with 50% to be handicap accessible. We propose that 100% be handicap accessible and that some measure be in place to ensure maintenance of the structures.

- Development of two turkey hunting blinds is designated for disabled hunters. Funds earmarked for disabled hunter access would be better spent elsewhere considering habits of the wild turkey and the low probability of one wandering by an established permanent stand.
- Site selection for the development of small ponds or lakes to provide public fishing opportunity should target already disturbed areas and include consultation with WRC fish biologists for appropriate fish population establishment and management advice.
- Establishment of day use facilities to accommodate 150 people on Brice Creek is well beyond the capacity of the area to maintain the quality of the experience, the wildlife habitat and prevent site degradation, therefore, no longer a "low-impact use". This plan doesn't take into account pressures from concentrated use waste disposal, nor the habitat loss within its floodplain already experienced associated with the New Bern airport soft landing zone and the Taberna residential community. This planned expansion of recreational facilities is definitely not in keeping with a Wild and Scenic Rivers designation.

Funding

- Catfish Lake Impoundment is one of the most intensively managed areas on the Forest with work done by WRC. The plan directs that additional work involve "substantial habitat improvement to achieve its potential", while maintenance funds are what is needed to maintain the quality already present, as well as, a commitment toward development of a deep well to augment impoundment water supplies during dry years.
- The appendix holds the KV budget for cooperative work at a constant. It is our understanding that as timber sale revenue increases, a corresponding increase in KV dollars should be available.

Thank you for the opportunity to review and comment on the revised Croatan National Forest Management Plan. If you have questions concerning these comments please contact Brent Wilson at 252/514-4738.

cc: Brent Wilson, NCWRC
William Wescott, NCWRC

FEIS APPENDIX B: DESCRIPTION OF THE ANALYSIS PROCESS

The Record of Decision for the Croatan and Uwharrie National Forests Land and Resource Management Plan (LRMP) was signed by Regional Forester John E. Alcock on June 3, 1986. Since that time, conditions have changed on both Forests to the extent that a combined LRMP is no longer practical. The decision to establish two separate plans was documented in the Notice of Intent to Prepare an Environmental Impact Statement published in the *Federal Register* October 17, 1996.

The decision to develop two plans was based upon reviews of the current plan and the changes in the issues facing the managers of the two forests. For the Croatan, seven issues were determined to drive the revision of the plan. These are as follows:

A. Biological Diversity
This includes recovery of the red-cockaded woodpecker (RCW) through restoration of the longleaf pine community, restoration of natural communities and wetlands, and provision of habitat for black bear.

B. Recreation Opportunities
Determination of how best to satisfy the demand from a changing public and which activities should be provided.

C. Special Land Allocations
Assessment of the need for additional designated wilderness and the suitability of the White Oak River and Brices Creek for Wild and Scenic designation.

D. Vegetation and Timber Management
Determination of which lands are suitable for timber production and what cover types would change as a result of the red-cockaded woodpecker recovery program.

E. Fire Management
Determination of the role of prescribed fire in the wildland urban interface and the restoration of natural communities and when natural fires should be allowed to burn.

F. Access
Assessment of the need for motorized access on the Forest.

G. Local Communities
The need to determine which special uses should be accommodated and how they would blend with other forest uses.

The following sections document the process for revising the LRMP. First is a description of the planning steps followed by an analysis of the supply of and the demand for products and services from the Forest. Finally is presented a description of the models used for developing alternatives and estimating effects.

B.1 Overview Of The Ten Step Process

The process for developing the LRMP consists of the following steps:

B.1.1 Identification of Issues, Concerns, and Opportunities

The first step in the process involved intensive public involvement to ensure that public issues, management concerns, and opportunities for developing resources were identified. This step consisted of gathering issues and concerns from the public and Forest Service employees, combining general topics, and determining major issues which are a combination of public issues and management concerns. The process began in July 1996 and the seven issues, concerns, and opportunities are described in detail in Chapter I of the EIS.

B.1.2. Development of Planning Criteria

Two types of planning criteria were developed, process criteria and decision criteria. Process criteria are specific requirements necessary for the planning process to function. They consist of guidelines and rules to guide the planning effort. Decision criteria provide the basis for evaluating and comparing alternatives and for selecting a preferred alternative.

B.1.3 Inventory Data and Information Collection

The Interdisciplinary (ID) Team determined what data were necessary based upon the major issues. Data collection is part of a normal forest operation and existing data were used whenever possible and were supplemented with new data where required to resolve issues. Data (including landtypes and acreages, supply and demand, expected output yields, and values and costs of resources) are needed for the formulation of the models used in the analyses of the management situation, formulation of the alternatives, monitoring and other phases of the planning process. These data are on file in the Forest Supervisor's Office in Asheville, North Carolina.

B.1.4. Analysis of the Management Situation (AMS)

This step of the planning process examines the current conditions and uses of the forest, the current management direction under the existing plan, and a determination of the need to establish or change management direction. The needs for changes were used as preliminary issues and scoped in the NEPA process for the environmental impact statement. The list of preliminary issues included access and road management practices.

Policy on road management (12/14/2001) includes a forest scale roads analysis (ID#7710-2001-3). This analysis fits into the planning process at the AMS step because it examines current conditions and provides guidelines for consideration of changes in future management.

<u>*Roads Analysis Process*</u> An assessment of the current management situation was conducted for open roads on the CNF to comply with FSM 7712.13(b). All classified roads on the CNF are shown on the Forest Plan Management Prescription Map. Guidelines identified in the analysis were captured as goals and objectives to address issues (See Plan 2.6). The social issues were narrowed to: safety from illegal shooting, illegal trash disposal, illegal, unauthorized access,

OHV use, and effects on bear and turkey habitat. Guidelines captured as objectives were: reduced open roads by 15-20 miles of the total 220 mile system with higher priority on those where illegal shooting occurs, close out unauthorized routes, use seasonal closures on 15 to 20 miles of current open roads, clean up trash dump sites. Standards (4.6.0) for road management included priorities for accomplishing road management objectives. Further documentation is available in the planning record as part of the Analysis of the Management Situation.

The AMS also determines the capability of the Forest to supply goods and services in response to society's needs. This is accomplished by constructing benchmarks which define the range of output levels and the feasibility of meeting them. These benchmarks include (1) projection of the Forest's current management program, (2) minimum level of management, (3) maximum timber production with market values, and (4) maximum present net value. The AMS is available as a separate document. Benchmarks are described in Section B.2 of this Appendix.

B.1.5. Formulation of Alternatives

The information gathered during the first four steps is combined and analyzed to formulate alternative management plans. The alternatives reflect the range of goals, objectives, and ways to address the issues. Each major issue was addressed in one or more alternatives. Each alternative represents the most cost-effective way of obtaining its goals and objectives. This process provides a basis for identifying the alternative which comes nearest to maximizing net public benefits, consistent with resource integration and minimum management requirements.

B.1.6. Estimation of Effects of Alternatives

The physical, biological, economic, and social effects of implementing each alternative were considered in detail, estimated, and compared. These effects include resource outputs, priced and nonpriced benefits and costs, and environmental factors.

B.1.7. Evaluation of Alternatives

Using the decision criteria, the ID Team evaluated the significant physical, biological, economic, and social effects of each alternative. This evaluation included a comparative analysis of the aggregate effects of the alternatives. Comparisons were made on present net value, social and economic impacts, outputs of goods and services, and overall protection and enhancement of environmental resources. These comparisons are presented in Chapter II of the EIS.

B.1.8. Recommendation of Preferred Alternative

The Forest Supervisor reviewed the ID Team's evaluation and recommended to the Regional Forester a preferred alternative, identified in the EIS and displayed as the Plan.

B.1.9. Implementation of the Plan

The Forest Plan is implemented following the issuance by the Regional Forester of the Final EIS, Plan, and Record of Decision. The Plan is the basis for the development of annual programs and budgets.

B.1.10. Monitoring and Evaluation

At intervals established in the Forest Plan, implementation shall be evaluated on a sample basis to determine how well objectives are being met and how closely management standards and guidelines are being applied. Monitoring requirements are described in Chapter 5 of the Forest Plan.

B.2. Benchmarks

Benchmarks were considered in the analysis to set "sideboards" on the range of outputs and activities. (More details of PNV and Timber Benchmarks are found in Section B.4.2) These are as follows:

B.2.1. Minimum Level

This is a benchmark in which management of the Croatan National Forest would be minimal. Personnel would consist of only a Ranger for administration, a Secretary to manage relations with the public, and one or two technicians to accomplish field activities. Management would consist of fire suppression, land-line maintenance, and some law enforcement. There would be no timber, recreation, wildlife, or fisheries programs. District personnel would be custodians, primarily.

B.2.2. Current Level

This is Alternative A (No-Action) in the Plan. Under this Benchmark, activities and outputs are what they have been since the original plan was implemented in 1986. This Benchmark assumes that no changes will be made in the outputs or activities.

B.2.3. Maximum Present Net Value (PNV)

This Benchmark represents the highest PNV, which can be achieved through management of the CNF.

B.2.4. Maximum Timber

This Benchmark determined the maximum amount of timber that can be produced given market conditions. Only timber-related values and costs were used in the calculation of PNV.

B.3. Analysis Of Supply And Demand

The Benchmarks determine the range of capability for providing resources on the Croatan National Forest. This section examines the demands for timber, recreation, and minerals from the Forest and the capability of the Forest of meeting those demands.

B.3.1. Timber Supply and Demand

Introduction

The Record of Decision for the Land and Resource Management Plan (LRMP) for the Croatan National Forest was signed in June of 1986. Prior to the LRMP, the Forest was producing

approximately 4.1 million board feet of timber annually from 91,300 acres classified as suitable for timber production. Approximately 320 acres were harvested by clearcutting and another 500 acres of timber were thinned. Surface water management for timber production (bedding) was done on approximately 20 acres each year.

Under the LRMP, the suitable acres were reduced to 30,300 and harvest was projected to be approximately 3.49 million board feet per year. The rotations would be lengthened and shelterwood would be used in conjunction with clearcutting for regenerating new stands. Thinning would be reduced to approximately 315 acres per year and surface water management for timber production would be discontinued.

Since adoption of the LRMP, circumstances affecting the management of timber on the Forest have changed. Specifically, the Final Environmental Impact Statement for the Management of RCW and its Habitat on National Forests in the Southern Region has been published which puts more limitations on timber harvesting on the Croatan. This analysis will focus on timber management since adoption of the LRMP in 1986 and the Forest's capability to meet regional timber demand.

Supply

Supply is defined as how much of a commodity, such as timber, will be made available for sale at various prices. The amount of timber offered in a fiscal year from the national forests is determined by the annual budget and commodity targets set by Congress rather than by the price of timber. The budget and output targets are distributed among the Districts based upon their ability to prepare and sell timber.

Timber Sold from the Croatan

The Allowable Sale Quantity (ASQ) for the Croatan National Forest was set in the LRMP at 35 million board feet for the 10 year period. The ASQ represents the maximum amount of timber which would be offered under normal conditions given the Forest's capability to sustain a flow of timber over the long-term. Table B-1 shows the amount of timber sold for each year since implementation of the LRMP.

As shown in Table B-1, in only three years has the amount of timber sold been greater than the average annual ASQ -- 1987, the first full year of plan implementation; 1991, when a major change was made in management; and 1997, which was a year of major impact from hurricanes and the Southern Pine Beetle. Most of the increase in timber sold in 1997 was in an attempt to salvage damaged and downed trees. Since implementation of the LRMP, the volume of timber sold has been approximately 86 percent of the ASQ.

Table B-1. Amount of Timber Cut and Sold from the Croatan National Forest in Millions of Board Feet from 1987 to 1997.

Fiscal Year	Timber Sold MBF	Timber Cut MBF	Percent of ASQ Sold %
1987	5,339	5,944	153.0
1988	2,807	4,758	80.4
1989	2,525	3,426	72.4
1990	1,343	2,603	38.5
1991	3,538	1,704	101.4
1992	3,170	3,367	90.8
1993	2,226	2,912	63.8
1994	1,915	1,097	54.9
1995	2,313	1,085	66.3
1996	2,045	1,480	58.6
1997	5,666	2,384	162.4
Average	2,990	2,796	85.7

Timber Cut from the Croatan

The amount of timber harvested from the Croatan has been declining since implementation of the LRMP (Table B-1). Harvest in 1997 was only 40 percent of the 1987 harvest. The average harvest from 1987 through 1997 was 2.796 million board feet or 80 percent of the ASQ.

Regional Timber Supply

Marketing Area: The Croatan National Forest lies entirely within the counties of Carteret, Craven, and Jones, but is in competition with timber supplied from several other counties. For purposes of analysis, a sixteen county marketing area was defined based upon a review of timber sales from 1987 through 1997 with a sale value of $2,000 or greater. The counties selected were Beaufort, Carteret, Craven, Duplin, Greene, Hyde, Jones, Lenoir, Martin, New Hanover, Onslow, Pamlico, Pender, Pitt, Washington, and Wayne. These counties all lie within 75 to 100 miles of the Forest and contain the major mills which process timber from the Croatan.

Ownership of Timberlands: There are an estimated 3,343,394 acres of timberlands in the sixteen counties (Table B-2). Of those, 118,846 acres are on the Croatan National Forest or 3.5 percent. The Forest Industry owns or leases 29.9 percent, 7.7 percent is owned by other public (state and local) agencies, and the majority, 58.9 percent, is in private ownership.

Under the LRMP, only 30,300 acres of the 118,846 (25.5 percent) timberland acres on the Croatan National Forest are classified as suitable for timber production. These acres have been further reduced as a result of the guidelines for managing the RCW.

Table B-2. Ownership of Timberlands in the Sixteen County Marketing Area of the Croatan National Forest (Acres).

Ownership Class	Acres No.	Percentage %
National Forest	118,846	3.5
Other Public	258,652	7.7
Forest Industry	952,020	28.5
Leased-Industry	47,437	1.4
Farmer	717,662	21.5
Miscellaneous Private	1,248,777	37.4
All Ownerships	3,343,394	100.0

Merchantable Volume: Merchantable volume of timber in the sixteen county marketing area is estimated to be approximately 5.5 billion cubic feet (Table B-3). Of that volume, 292,686 thousand cubic feet (MCF) or 5.3 percent, is on the Croatan, 409,028 MCF (7.5 percent) is on other public lands, 1,283,352 MCF (23.4 percent) is owned or leased by forest industry, and the remainder (63.8 percent) is in private ownership. Pine timber on the Croatan is 7.3 percent of the total in the marketing area.

The volume of available timber on the Croatan was reduced in the LRMP by approximately 25 percent. Further reductions have occurred as a result of the RCW guidelines.

Demand

Demand is defined as how much of a commodity, such as timber, will be purchased at various prices. The demand for timber from the Croatan National Forest is a demand derived from the demand for products which utilize national forest timber. For example, softwood roundwood will be utilized by pulp mills such as the Weyerhaeuser pulp mill in New Bern which, in turn, sells the pulp to a paper manufacturer. Similarly, sawtimber is converted to boards which are used in construction. The purchasers of national forest timber are not the ultimate consumers.

Table B-3. Merchantable Volume of Live Trees in the Sixteen County Marketing Area of the Croatan National Forest by Ownership and Species Group, Thousand Cubic Feet.

	All species		Pine		Hardwood and Other	
Ownership Class	Volume	Percent	Volume	Percent	Volume	Percent
	MCF	%	MCF	%	MCF	%
National Forest	292,686	5.3	184,497	7.3	108,189	3.6
Other Public	409,028	7.5	258,238	10.2	150,490	5.1
Forest Industry	1,224,677	22.3	737,255	29.2	487,422	16.4
Leased-Industry	58,675	1.1	53,586	2.1	5,089	0.2
Farmer	1,319,178	24.0	409,427	16.2	909,751	30.7
Miscellaneous Private	2,185,729	39.8	882,122	35.0	1,303,607	44.0
All Ownerships	5,489,973	100.0	2,525,125	100.0	2,964,848	100.0

Demand for Croatan Timber

Since 1987, 34 timber sales valued at $2,000 or more have been made on the Croatan. Three-quarters of these (76 percent) were purchased by individuals or corporations located within the three Croatan Counties -- Carteret, Craven, and Jones. Much of the timber was then hauled to

the Weyerhaeuser pulp mill in New Bern (Craven County), the Weyerhaeuser saw mill in Ayden (Pitt County), the Weyerhaeuser saw mill and plywood mill in Plymouth (Washington County), or the Georgia Pacific saw mill in Dudley (Wayne County). The distance from the Croatan to these mills was the basis for defining the sixteen county marketing area.

Under the assumption that these four mills constitute the majority of the demand for timber from the Croatan, the Forest is in competition with timber growers from a much larger area than the sixteen counties. A hauling distance equivalent to the distance from the Croatan from any of the four mills would encompass an additional 20 counties in North Carolina -- Bertie, Bladen, Camden, Chowan, Cumberland, Currituck, Dare, Edgecombe, Gates, Halifax, Hartnett, Hertford, Johnston, Nash, Northhampton, Pasquotank, Perquimans, Sampson, Tyrrell, and Wilson -- and 4 counties in Virginia -- Chesapeake, Southhampton, Suffolk, and Virginia Beach.

Although the mills which process timber from the Croatan most likely obtain their raw material from the 36 county marketing area (or more), for purposes of this analysis, the Croatan is assumed only to be in competition with timber producers in the 16 counties.

Regional Timber Removals

The amount of timber removed from the 16 county marketing area is an indication of the demand for the available timber. As shown in Table B-4, regional timber removals average 196,800 thousand cubic feet (MCF) each year. Of this, 74 percent is softwood and 26 percent is hardwood. Softwood timber removals from the Croatan have averaged 525 MCF or only 0.36 percent of the regional total. Hardwood removals have been only 0.04 percent of the regional total.

Since the implementation of the LRMP, timber removals from the Croatan have been declining (Table B-1). This has been the result of a reduction in the suitable timber acreage, restrictions for the RCW, and declining Forest timber budgets.

Table B-4. Timber Removals from the Sixteen County Marketing Area and the Croatan National Forest for Selected Years, Thousand Cubic Feet. Timber Converted from MBF to MCF by the Formula, MBF x .18182 = MCF.

	Sixteen County Area		Croatan		Percent Croatan	
Year	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
	MCF	MCF	MCF	MCF	%	%
1986	138,197	42,426	1,038.39	42.26	0.75	0.10
1989	151,788	54,316	620.04	2.94	0.41	0.01
1992	150,907	51,177	598.39	13.85	0.40	0.03
1994	144,937	56,003	168.97	30.46	0.12	0.05
1995	144,685	49,347	197.21	0.00	0.14	0.00
Average	146,103	50,654	524.60	17.90	0.36	0.04

Future Supply and Demand

The demand for timber from the 16 county region will continue to rise as the population increases. The Forest has the capability of supplying 5.3 percent of the regional demand (Table B-3). This is under the assumption that all 118,846 acres of timber land would be utilized. Under the LRMP, the suitable timber production acres were reduced to 30,300 or 25.5 percent.

With this timber base, the Forest could only supply 1.35 percent of the regional demand, or approximately four times what has been supplied historically.

Timber production on the Croatan National Forest will continue to be limited by budgets, RCW restrictions, and public opinion. Meeting regional timber demand may be of less importance than managing for RCW, watershed protection, wildlife habitat, and recreation opportunities.

B.3.2. Recreation Supply and Demand

The Croatan National Forest is uniquely positioned to provide outdoor recreation opportunities to coastal North Carolina. National Forest lands occupy 16.5 percent of the land area of Carteret County, 14.1 percent of Craven County, and 13.1 percent of Jones County. Outside the national forest the three counties are growing in population at a rate greater than that of the state of North Carolina. From 1970 to 1990, population in the three counties increased by 38.1 percent compared to the state average of 30.4 percent.

This rapidly increasing population is putting more demands on the Forest to provide developed and dispersed recreation opportunities. When the Land and Resource Management Plan 1986-2000 (LRMP) for the Croatan and Uwharrie National Forests was implemented in 1986, an estimate of supply and demand indicated that estimated demand would be met by the Croatan National Forest for dispersed recreation, but not for developed. The purpose of this analysis is to determine if the supply and demand conditions have changed for the Forest in the past ten years and, if so, what changes in management might be required.

Supply

Supply refers to how much of a commodity or service will be made available for consumption at various prices. The concept of price is not relevant when the commodity or service is being provided at no or minimal cost by a public agency such as the Forest Service. Therefore, for this analysis, supply is defined as the opportunity to participate in a desired recreation activity in a preferred setting to realize desired and expected experiences. The three components of supply, under this definition, are settings, activities, and facilities.

Recreation Settings

Recreation settings refer to the physical and social environments needed to produce recreation opportunities. The Forest Service defines recreation opportunities by the Recreation Opportunity Spectrum (ROS) which describes recreation settings in terms of physical, social and managerial characteristics. The spectrum goes from primitive (a setting with a high degree of remoteness) to urban (a setting characterized by large buildings and paved surfaces). Five classes of ROS settings occur on the Croatan National Forest -- semi-primitive non-motorized, semi-primitive motorized, roaded natural 1, roaded natural 2, and rural.

Under current conditions, 20 percent of the land area on the Forest is classified as semi-primitive non-motorized, 4 percent is semi-primitive motorized, 56 percent is roaded natural 1, 10 percent is roaded natural 2, and 10 percent is rural. As the LRMP is implemented (Record of Decision signed on June 3, 1986) more of the Forest will be managed as semi-primitive non-motorized. Under the LRMP, 54 percent of the Forest will be semi-primitive non-motorized, 29 percent

roaded natural 1, and 17 percent roaded natural 2. Rural ROS would occur on less than 1 percent of the Forest and none of the Forest would be classified as semi-primitive motorized.

Recreation Activities

According to the Recreation Information Management System (RIM), recreation use on the Croatan National Forest is approximately 400,000 Recreation Visitor Days (RVDs) per year (a RVD is one person recreating for a 12-hour period) (Table B-5). Of this use, most is for activities dispersed over most of the Forest (70.7 percent). Developed recreation use is limited by available facilities and competing land uses.

Most of the dispersed use of the Forest is for consumptive activities such as hunting (30.3 percent) and fishing (12.1 percent). Warm water fishing on the Forest is primarily an activity of residents in the three counties surrounding the Croatan, but hunting opportunities attract visitors from all over North Carolina. Much of the land outside the National Forest is privately owned and unavailable for hunting except to organized groups or for a fee.

Big game hunting is the largest single use of the Forest (21.9 percent). The Croatan has a large deer population which provides hunters with excellent opportunities for hunting success, but creates management problems on gated forest roads and transportation corridors. During bear season, hunters from as far away as western North Carolina come to the Forest. They utilize the camping facilities or camp wherever they can and often stay for as long as a week. Almost all of the deer and bear hunting is with dogs and from roads that are not gated (or, in some instances, from roads which have gates).

Other dispersed use is more often by local residents or by visitors who are using the developed facilities. The Croatan has a variety of unique flora (e.g., Venus fly trap, pitcher-plants) and fauna (e.g., red-cockaded woodpecker). Visitors often will use the campgrounds as "staging areas" from which they will participate in other activities.

There are 31,221 acres of Wilderness on the Croatan, but wilderness use is less than 1 percent of the total dispersed use. Most of the areas are difficult to traverse so most of the use is around the edges and along roads. This use shows no real upward trend.

Recreation Facilities

Recreation facilities are made available to assist uses of recreation settings and to support recreation activities. Facilities can be either corridors which are used to transport users through a setting or places. Corridors include roads, trails, lakes or streams.

Table B-5.Total Recreation Use on the Croatan National Forest, 1991 to 1996, Thousands of Recreation Visitor Days (MRVDs).

							Average	Percent
RIM Activity	1991	1992	1993	1994	1995	1996	1991-1996	of Total
	MRVDs	MRVDs	MRVDs	MRVDs	MRVDs	MRVDs	MRVDs	%
Hunting, Big Game	93.9	103.8	80.6	83.0	83.0	83.0	87.88	21.94
Fishing, Warm Water	45.3	49.8	38.3	39.5	41.4	41.4	42.62	10.65
Picnicking	34.4	37.8	38.6	38.6	40.5	40.5	38.40	9.60
Hiking and Walking	27.6	30.4	29.2	29.2	30.6	31.2	29.70	7.42
Hunting, Small Game	25.5	28.1	26.3	27.1	27.1	27.1	26.87	6.71
Camping, Tent	24.0	26.4	20.7	20.7	21.7	21.7	22.53	5.63
Swimming	18.1	19.9	20.3	19.5	20.4	20.4	19.77	4.94
Viewing Scenery	15.5	17.1	17.4	17.4	18.2	18.2	17.30	4.32
Camping, Trailer	14.0	15.4	12.8	12.8	13.4	12.4	13.47	3.36
Nature Study, Hobby	9.4	10.3	10.1	10.1	10.1	11.1	10.18	2.54
Automobile Travel	9.9	10.9	9.0	9.0	9.4	9.4	9.60	2.40
Recreation Cabin Use	8.3	9.1	8.7	9.1	9.1	9.1	8.90	2.22
Hunting, Waterfowl	6.2	6.8	6.2	6.4	6.4	7.4	6.57	1.64
Fishing, Salt Water	5.1	5.6	5.7	5.9	6.1	6.1	5.75	1.44
Camping, Automobile	7.2	7.9	5.1	5.1	5.3	3.3	5.65	1.41
Canoeing	4.4	4.8	4.9	5.1	5.3	5.3	4.97	1.24
Camping, General Day	4.8	5.3	5.3	5.3	5.5	3.5	4.95	1.24
Boat, Powered	5.4	5.9	3.8	3.8	3.9	3.9	4.45	1.11
Horseback Riding	3.9	4.3	3.8	3.9	4.0	4.0	3.98	1.00
Nature Study, Wildlife	3.5	3.9	1.5	4.1	4.1	4.1	3.53	0.88
General Information	3.0	3.3	3.9	3.5	3.5	3.9	3.52	0.88
Water-Skiing and Other	3.0	3.3	3.5	3.4	3.4	3.4	3.33	0.83
Touring, Unguided	2.9	3.2	3.3	3.3	3.3	3.3	3.22	0.80
Bicycle	2.7	3.0	3.1	3.1	3.2	3.6	3.12	0.78
Walking, Unguided	2.5	2.8	2.9	2.9	2.9	3.2	2.87	0.72
Attending Talks and Prog.	2.4	2.6	2.7	2.8	2.8	3.8	2.85	0.71
Sailing	2.2	2.4	1.9	2.0	2.1	2.1	2.12	0.53
Organized Camping, Night	1.8	2.0	1.0	2.0	2.0	2.0	1.80	0.45
Gathering Forest Products	1.6	1.8	1.6	1.8	1.8	1.8	1.73	0.43
Motorcycle and Scooter	1.8	2.0	1.4	1.4	1.4	1.4	1.57	0.39
Viewing Inter. Exhibits	1.4	1.5	1.5	1.5	1.5	1.5	1.48	0.37
Diving	1.0	1.1	1.1	1.1	1.1	1.1	1.08	0.27
Viewing Inter. Signs	0.8	0.9	0.9	1.0	1.0	1.0	0.93	0.23
Games and Play	0.8	0.9	0.9	0.9	0.9	0.9	0.88	0.22
Walking, Guided	0.7	0.8	0.4	0.8	0.8	0.8	0.72	0.18
Touring, Guided	0.5	0.6	0.6	0.6	0.6	0.9	0.63	0.16
Train and Bus Touring	0.6	0.7	0.2	0.7	0.7	0.7	0.60	0.15
Organized Camping, Day	0.5	0.6	0.6	0.6	0.6	0.6	0.58	0.15
Other Watercraft	0.2	0.2	0.1	0.2	0.2	0.2	0.18	0.05
Total	396.8	436.7	379.9	389.2	399.3	399.3	400.20	100.0
Wilderness (Included Above)	2.3	2.5	2.6	2.6	2.6	2.6	2.53	0.63

Corridors

There are approximately 200 miles of roads serving the Croatan National Forest. Some of these are "through" roads which traverse the entire Forest and are used for commercial and commuter traffic as well as for recreation. Others are used to access the Forest and facilitate fire control

and forest administration. Approximately 35 miles (on 24 roads) have been designated for riding off-highway vehicles.

The Forest has 7 trails totaling 31 miles, all but two of which are designated for hiking only. The Cedar Point Tideland National Recreation Trail and the Island Creek Forest Walk are loop trails which provide opportunities to view unique scenic landscapes. The Neusiok Trail is a long distance (22 miles) trail through different coastal environments.

Water corridors include the White Oak and Neuse Rivers and Brice and Cahooque Creeks.

Places

Places are where people spend time engaged in a recreation activity. They may be developed such as a campground or picnic area or undeveloped, but favorite spots such as beaches, river banks, or hunting areas. Places may be further differentiated as Special Places or Hot Spots.

Special Places are those sites for which the location, attraction, or feature has been identified by users as unique, different, distinctive, or extraordinary. Hot Spots are places where capacities are reached or exceeded during peak periods because the resource attributes or facilities accommodate the needs and desires of users for specialized settings, activities, or experiences.

Recreation places on the Croatan National Forest are shown in Table B-6. Five of the places have been identified as Special and two are considered to be Hot Spots. Development of the sites ranges from primitive to highly developed. Total capacity is approximately 1,676 persons at one time (PAOT).

Most of the recreation places get light to moderate use except for the two Hot Spots -- Long Point and Siddie Fields. Both provide opportunities for primitive camping, fishing, and social interaction. Capacity is exceeded on both of them during peak periods. Use on the other areas is mostly on weekends.

Demand

Demand refers to how much of a commodity or service will be purchased at various prices. The concept of price is not relevant when the commodity or service is being provided at no or minimal cost by a public agency such as the Forest Service. For this analysis, demand is measured by participation rates in various recreation activities. Future demand will be measured by anticipated changes in participation rates resulting from population changes in the region and trends determined through research.

Much of the demand for recreation activities on the Croatan National Forest comes from the population in the three counties surrounding the Forest -- Carteret, Craven, and Jones. From 1970 to 1990, the population increased by 38.1 percent (from 103,936 to 143,583). This was a rate higher than that for the state of North Carolina (30.4 percent). By 2005, the three-county population is projected to be 171,853 or an increase of 19.7 percent over the 1990 population. The increase for the state of North Carolina is projected to be only 18.8 percent.

Table B-6. Recreation Places on the Croatan National Forest (Special, Hot Spots, and Others) with Estimated Capacity, Persons at One Time (PAOT).

Place Name	Special or Hot Spot	Capacity PAOTS	Facilities/ Activities	Attributes
Brice Creek	Special	100	Boat Ramp	Blackwater Stream
Cahooque Creek	Special	50	Boating/Picnicking	Oak Trees, Water
Catfish Lake		50	Boat Ramp	Lake
Catfish Sand Ridges	Special		Hiking/Viewing	Scenery, Wildlife
Cedar Point		215	Campground	Water, Scenery
Cedar Point		24	Picnicking	Water, Scenery
Fishers Landing		100	Camping/Picnicking	Neuse River
Flanners Beach		270	Swimming	Neuse River
Great Lake		50	Boat Ramp	Remote Lake
Haywood Landing		50	Boating/Picnicking	White Oak River
Island Creek Trail	Special	40	Interpretive Trail	Hardwoods, Creek
Long Point	Hot Spot	30	Picnicking/Camping	White Oak River
Neuse River		240	Campground	Neuse River
Neuse River		265	Picnicking	Neuse River
Oyster Point		18	Campground	Newport River, Remote
Patsy Pond			Pond	Ponds, Plants
Pine Cliff		100	Picnicking	Neuse River, Flounder
Siddie Fields	Hot Spot	24	Camping	Neuse River, Social
Tideland Trail		50	Interpretive Trail	Salt Marsh, Waterfowl
Waterfowl Imp.			Duck Hunting	Duck Hunting
Whiteoak River	Special		Boating/Viewing	Water, Scenery, Wildlife
Total		1,676		

Demand for recreation activities also comes from non-residents of the three counties. As shown in Table B-5, Big Game Hunting is the single largest recreation activity on the Forest (21.9 percent). While many of the hunters are local residents (or at least residents of nearby counties), many of the hunters are from western North Carolina, particularly bear hunters. They are able to extend the bear hunting season for themselves by hunting in both the western and eastern counties. A significant proportion of the camping activity also is associated with this group of Forest users.

Surveys of tourists by local chambers-of-commerce indicate that opportunities to recreate in the Croatan National Forest is one of the reasons for choosing the region as a destination. The Forest offers unique opportunities for wilderness experiences, primitive camping, and viewing rare flora and fauna. The analysis which follows will focus on which recreation opportunities provided on the Forest compared to those which might be provided off the Forest.

Participation in Activities

Participation in recreation activities is a reflection of the demand for those activities. Table B-5 shows the recreation visitor days (RVDs) for forty (40) activities on the Croatan National Forest from 1991 to 1996. Ninety percent (90%) of the participation is in just eighteen (18) activities and 50 percent is in only four activities -- Big Game Hunting, Warm Water Fishing, Picnicking, and Hiking and Walking. Participation in dispersed recreation activities account for 70.7 percent of the total.

Table B-7 shows the average participation in all activities and changes in participation from 1991 to 1996 and from 1993 to 1996. Both periods were analyzed because fiscal year 1992 was a year of higher than average participation.

From 1991 to 1996, participation declined in 10 activities -- Big Game Hunting, Warm Water Fishing, Tent Camping, Trailer Camping, Automobile Travel, Automobile Camping, General Day Camping, Power Boating, Sailing, and Motorcycle and Scooter Travel. Participation declined in four activities -- Trailer Camping, Automobile Camping, General Day Camping, and Water-skiing -- from 1993 to 1996. Participation in all other activities increased except for General Information, Unguided Touring, Motorcycle and Scooter Travel, Visiting Interpretive Exhibits, Diving, Games and Play, and Organization Day Camping which did not change during the period.

The increase in total participation from 1991 to 1996 (0.63 percent) or from 1993 to 1996 (5.11 percent) is less than what would be expected given that the population most likely increased by 8 to 10 percent during the same periods. This suggests that participation in recreation activities also is being influenced by a population which is getting older, more affluent, and less diverse. Future participation is expected to be influenced by these changing demographic trends.

Future Participation in Activities

Analysis of RIM data for the last thirty years (1966 to 1995) shows a continually rising trend in participation, which, if projected into the future, would indicate that participation could more than double by the year 2040. This is unrealistic for two reasons -- the limited national forest land area and the previously noted demographic changes in the population.

On September 30, 1995, the land area on the Croatan National Forest was 159,590 acres. This was only a 1.6 percent increase over the land area of 157,054 acres in 1985. With the exception of some national forest land which might be included in the proposed by-pass around the town of Havelock, the Forest will increase its land area through purchase, exchange or donation, but not significantly. Suitable land outside the national forest will become increasingly more difficult to acquire because of demand pressures from the increasing population.

The limiting land area eventually will result in an upper limit on participation in activities and, as that limit is approached, increases in participation will be reduced. Crowding will discourage forest users and they will seek opportunities elsewhere. This will be particularly true of developed sites which currently are at approximately 80 percent of capacity.

Table B-7. Average Participation in Recreation Activities and Percentage Changes in Participation 1991 to 1996 on the Croatan National Forest, Thousands of Recreation Visitor Days (MRVDs).

RIM Activity	Average 1991-1996 MRVDs	Percent of Total %	Change 1991-1996 %	Change 1993-1996 %
Hunting, Big Game	87.80	21.94	-11.61	2.98
Fishing, Warm Water	42.62	10.65	-8.61	8.09
Picnicking	38.40	9.60	17.73	4.92
Hiking and Walking	29.70	7.42	13.04	6.85
Hunting, Small Game	26.87	6.71	6.27	3.04
Camping, Tent	22.53	5.63	-9.58	4.83
Swimming	19.77	4.94	12.71	0.49
Viewing Scenery	17.30	4.32	17.42	4.60
Camping, Trailer	13.47	3.36	-11.43	-3.13
Nature Study, Hobby	10.18	2.54	18.09	9.90
Automobile Travel	9.60	2.40	-5.05	4.44
Recreation Cabin Use	8.90	2.22	9.64	4.60
Hunting, Waterfowl	6.57	1.64	19.35	19.35
Fishing, Salt Water	5.75	1.44	19.61	7.02
Camping, Automobile	5.65	1.41	-54.17	-35.29
Canoeing	4.97	1.24	20.45	8.16
Camping, General Day	4.95	1.24	-27.08	-33.96
Boat, Powered	4.45	1.11	-27.78	2.63
Horseback Riding	3.98	1.00	2.56	5.26
Nature Study, Wildlife	3.53	0.88	17.14	173.33
General Information	3.52	0.88	30.00	0.00
Water Skiing and Other	3.33	0.83	13.33	-2.86
Touring, Unguided	3.22	0.80	13.79	0.00
Bicycle	3.12	0.78	33.33	16.13
Walking, Unguided	2.87	0.72	28.00	10.34
Attending Talks and Programs	2.85	0.71	58.33	40.74
Sailing	2.12	0.53	-4.55	10.53
Organized Camping, Night	1.80	0.45	11.11	100.00
Gathering Forest Products	1.73	0.43	12.50	12.50
Motorcycle and Scooter	1.57	0.39	22.22	0.00
Viewing Interpretive Exhibits	1.48	0.37	7.14	0.00
Diving	1.08	0.27	10.00	0.00
Viewing Interpretive Signs	0.93	0.23	25.00	11.11
Games and Play	0.88	0.22	12.50	0.00
Walking, Guided	0.72	0.18	14.29	100.00
Touring, Guided	0.63	0.16	80.00	50.00
Train and Bus Touring	0.60	0.15	16.67	250.00
Organized Camping, Day	0.58	0.15	20.00	0.00
Other Watercraft	0.18	0.05	0.00	100.00
Total	400.20	100.00	0.63	5.11
Wilderness (Included Above)	2.53	0.63	13.04	0.00

As the regional population gets older, the mix of recreation activities will change. As Dwyer[1] has noted, as people get older, for example, they will hunt less and observe or photograph wildlife more. They also are more likely to go fishing more often, but camping less. Age was the dominant variable in predicting changes in participation rates.

Future participation in recreation activities on the Croatan is estimated through two sources -- The North Carolina Outdoor Recreation Plan 1995-2000[2] and Regional Demand and Supply

Projections for Outdoor Recreation[3]. Estimates for hunting and fishing are from Flather and Hoekstra[4].

Future Participation: North Carolina Outdoor Recreation Plan

The state of North Carolina is required to prepare a Statewide Comprehensive Outdoor Recreation Plan (SCORP) by the federal Land and Water Conservation Fund (LWCF) Act of 1965 to be eligible for acquisition and development assistance. The SCORP provides a framework for addressing the problems, needs, and opportunities related to the need for improved public outdoor recreation. The plan is prepared by the N.C. Division of Parks and Recreation.

Future demand was estimated through a survey process. Respondents were asked to identify activities (up to 10) in which their households would have participated more often if the opportunities had been available. From this list, the respondents were asked to choose the top five and list them in priority order. The activities were averaged for all respondents.

Activities were ranked as "high" or "moderate" depending upon whether they were listed in the top five by at least one-half of the respondents (high), or one-quarter of the respondents (moderate). All other activities were ranked as "low". Table B-8 shows the SCORP ranks for recreation activities on the Croatan National Forest.

As shown in Table B-8, eleven activities were ranked as having high future demand. These were fishing (both warm and salt water), picnicking, all types of developed camping, swimming, bicycle riding, and walking for pleasure (both unguided and guided). Fourteen activities were ranked as having moderate future demand. These included all types of hunting, trail hiking, viewing scenery and automobile travel, horseback riding, organized camping (day and night), and educational activities such as attending programs, viewing interpretive exhibits or signs, and general information. All other activities were ranked as having low future demand.

Forest Service plans are made for 10 to 15 years, with reviews at 5 year intervals. Even though the accuracy of projections declines the further into the future they are made, long term projections are necessary in order to establish goals and provide direction. Short term projections can result in inefficient allocations of resources and the need to make adjustments in direction more often.

Management for recreation activities also requires quantifiable estimates of participation in those activities. In Table B-8, for example, participation in Picnicking and Swimming are both projected to increase at a high rate. In 1996, participation in Picnicking was twice that of Swimming on the Forest. Should future resources be allocated more to providing opportunities to Picnic or to Swim? The SCORP projections do not provide that information.

Future Participation: Regional Demand and Supply Projections

English *et al.* estimated recreation demand and supply for 33 recreation activities in four regions of the United States. Their estimates were of recreation trips based upon such variables as cost of trip, suitability of site for a particular activity, income, age of population, and availability of

substitute recreation opportunities. Their results are presented as percentage increases by activity from 1987 to the years 2000, 2010, 2020, 2030, and 2040.

Flather and Hoekstra estimated wildlife and fish user-days based upon changes in population in four regions of the United States. Their estimates project changes in participation in non-consumptive use, hunting (big game, small game, and waterfowl), and fishing from 1980 to 1990, 2000, 2010, 2020, 2030, and 2040.

For the analysis of future demand (participation) in recreation activities on the Croatan National Forest, the estimates for maximum preferred demand for the South Region were used. Maximum preferred demand is defined as the number of trips that households would prefer to consume, given constant trip costs and an unconstrained supply of recreation opportunities.

These estimates are shown in Table B-9 projected to the year 2040 from the average recreation participation for the years 1991 to 1996. The estimates for hunting and fishing are from Flather and Hoekstra for the year 2040 for the South Region.

The estimates shown in Table B-9 should be the maximum future demand for each activity. Population changes previously identified and limited opportunities to increase land area would limit increases in recreation participation. As shown in Table B-9, recreation participation could increase by as much as 49.3 percent by the year 2040.

As shown in Table B-9, approximately 80 percent of recreation participation in the year 2040 will be in just eleven activities, the same eleven activities which accounted for 80 percent of the participation in 1966 (Table B-5). In 2040, Hunting (Big and Small Game) will continue to dominate recreation participation with 26.1 percent of the total (down slightly from 28.6 percent in 1966). Participation in Hiking and Walking (trail) will more than double by 2040 (12.3 percent of the total in 2040 compared to 7.8 percent in 1996).

Participation in Camping (Tent and Trailer) and Picnicking will almost double by 2040. North Carolina respondents to the SCORP survey also indicated that they would participate in these activities more often if facilities were available. Providing more facilities for these activities should be a priority for the Forest.

The North Carolina SCORP ranked Warm Water Fishing and Swimming as "high" for future demand, but there should be only moderate increases in participation on the Forest. Participation in activities such as Viewing Scenery, Automobile Travel, and Nature Study will all increase at a moderate rate.

Table B-8. Future Demand for Outdoor Recreation Activities on the Croatan National Forest Utilizing Ranks Developed for the Statewide Comprehensive Outdoor Recreation Plan (SCORP) 1995-2000.

RIM Activity	Average 1991-1996 MRVDs	Rank
Fishing, Warm Water	42.62	HIGH
Picnicking	38.40	HIGH
Camping, Tent	22.53	HIGH
Swimming	19.77	HIGH
Camping, Trailer	13.47	HIGH
Fishing, Salt Water	5.75	HIGH
Camping, Automobile	5.65	HIGH
Camping, General Day	4.95	HIGH
Bicycle	3.12	HIGH
Walking, Unguided	2.87	HIGH
Walking, Guided	0.72	HIGH
Hunting, Big Game	87.80	MODERATE
Hiking and Walking	29.70	MODERATE
Hunting, Small Game	26.87	MODERATE
Viewing Scenery	17.30	MODERATE
Automobile Travel	9.60	MODERATE
Hunting, Waterfowl	6.57	MODERATE
Horseback Riding	3.98	MODERATE
General Information	3.52	MODERATE
Touring, Unguided	3.22	MODERATE
Attending Talks and Programs	2.85	MODERATE
Organized Camping, Night	1.80	MODERATE
Viewing Interpretive Exhibits	1.48	MODERATE
Viewing Interpretive Signs	0.93	MODERATE
Organized Camping, Day	0.58	MODERATE
Nature Study, Hobby	10.18	LOW
Recreation Cabin Use	8.90	LOW
Canoeing	4.97	LOW
Boat, Powered	4.45	LOW
Nature Study, Wildlife	3.53	LOW
Water-Skiing and Other	3.33	LOW
Sailing	2.12	LOW
Gathering Forest Products	1.73	LOW
Motorcycle and Scooter	1.57	LOW
Diving	1.08	LOW
Games and Play	0.88	LOW
Touring, Guided	0.63	LOW
Train and Bus Touring	0.60	LOW
Other Watercraft	0.18	LOW
Total	400.20	
Wilderness (Included Above)	2.53	LOW

Future demand for recreation activities on the Croatan National Forest has been defined as anticipated changes in participation in those activities. By 2040, the Forest should be generating approximately 600,000 RVDs. The next section will discuss the capability for accommodating that demand.

Capability to Meet Future Demand

In Appendix C of the Land and Resource Management Plan (LRMP) for the Croatan National Forest, demand for developed recreation opportunities by the year 2000 was estimated to be 98,000 Recreation Visitor Days (RVDs) and for dispersed recreation, 170,000 RVDs. Since the LRMP was implemented in 1986, the Forest has added developed recreation capacity and by

1996, the Forest was estimating developed use at 117,000 RVDs (Table B-5). Dispersed recreation use in 1996 was almost two-thirds greater than that predicted for the year 2000 (282,300 RVDs).

The demand estimates in the LRMP were conservative given the changes in use which have occurred over the past ten years. They also did not take into account changes in participation by activities other than the broad categories of dispersed and developed recreation. The following analysis examines the recreation activities which will account for 90 percent of the participation on the Croatan by 2040 (Table B-9) to determine the capability of the Forest to meet future demand.

Hunting

Big Game Hunting will continue to be the dominant recreation activity on the Forest in 2040 (20.7 percent). Participation should increase by 41 percent (Table B-9) over that of 1966. This activity attracts hunters from all over North Carolina. Bear hunters from western North Carolina, for example, come to the Croatan in November and December to hunt when the season is closed in their area. As more of the Forest is managed as semi-primitive non-motorized, bear habitat should be improved and the forest should be able to accommodate the increase in hunting demand. There will most likely be increased law enforcement problems as more hunters want greater access to the Forest.

Hunting of Small Game and Waterfowl also will increase by 2040, but moderately (19 percent and 33 percent, respectively). Almost all of the participation in these two activities is from the local population. The Forest will be able to accommodate the increase in demand with the current facilities.

Hiking and Walking

The largest increase in demand will be for facilities to accommodate Hiking and Walking. Currently the Forest has 7 trails for a total of 31 miles. The Cedar Point Tideland National Recreation Trail and the Island Creek Forest Walk are special facilities (Table B-6) which also can accommodate those who want to View Scenery, Walk for Pleasure (Guided and Unguided), View Interpretative Exhibits or Signs, or Study Nature for either Hobby or Education. The Neusiok Trail is for more serious hikers.

Table B-9. Average Participation (1991-1996), SCORP Rank, and Estimated Future Participation in Recreation Activities on the Croatan National Forest, Thousands of Recreation Visitor Days (MRVDs).

RIM Activity	Average 1991-1996 MRVDs	SCORP Rank	Growth Indices No.	Projected Use MRVDs	Percent of Total %	Cumulative Percent %
Hunting, Big Game	87.80	MODERATE	141	123.798	20.72	20.72
Hiking and Walking	29.70	MODERATE	247	73.359	12.28	33.01
Picnicking	38.40	HIGH	131	50.304	8.42	41.43
Fishing, Warm Water	42.62	HIGH	115	49.009	8.20	49.63
Camping, Tent	22.53	HIGH	174	39.208	6.56	56.20
Hunting, Small Game	26.87	MODERATE	119	31.971	5.35	61.55
Viewing Scenery	17.30	MODERATE	174	30.102	5.04	66.59
Camping, Trailer	13.47	HIGH	174	23.432	3.92	70.51
Swimming	19.77	HIGH	118	23.325	3.90	74.41
Automobile Travel	9.60	MODERATE	153	14.688	2.46	76.87
Nature Study, Hobby	10.18	LOW	128	13.035	2.18	79.06
Recreation Cabin Use	8.90	LOW	115	10.235	1.71	80.77
Hunting, Waterfowl	6.57	MODERATE	133	8.734	1.46	82.23
Camping, General Day	4.95	HIGH	174	8.613	1.44	83.67
Camping, Automobile	5.65	HIGH	151	8.532	1.43	85.10
Canoeing	4.97	LOW	158	7.847	1.31	86.41
Horseback Riding	3.98	MODERATE	176	7.011	1.17	87.59
Fishing, Salt Water	5.75	HIGH	115	6.612	1.11	88.70
Bicycle	3.12	HIGH	206	6.420	1.07	89.77
Sailing	2.12	LOW	302	6.392	1.07	90.84
Nature Study, Wildlife	3.53	LOW	162	5.724	0.96	91.80
Touring, Unguided	3.22	MODERATE	174	5.597	0.94	92.74
General Information	3.52	MODERATE	155	5.451	0.91	93.65
Boat, Powered	4.45	LOW	118	5.251	0.88	94.53
Walking, Unguided	2.87	HIGH	162	4.644	0.78	95.30
Water-Skiing and Other	3.33	LOW	137	4.567	0.76	96.07
Attending Talks and Programs	2.85	MODERATE	155	4.418	0.74	96.81
Organized Camping, Night	1.80	MODERATE	174	3.132	0.52	97.33
Gathering Forest Products	1.73	LOW	158	2.739	0.46	97.79
Viewing Interpretive Exhibits	1.48	MODERATE	174	2.581	0.43	98.22
Motorcycle and Scooter	1.57	LOW	118	1.849	0.31	98.53
Viewing Interpretive Signs	0.93	MODERATE	198	1.848	0.31	98.84
Diving	1.08	LOW	118	1.278	0.21	99.06
Walking, Guided	0.72	HIGH	162	1.161	0.19	99.25
Touring, Guided	0.63	LOW	174	1.102	0.18	99.43
Train and Bus Touring	0.60	LOW	174	1.044	0.17	99.61
Games and Play	0.88	LOW	118	1.042	0.17	99.78
Organized Camping, Day	0.58	MODERATE	174	1.015	0.17	99.95
Other Watercraft	0.18	LOW	150	0.275	0.05	100.00
Total	400.20			597.344	100.00	
Wilderness (Included Above)	2.53	LOW	238	6.029	1.01	

Current facilities probably are not sufficient to accommodate the anticipated increase in demand. The options would be to increase the number of miles of trail on the Forest or to regulate use of current facilities during peak periods to prevent over-crowding and environmental deterioration.

Since the three-county population is expected to continue to increase at a rate greater than that of the state, the former option appears to be more acceptable.

Picnicking
Participation in this activity is expected to increase by 31 percent by 2040. Current facilities should be adequate to meet the increased demand with the exception of peak week-ends in the summer, particularly Long Point (Table B-6) on the White Oak River. Most of the demand will be from local residents.

Fishing
North Carolina respondents to the SCORP survey ranked fishing high among the activities they would participate in if facilities were available. Demand on the Croatan is expected to increase by only 15 percent by year 2040, so current facilities should be adequate for warm water and salt water fishing demand. Fishing facilities also are available through public and private sources.

Camping
Participation in all types of Camping (Tent, Trailer, Automobile, and General Day) is projected to increase by 74 percent by 2040. Current facilities on the Forest would be able to accommodate no more than one-half to two-thirds of this increase. Already some facilities, such as Hot Spots like Siddie Fields (Table B-6), are over-crowded on peak week-ends. Demand for camping is from a larger region (including the western North Carolina bear hunters) than just the adjacent three counties. Meeting the expected increase in future demand will require additional facilities.

Swimming
The SCORP survey ranks Swimming as high among the respondents, but demand on the Forest is projected to increase by only 18 percent. Current facilities such as Flanners Beach on the Neuse River should be adequate to accommodate the increase in demand. Substitute facilities are available on nearby public and private beaches. Consideration could also be given to developing additional camping and swimming facilities at Oyster Point on the Newport River.

Automobile Travel
Automobile Travel on the approximately 200 roads serving the Forest could increase by 53 percent by 2040. No additional roads would be constructed to accommodate this increase in use. The increase in Automobile Travel could be absorbed by changing access to the Forest, for example, opening previously closed roads.

Recreation Cabin Use
There are six cabins on the Forest under long-term special use permits. The use by permit holders is not expected to increase by more than 15 percent by year 2040. The land on which these cabins are located is highly desirable for developed camping and picnicking and could be used to accommodate future increases in demand for these activities. The Forest should consider purchase of the cabins as they become available. This would be an investment in providing more recreation opportunities for future Forest users.

Canoeing
Participation in Canoeing could increase by as much as 58 percent by 2040. The lakes and streams on the Croatan National Forest should be sufficient to meet the increased demand. Current facilities can accommodate 300 PAOTs (Table B-6).

Horseback Riding
Horseback Riding was estimated in the SCORP survey to increase moderately and could increase by 76 percent on the Croatan by 2040. Current facilities are not sufficient to meet this increase in demand. New trails need to be constructed or old trails need to be re-designed for use by horses.

Bicycle
Bicycling is an activity which could more than double on the Forest by 2040 and was ranked high in the SCORP survey. Although participation in this activity will represent only about 1 percent of the total use (Table B-9), the Forest should consider developing facilities for bicycle riders. This could most likely be accomplished on the current road system.

Sailing
Sailing was ranked as low on the SCORP survey, but use could increase on the Forest by 2040. This is an activity which should be accommodated at other public or private facilities. The Forest could consider more intensive development of Oyster Point on the Newport River to provide additional Sailing and Swimming facilities.

Summary
The Croatan National Forest is already providing more recreation visitor days in 1996 than were projected in the Land and Resource Management Plan for the year 2000. It was able to meet the increased demand with modest increases in developed Camping and Picnicking facilities and use of Volunteers for maintenance and daily operations. Meeting future demand will require more significant changes.

Future demand for dispersed recreation activities such as Hunting (all types), Fishing, Walking for Pleasure, and Picnicking can be met with current facilities. Demand for activities such as Automobile Travel, Bicycling, Canoeing, Swimming, and Sailing can be accommodated with current facilities with some changes in management. These changes include providing more access to the Forest through road management (open or closed). Use of Recreation Cabins should not increase significantly by year 2040.

To accommodate future demand for Camping (all types), Hiking, and Horseback Riding, more developed facilities will be required. Camping demand is expected to increase by 74 percent by 2040, Horseback Riding by 76 percent, and Hiking to more than double (147 percent). The options would be to expand current facilities to their limits or to acquire additional land for the national forest suitable for recreation activities.

The Forest will have limited opportunities to acquire additional recreation land. National forest land area on the Croatan has only increased by 1.6 percent since 1985 and would not be expected to increase by more than 6.5 percent or 10,000 acres by 2040. The demand for land to house and

serve the expanding regional population will further reduce opportunities to acquire land at a reasonable price.

To meet future demand for developed recreation, current facilities need to be expanded. More miles of trail will be needed with some of these designated for use by horses and riders. Some camping facilities are currently under-utilized while hot spots such as Long Point on the White Oak River and Siddie Fields on the Neuse River often reach their capacity. There may be opportunities to re-direct use to some areas or to expand facilities where use exceeds capacity.

By 2040, the population in the three-county region surrounding the Croatan National Forest could be double the current population. Demand for recreation activities will intensify and current developed facilities will be inadequate to meet this demand.

B.3.3. Minerals Supply and Demand

The Forest Service is responsible for integrating use of minerals with the use of surface resources. The minerals program is administered to:

- Encourage and facilitate the orderly exploration, development, and production of mineral and energy resources within the National Forest system in order to maintain a viable, healthy minerals industry and to promote self-sufficiency in those mineral and energy resources necessary for economic growth and the national defense.
- Ensure the exploration, development, and production of mineral and energy resources are conducted in an environmentally sound manner and that these activities are integrated with the planning and management of other national forest resources.
- Ensure that lands disturbed by mineral and energy activities are reclaimed for other productive uses.

The production of minerals and energy resources in the state of North Carolina has been constantly increasing each year for the last ten years. The mineral commodities responsible for this increase may change from year to year, but there have been consistent increases in volume and value for crushed stone, construction sand, and gravel. These three commodities are necessary for construction of houses and the infrastructure to support the continued increase in the North Carolina population.

Supply of Mineral and Energy Resources

Mineral and energy resources are not a homogeneous commodity, but are made up of several categories including mineral material (common variety), hard-rock minerals (metals), and leasable minerals.

Mineral Material (Common Variety)

This category of minerals is the only one that the Forest Service has full responsibility to regulate. Included are such things as petrified wood, stone, pumice, cinders, clay, sand, and gravel. These minerals have a variety of uses in agriculture, animal husbandry, building, abrasion, construction, and landscaping. The most common uses for aggregates such as crushed stone, sand, and gravel are for road and street construction and in construction of buildings.

Most common variety minerals are utilized within forty miles of where they are produced. Aggregate is heavy and has a low production cost, therefore hauling distance generally controls price. Location is as important as the suitability of the product.

At present, the Croatan National Forest is not producing any common variety minerals. The potential for discovery of these resources for the production of crushed stone and sand is low. Because of the lack of topographic relief, the shallow ground water table, and the need to protect other forest resources, quarry operations would encounter special development problems. Materials required to satisfy the growing regional population would need to be brought in from other locations.

Hard-Rock Minerals (Metals)

The Bureau of Land Management has the responsibility for issuance of permits and administration of hard-rock leasable minerals. The Forest Service does have consent authority for leases and permits on national forest land. It also has responsibility for the resources and use of the surface.

This category of minerals are generally called metals, precious metals, or industrial metals. They are used in industrial manufacturing, communications, chemical production, and jewelry. Included in this category in North Carolina are gemstones, mica, olivine, and feldspar.

There is no production of hard-rock minerals on the Croatan National Forest. Industry interest is low because the potential for discovering an economic deposit is low. Market price is the controlling factor.

Leasable Minerals

As with hard-rock minerals, the Bureau of Land Management has the responsibility for issuance of permits and administration of leasable minerals. The Forest Service does have consent authority for leases and permits on national forest land. It also has responsibility for the resources and use of the surface.

Leasable minerals include oil, gas, coal, phosphate, sodium, and potassium. There are no known leasable minerals on the Croatan National Forest.

Demand for Mineral and Energy Resources

Mineral Material (Common Variety)

Demand for mineral material will follow trends in population growth and gross domestic product. A concern of the aggregate industry will be the ability to extract minerals in areas changing from rural to urban. Land use conflicts will intensify as the population becomes more affluent, older, and more environmentally sensitive. National forests may be asked to supply more of these minerals, but the Croatan national Forest should not be affected by the increased demand.

Hard-Rock Minerals (Metals)
The demand for hard-rock minerals is expected to continue to increase, but demand for individual metals will be variable. New technologies will stimulate the demand for some metallic minerals and reduce the demand for others. Lead, for example, is being used less as a gasoline additive, but used more to screen radiation in television and computer monitors. These variations in demand will not affect the Croatan National Forest.

Leasable Minerals
The demand for energy minerals will increase. This demand will be satisfied within the United States or from foreign sources depending upon cost and availability. If the world price for oil, for example, increases, more oil will be produced from domestic sources. This increase in demand should have little or no effect on the Croatan National Forest.

The Minerals Program on the Croatan National Forest
The minerals program on the Croatan has been funded at an average of $1,000 for each of the past seven years. Each year the Forest processes one or two cases usually for permits for exploration. There is apparently no serious interest in the minerals on the Croatan by any of the mineral industries.

B.4. Analysis Tools

The following section describes the tools and models used in the analysis process.

B.4.1. Timber Scheduling Model

This section documents the work of Dr. Joseph Roise of North Carolina State University, who formulated the timber analysis model for the Croatan National Forest (CNF).

The problem formulation follows: Given a fixed land base, what are the allowable sale quantities and long-term sustained yield capacities of timber scheduled in 10-year increments over a planning horizon of 160 years, subject to non-declining flow and other constraints (depending on the alternative). To solve this problem, SPECTRUM (Version 1.5), a decision support model, was used to estimate optimal harvest scheduling levels among the alternatives. The following discussions describes the model formulation process.

Land Stratification
The CNF was stratified by 5 levels. Level 1 identifies the management areas, which are contiguous land areas of the CNF (refer to figure 4-1 of the CNF Plan). Table B-10 displays the acreage of the 7 management areas on the CNF.

Table B-10. Spectrum Timber Analysis Model: Level 1 Identifiers.

Management Area	Acres
1	9,238
2	63,157
3	28,139
4	18,788
5	19,404
6	12,220
7	10,198

The next level identifiers keyed on RCW habitats, since RCW is the most limiting factor on timber scheduling due to the standards in the RCW Final Environmental Impact Statement (1996). Table B-11 displays the land stratification for these habitats.

Table B-11. Spectrum Timber Analysis Model: Level 2 Identifiers.

Level 2	Character	Acres
1	A/<.25/TS/RS	7,095
2	A/<.25/TS/RU	1,395
3	A/<.25/TU/RS	870
4	A/<.25/TU/RU	1,379
5	A/>.25/TS/RS	3,972
6	A/>.25/TS/RU	940
7	A/>.25/TU/RS	713
8	A/>.25/TU/RU	986
9	T/<.25/TS/RS	1,709
10	T/<.25/TS/RU	111
11	T/<.25/TU/RS	194
12	T/<.25/TU/RU	61
13	T/>.25/TS/RS	1,095
14	T/>.25/TS/RU	134
15	T/>.25/TU/RS	201
16	T/>.25/TU/RU	36
17	R/TS/RS	32,167
18	R/TS/RU	2,742
19	R/TU/RS	3,871
20	R/TU/RU	2,104
21	N/TS	25,256
22	N/TU	83,112

A = Active RCW Cluster
<.25 = Within 0.25 miles of the Cluster
>.25 = Outside 0.25 miles of the Cluster
TS = Suitable for timber (Stage 1)
TU = Unsuitable for timber
RS = Suitable for RCW habitat
RU = Unsuitable for RCW habitat
T = Transition, artificial cavities installed
R = Recruitment stands
N = Not in the RCW HMA

The Level 3 identifier keyed on vegetation potential based on the ecological classification system. This variable identifies longleaf or hardwood restoration potential.

Table B-12. Spectrum Timber Analysis Model: Level 3 Identifiers.

Level 3	Acres
Hardwood	1,962
Longleaf Dry	6,856
Longleaf	3,981
Longleaf Wet	5,763
Mixed Pine	6,675
No Restoration	135,906

The Level 4 identifier keyed on existing forest type and site index. Table B-13 displays the acreage for each site characteristic.

Table B-13. Spectrum Timber Analysis Model: Level 4 Identifiers.

Level 4	Acres
Hardwood, >70 Site Index	16,960
Hardwood, <70 Site Index	2,341
Loblolly, >70 Site Index	28,279
Loblolly, <70 Site Index	1,766
Longleaf, >70 Site Index	6,229
Non-forest	6,657
Pond Pine, >70 Site Index	2,413
Pond Pine, <70 Site Index	97,655

The last identifier related to ages of existing stands, as shown in Table B-14. Existing ages are needed to build yield tables for outputs.

Table B-14. Spectrum Timber Analysis Model: Level 5 Identifiers.

Years	Acres
0-3	10,360
4-10	1,258
1-20	3,381
21-30	6,292
31-40	2,370
41-50	737
51-60	6,858
61-70	26,960
71-80	82,837
83-90	3,557
91-100	1,360
>100	5,174

Silvicultural Activities

The types of management actions for timber harvest, regeneration, and stand improvement follow.

Table B-15. Summary of Management Actions for Regeneration.

Number	Desired Forest Type	Method	Sale Prep Cost ($/MCF)	Sale Admin Cost ($/MCF)	Reforestation Cost ($/AC)
1	Longleaf	CC	119	35	308
2	Loblolly	CC	119	35	336
3	Pond Pine	ST	119	35	50
4	LL to LL	TA	155	45	100
5	LL to LL	GS	178	52	100
5a	Lob to LL	GS	178	42	210
6	Lob to Lob	SW	131	38	30
7	Loblolly	CC	119	35	215
8	MP to LL	TA	155	45	100
9	MP to LL	TA	155	45	100
10	HW to HW				
11	Pine to HW	Thinning	119	35	
12	Lob to LL	TA	155	45	100

LL = Longleaf *Lob = Loblolly* *MP = Mixed Pine* *HW = Hardwood*
CC = Clearcut *TA = Two-aged* *SW = Shelterwood* *GS = Group Selection*

Assumptions about Silvicultural Activities

1. Artificial regeneration, shear, V blade, bed and fertilize, hand plan containerized longleaf seedlings. Use prescribed fire, stand improvement costs are $50/acre for dormant season burns before age 5.
2. Artificial regeneration, shear, V blade, bed and fertilize, hand plant bare root longleaf seedlings. Use prescribed fire, stand improvement costs are $50/acre for 2 dormant season burns before age 5.
3. Leave basal area of 15 square feet per acre, natural regeneration-prescribed burn after harvest.
4. Leave basal area of 30 square feet per acre, natural regeneration, 2 prescribed fires to prepare seedbed, cone crop monitoring, TSI cost of $50/acre.
5. Unevenaged management using BDQ method with maximum diameter at 22 inches, Q=1.2 for 1 inch classes, average opening size of 1 acre, prescribed fire after harvests, 2 dormant season burns before age 5.

5a. Unevenaged management, average opening of 1 acre, regeneration of 25 percent of stand every 20 years, prescribed fire after harvest, 2 dormant season burns before age 5.

6. Leave basal area of 30 square feet per acre, remove residual trees 10 years after regeneration harvest, natural regeneration by roller chop following harvest.
7. Artificial regeneration, roller chop followed by prescribed fire and hand plant containerized seedlings, 2 dormant season burns before age 5.
8. Remove all loblolly and leave 30 square feet per acre of longleaf in seed producing trees, evenly distributed across the stand. Ten years following initial seed cut reduce residual basal area to 10 square feet per acre. Natural regeneration, prescribed fire after harvest, 2 burns to prepare seedbed.
9. Leave 30 square feet of basal area in seed producing longleaf pine, evenly distributed acress the stand. Natural regeneraton, 2 burns to prepare seedbed, cone crop monitoring and site visits.

10. No hardwood to hardwood regeneration. These are unsuitable for timber management.
11. Thin to favor existing hardwood in all size classes, reduce basal area to 20 square feet per acre, schedule timber stand improvement to assure development of existing hardwood seedlings.
12. Leave 30 square feet of loblolly pine to provide structure for RCW nesting or foraging. Use fire to prepare seedbed and plant longleaf. Use fire to release longleaf from loblolly encroachment.

Pinestraw raking assumed harvesting every 3 years, with fertilization occurring after every harvest. Prescribed fire would also be applied to each area on a 3 year rotation. Pinestraw raking could occur only in longleaf stands, ages more than 20 years and outside of sensitive areas, such as natural areas.

Outputs and Revenues

Table B.15a.

Output	Units	Revenue ($)
Pine Straw	Tons	62
Hardwood Sawtimber	MCF	598
Hardwood Pulpwood	MCF	167
Pine Sawtimber	MCF	951
Pine Pulpwood	MCF	235

Yields

Timber and Pine straw yields were generated using the following models:

- Smith, William D. 1989. NATYLD - Natural Pine/Hardwood Stand Growth and Yield Simulator and Economic Evaluation, Department of Forestry, North Carolina State University, Raleigh, NC.
- Schumacher, F.X. and Coile, R.S. 1960. Growth and Yield of Natural Stands of the Southern Pines. Published by Coile, Inc, Durham, NC.
- Hafley, W.L. and Buford, M.A. 1985. A Bivariate Model for Growth and Yield Prediction, Forest Science, Vol. 31 No 1, pp 237-247.
- Hafley, W.L. 1986. North Carolina State University Managed Pine Plantation Growth and Yield Simulator. Department of Forestry, North Carolina State University, Raleigh, NC.

Timber Suitability Stage 1 Evaluation

Results of the Stage 1 analysis are documented in the CNF plan, Appendix I. Of the 161,142 acres of land evaluated, 37,921 acres are not physically suited for timber production.

Timber Suitability Stage 2 Evaluation

Over 47,000 combinations of timber activities and timing choices were evaluated for the 3,100 analysis units on the CNF. All analysis units with timber options had choices with positive present net values. Only 655 options of the 47,000 available were negative, less than 2 percent.

The timber options with negative PNV's occurred on about 5,000 acres of land, usually low site index on existing loblolly or pond pine forest types. Table B-15b presents the land suitability classifications for each alternative.

Timber Suitability Stage 3 Evaluation

Each management prescription was reviewed to determine whether the desired conditions could be attained under sustained timber production. Prescriptions for Wilderness, Natural Areas, and Hardwood/Cypress wetlands were withdrawn from timber production. Also withdrawn were prescriptions involving pocosin ecological types, due to the sensitive soils on these lands.

Table B-15b. Timber Land Suitability Classifications by Alternative (Acres).

Classification	Alt. A	Alt. B	Alt. C	Alt. C-Modified	Alt. D	Alt. E
1. Non-Forest	5,914	5,914	5,914	5,914	5,914	5,914
2. Forest Land	155,228	155,228	155,228	155,228	155,228	155,228
3. Forest Land withdrawn from timber production	32,007	52,087	32,007	34,987	32,007	32,007
4. Forest Lands not capable of producing crops	0	0	0	0	0	0
5. Forest Land physically unsuitable	0	0	0	0	0	0
6. Forest Lands with inadequate information	0	0	0	0	0	0
7. Forest Lands tentatively suitable for timber prod.	123,221	103,141	123,221	120,241	123,221	123,221
8. Forest Lands not appropriate for timber prod.	98,236	92,251	96,447	93,467	101,675	96,447
9. Total suitable Forest Land	24,985	10,890	26,774	26,774	21,546	26,774
10. Total national forest land	161,142	161,142	161,142	161,142	161,142	161,142

Benchmarks

Without constraints, except for non-declining yield, the following quantities were generated:

Table B-15c.

	PNV (MM$)	ASQ (MCF)	LTSY (MCF/yr)	Sched (Ac)	Regen (Ac)	Thin (Ac)	LL (Ac)
PNV	46,900	23,700	2,360	42,999	10,700	4,413	1,670
TIMBER	45,800	24,200	2,415	42,999	9,820	4,413	1,720

PNV = Present Net Value
ASQ = Allowable Sale Quantity
LTSY = Long Term Sustained Yield
Sched = Scheduled for treatments over 160 years
Regen = Acres Regenerated
Thin = Acres Thinned
LL = Longleaf Conversion

The PNV benchmark maximized present net value over the 160 year planning horizon. The timber benchmark maximized timber volume first, and then maximized present net value. It is economically efficient to operate on 43,000 acres of the CNF for purposes of timber production.

The minimum level benchmark would have no timber or other vegetation management activities. The management emphasis would be custodial care. Only incidental recreation use would occur. Fire suppression would be primary activity. Therefore, the only staffing would be a district ranger and a fire crew.

The current level benchmark would be the same as the no-action alternative, as described in Alternative A of this document.

Alternatives
The following table displays assumptions used to formulate alternatives. The alternatives are documented in Chapter 2 of this EIS.
Table B-15d.

Feature	Alt A	Alt B	Alt C/C-Mod	Alt. D	Alt. E
RCW Territories	139	169	169	145	169
Rotation Age					
Longleaf	100	160	120	120 (100)	120
Loblolly	80	100	80 (60)	80 (60)	80(60)
Pond Pine	NA	100	80 (60)	80 (60)	80(60)
Regen Goals	Existing Forest	Eco-Class	Eco-Class	Existing Forest	Eco-class
Regen Methods	Even-Aged	Unevenaged	Even/Two-aged	Even-Aged	Two-aged/cu
Pine Straw	No	No	200 ac/yr	400 ac/yr	200 ac/yr

Rotation age: (60) means 60 years outside the RCW Habitat Management Area. Eco-Class refers to the potential natural vegetation that would occur on the site. In many cases, the existing forests are loblolly plantatin with a potential natural vegetation of longleaf pine. Therefore, Alternatives B and C/C-mod are the restoration alternatives. A regeneration goal of existing forest would replace a loblolly plantation with another loblolly plantation.

Alternative A was formulated to maximize harvest in the first planning period, subject to:

- Regeneration goals that mimic current harvest levels.
- Land allocation of the 1986 plan, with amendments that include the RCW interim guidelines.
- Non-declining and sustained yield.

Alternative B was formulated to maximize harvest in the first planning period, then maximize present net value, subject to:

- Only uneven aged management.
- Land allocation for Alternative B.
- Non-declining and sustained yield.

Alternative C/C-Mod was formulated to maximize longleaf restoration in the first planning period, then maximize harvest in the first planning period, then maximize present net value, subject to:

- Longleaf conversion goals of 4,000 acres.
- Non-declining yield after the first planning period. The first planning period is a departure from non-declining yield.
- Land allocations for Alternative C/C-mod.

Alternative D was formulated to maximize harvest in the first planning period, then maximize present net value, subject to:

- Land allocations in Alternative D.
- Non-declining and sustained yield.

Further discussion of results are in Chapter 3 of this EIS, Cultural and Economic Environment, Silviculture and Forest Products.

Alternative E was formulated to maximize longleaf restoration in the first planning period, then maximize present net value, subject to:

- Loblolly conversion only, using two-age regeneration on suited sites;
- Non-declining yield;
- Land allocations for Alt. E (same as Alt. C with some modifications).

Analysis Results

The following table displays some of the important results from the analysis.
Table B-15e.

	Alt A	Alt B	Alt C/C-Mod	Alt D	Alt E
ASQ (MCF)	4,970	2,600	20,930	14,840	8,758
LTSY (MCF/yr)	1,625	442	1,247	1,573	1,303
Scheduled (Ac)	24,985	10,890	26,774	21,546	25,723
PNV (MM$)	23.2	4.4	29.3	26.2	20.9
LL Rest (Ac)	600	1,040	4,000	230	2,350
Regen (Ac)					
CC			2,730	4,440	1,000
ST	600		2,000		0
SW					
TA			1,500		1,350
GS		1,040			
Thin (Ac)	1,200		6,230	4,630	3,200
Straw (Tons)	0	0	2,200	4,530	0

The interpretation of these results are discussed in Chapter 3 of the EIS.

B.4.2. The IMPLAN Model

Impact analysis for Planning (IMPLAN) was developed by the Forest Service at Fort Collins, Colorado, and has been in use since 1979. The system has undergone several evolutions from a main-frame, non-interactive application that ran in "batch" mode to a menu-driven microcomputer program that is completely interactive.

IMPLAN software and databases are used to construct regional economic accounts of any zip code, state, or county in the United States and several U.S. territories. The databases consist of two major parts: 1) national-level technology matrices, and 2) estimates of sectoral activity for final demand, final payments, industry output, and employment.

The data used for the Croatan model is from the 1990 census upgraded to 1993. The data set consists of 528 industrial sectors in the United States, 479 of which are in the state of North Carolina.

The Croatan Model:

The IMPLAN model used in the analysis of the Croatan National Forest was developed using data from the three counties of Carteret, Craven, and Jones. The resulting model consisted of 181 industrial sectors with an estimated Gross Regional Output of $4.5 billion. Fifty-three percent of the population is employed with a personal income of $2.5 billion.

The three-county area was chosen because most of the impacts are assumed to be local. Most of the recreation activities are from the indigenous population of the three counties and most of the timber purchased is by local timber contractors and sold to local wood processers, the largest of which is Weyerhaeuser. Estimation of the differences in employment and income associated with each alternative is the result of combining several components -- Forest Service employment, Forest Service expenditures, payments to the three counties, the sale and harvest of national forest timber, and recreation activities. Following is a discussion of the employment and income coefficients for each component and how they were derived.

Forest Service Timber Employment
Forest Service employment in the timber program consists of the support from the Supervisor's Office as well as personnel directly and indirectly employed in the timber program on the District. For purposes of this analysis, it was assumed that one person-year in the Supervisor's Office was utilized in support of the Croatan timber program. On the District, four persons are employed in the timber program for a total employment of five (5).

Forest Service Expenditures
Forest Service expenditures have two major components -- salary and non-salary. Salary expenditures are direct payments to employees who use these payments to purchase commodities in the region. These expenditures are, in turn, spent for supplies and other commodities, both within and outside the region. Forest Service expenditures to employees, therefore, have a direct, indirect, and induced effect within the region. Non-salary expenditures are for contracts, services, and materials. These may be purchased within the region or outside the region. These expenditures also have a direct, indirect, and induced effect.

An analysis of FY 1990 Forest Service expenditures showed that approximately 56 percent of these were for salaries and 44 percent were non-salary. Based upon this analysis, the IMPLAN model determined that for each $1 million spent on salaries, 15.88 people would be employed with a total income of $377,600. Each $1million of non-salary expenditures results in 15.65 people employed with a total income of $462,700.

Payments to the Three Counties
For each $1 million returned to the counties in lieu of taxes, 31.96 persons are employed with a total income of $867,000. One million dollars used for education would support 40.52 jobs at a total income of $773,000.

Sale and Harvest of Timber

Determining the effects of timber sale and harvest required developing coefficients based upon output (million board feet) rather than dollars. Data on timber harvest prepared by the North Carolina Division of Forest Resources were coupled with estimates of employment by sector to develop employment by unit of volume. For example, in 1990, total volume from Sawmills in North Carolina was 1,688 million board feet (MMBF). The IMPLAN estimates of employment in the Sawmill sector was 16,975 or approximately 10 jobs per MMBF. This is direct employment.

Direct income was determined from IMPLAN. For example, sector total income divided by total employment results in average income per job which when multiplied by the total jobs per MMBF results in total income per MMBF. Similar calculations were made for indirect and induced employment and income.

The assumption was made that all timber harvested from the Croatan National Forest was processed first by the Logging Sector. All sawtimber was then processed by the Sawmill Sector and roundwood was processed in the Pulpwood Sector. For each MMBF processed in the Logging Sector, 1.54 jobs would be created with a total income of $54,626. One MMBF processed by Sawmills would result in 7.36 jobs and a total income of $108,970. A MMBF of pulpwood would support 0.82 jobs with a total income of $49,531.

Recreation

Recreation differs from timber in that no specific output is sold, but opportunities are provided for different activities. The impact on the economy is from expenditures by people recreating on the Croatan National Forest. Each activity requires a different amount of time to pursue it. For example, more time might be spent at a developed site than on a trail. Also IMPLAN estimates expenditures by visits while the Forest Service estimates Recreation Visitor Days (RVDs).

Estimates were made for 10 different activities -- Developed Site Use, Trail use, Big Game Hunting, Waterfowl Hunting, Small Game Hunting, Warm Water Fishing, Salt Water Fishing, Non-Consumptive Use, Mechanized Travel, and All Others. Estimates of RVDs by activity are provided in the RIM data. These were disaggregated to specific uses based upon the capacity of areas. The calculations for RVDs were as prescribed in the Deputy Regional Forester memorandum 1920 for July 22, 1997, Guidance to FSH 1909.12, Chapter 7.2 and 4.19c.

The formula is as follows:

$$\text{RVDs per acre per year} = \frac{C \times MS \times PU \times LOS}{12}$$

where:

C = Capacity Coefficient in PAOT per acre;
MS = Managed season of use;
PU = Pattern of use;
LOS = Length of visit;
12 =The constant of 12 hours = 1 RVD; and

RVD = Recreation Visitor Day.

As an example, Cedar Point (Picnicking, Rural ROS) has a capacity of 24 PAOTs, is managed for 150 days, has a pattern of use of .67 (percentage of the managed days), and an average length of stay of 3.6 hours. The estimate of RVDs would be as follows:

$$\text{RVDs} = \frac{24 \times 150 \times 0.67 \times 3.6}{12} = 724$$

The RVDs estimated for each Alternative were determined by changinging the capacity of developed areas or adding new areas with specified capacity.

Recreation visitor days (RVDs) were converted to visits using coefficients provided by the Regional Economist, Clair Redmond. For example, Developed Sites are assumed to have 0.43 RVDs per visit. He also provided IMPLAN coefficients per 10,000 visits. The coefficients used for the Croatan per 10,000 visits were as follows:

Developed Sites: 6.8 jobs and $161,755 total income.
Trail Use: 7.6 jobs and $182,345 total income.
Big Game Hunting: 4.3 jobs and $53,856 total income.
Waterfowl hunting: 1.0 jobs and $18,504 total income.
Small Game Hunting: 0.8 jobs and $13,297 total income.
Warm Water Fishing: 0.6 jobs and $18,057 total income.
Salt Water Fishing: 4.0 jobs and $44,548 total income.
Non-Consumptive: 0.8 jobs and $13,893 total income.
Mechanized Travel: 9.5 jobs and $178,907 total income.
All Others: 13.8 jobs and $227,192 total income.

Present Net Value of Alternatives

The present net value of the Alternatives considered for the Croatan Land Management Plan represents the discounted projected costs and revenues over the planning cycle of 160 years. The costs and revenues were discounted at a rate of 4 percent.

Revenues for the timber program were projected based upon timber prices and projected changes in these prices. Costs were projected based upon inflation.

Recreation benefits were taken from the 1990 RPA and inflated to 1997. Values used (in 1990 dollars) were as follows:

Developed Sites: $10.14 per RVD
Trail Use: $3.41 per RVD
Big Game Hunting: $33.27 per RVD
Waterfowl Hunting: $33.27 per RVD
Small Game Hunting: $33.27 per RVD
Warm Water Fishing: $65.56 per RVD
Salt Water Fishing: $65.56 per RVD
Non-Consumptive: $39.26 per RVD

Mechanized Travel: $7.73 per RVD
All Others: $61.43 per RVD

Costs were assumed to be what the District will be expected to spend on the recreation program. Benefits and costs were not inflated beyond 1997.

Timber Program

The Present Net Values of the Timber Program by Alternative are shown in Table B-16. Each value is the maximum PNV for the Alternative, given the applied constraints.

Table B-16. Present Net Value of the Timber Program by Alternative, 4 Percent Discount Rate, Cumulative for 160 Years.

Alternatives	A	B	C/C-Modified	D	E
PNV	$23,168,574	$4,391,662	$32,078,482	$27,118,008	20,900,000
Opportunity Cost	$8,909,908	$27,686,820	$0	$4,960,474	11,178,000

Opportunity cost represents how much the Forest Service would "lose" or "give up" if the alternative with the highest PNV was not selected. For example, if Alternative A were selected instead of Alternative C, the Forest Service would "lose" $8,909,908 in discounted net revenues over the 160 year planning horizon. These values are a "trade-off" to not selecting Alternative C or C-Modified.

The highest level of timber output is achieved through Alternative C/C-modified. It departs from the sustainable non-declining yield in the first ten-year planning period. The high level of timber output that occurs early in the planning horizon boosts the PNV substantially higher than any other alternative. The opportunity costs of the other alternatives are due to the constraint for sustainable non-declining yield and lower timber output, especially in the first planning period.

Recreation Program

The Present Net Values of the Recreation Program are shown in Table B-17. These values are in 1997 dollars.

Table B-17. Present Net Values of the Recreation Program by Alternative, 4 Percent Discount Rate, Cumulative for 160 Years.

Alternatives	A	B	C	C-Modified	D	E
PNV	$357,048,211	$361,274,146	$375,005,267	$372,509,977	$375,138,513	$374,820,00
Opportunity Cost	$18,090,302	$13,864,367	$133,246	$2,628,536	$0	$318,512

The opportunity costs of selecting any alternative other Alternative D are shown in Table B-17. The highest cost would result in Alternative A were selected.

Alternative D has the highest level of recreation visitor days by allowing high levels of access and increasing access where possible. The high levels of access are traded off in the other alternatives by closing roads, especially the unauthorized access. Alternatives A and B go further in trading off recreation outputs by de-emphasizing recreation site developments.

Summary

A summary of PNVs for priced outputs are shown below. Only timber and recreation outputs were priced. There are no opportunities for mineral development known to exist on the CNF.

The total of the PNVs and Opportunity Costs of the Timber and Recreation Programs are shown in Table B-18. Alternative C has the highest PNV and Alternative B has the lowest. The highest Opportunity Cost ($41,417,941) if Alternative B were selected.

Table B-18. Total Present Net Values by Alternative for the Timber and Recreation Programs.

Alternatives	A	B	C	C-Modified	D	E
PNV	$380,216,785	$365,665,808	$407,083,749	$404,588,459	$402,256,521	$395,720,000
Opportunity Cost	$26,866,964	$41,417,941	$0	$2,495,290	$4,827,228	$11,363,749

Unpriced benefits accrue for each alternative. These non-quantifiable benefits are described through the goals, objectives, and the desired conditions attained through the management emphasis of each alternative.

B.4.3. Ecological Classification Methods

Introduction

Ecologically based land management requires classification of land into ecosystem components. The ecological classification described here organizes the landscape into units having similar topography, geology, soil, climate, and natural disturbance regimes. The premise is that these factors provide the environmental conditions that dictate biological responses, site potentials, and site limitations. The linking of biotic and abiotic elements allows for prediction of species suitablility and productivity, identifies physical limitations of sites and critical habitats for wildlife, and highlights unique features of the land that might have important recreation and scientific value.

The ecological classification, mapping, and inventory system used on the CNF describes and maps ecosystems at different scales. This type of multiscale system is tied to the National Hierarchical Framework of Ecological Units, "a regionalization, classification and mapping system for stratifying the Earth into progressively smaller areas of increasingly uniform ecological potential" (ECOMAP, 1993). In short, it provides a framework for implementing ecosystem management across physiographic regions, subregions, and local landscapes. Management is possible because individual ecosystem units, can be compared with adjacent units and their patterns and relationships recognized at the landscape and land unit scales.

At the landscape scale, ecological units are termed Landtype Associations and are identified and mapped based on similarities in geomorphic processes, geologic rock types, soil complexes, stream types, lakes, wetlands, and plant association patterns. At the land unit scale, ecological units are termed Landtypes and Landtype Phases and are identified and mapped based on topographic criteria, hydrologic characteristics, soil types, and plant associations and phases. The ecological classification starts by acquiring data from resource maps on climate, geology,

soils, water, and vegetation. The maps are combined along with available local knowledge to identify ecological patterns based on the interrelationships between the different resource components.

Important Ecological Factors on the Croatan

Terrestrial ecosystems on the Croatan are distributed along gradients controlled by landform, soil moisture, fire frequency, and fertility. Lightning ignition, which once created most fires is no longer a significant factor in the landscape. Historic erosion following widespread logging, farming, and other land-clearing during European settlement, has been comparable to that in the Piedmont region (Phillips 1995). Extensive land clearing has also reduced the natural distribution of many native species. As a result of these influences, the Croatan landscape, with its complex topography and soils, has lost some of the associated complex vegetation patterns. The losses obscure the relationships among landscape, soil, and vegetation that could be used to identify ecological types.

The relationship between vegetation and its environment is crucial in any ecological classification system. While physical components such as soils and topography define environmental limits on ecosystems, plant communities define the biological potential for plants and animals. Knowing the potential of sites to support various mixtures of species is necessary for making sound decisions about management and sustainability.

The distribution of natural plant communities, or plant associations, has been used to classify land throughout the United States. Plant associations are one ecological component and used on the CNF as a point of reference to define the equilibrium reached between vegetation and its environment. The sorting out of species and communities across the landscape over time, without man's influence, reflects the role that natural processes and physical site limitations play in shaping ecosystems and allows us to better understand and describe these relationships. On the CNF we used an approximation of presettlement vegetation in evaluating these biotic and abiotic interactions.

Classifying and Mapping Presettlement Vegetation

We use the term "presettlement" to describe 'natural' or 'original' vegetation because it is more precise than "pre-Columbian", which just means before 1492. First exposure of the land to European influences came much later in most of the South. In east Florida, for instance, presettlement means before 1565; in southeastern Virginia it means before 1607, and in the southern Appalachians it means before 1800. In the Croatan region, the first settlers arrived along the Neuse River between 1667 and 1700 (Lonsdale 1967).

There is some question about what is meant by original vegetation, and, since vegetation is always in a state of change in response to disturbances or changes on some climatic scale, some question whether "original" means anything at all. This often debated topic is addressed by Cecil Frost in his publication *Presettlement Vegetation and Natural Fire Regimes on the Croatan National Forest (1996)* .

“On a human time scale there is considerable evidence that 'original' vegetation is a valid concept. We are presently in a warm interglacial period, and for as long as genus Homo has

been evolving there have been glacial cycles. With each cycle there have been major geographic displacements of species, perhaps to form somewhat different community groupings in their new latitudes (Webb 1988). Some species, like walnuts and hickories with heavy seeds, may take longer to migrate than those with light, windborne seeds, and species may be in somewhat continual adjustment at the fringes of their range, in response to minor climatic fluctuations. One possible conclusion, then is that since vegetation is constantly in flux, presettlement vegetation is meaningless, as is any effort to preserve or restore examples. This is a close relative of the reasoning that concern over the extinction of species is misplaced because it is the natural course of species to arise, flourish, and then die off. This is the geological view taken to the extreme. On the time scale of human history, however, somewhat different conclusions are likely to be reached".

"Our southeastern plant communities began to sort out at around the same time as the beginning of recorded human history. The Wisconsin glacial epoch ended some 10,000 years age, and a climate with warm winters similar to those we now experience stabilized around 8,000 years ago. Most modern plant assemblages finished responding to these changes and have been in place for the past 6,000 years (Webb 1988). Minor Holocene climatic fluctuations like the "little ice age", a slightly cooler period from AD 1450 to 1850, have produced no substantial shifts in the major plant formations. The natural communities found by the first explorers, then, had been in place for thousands of years. The species of which these communities were composed, themselves probably the products of hundreds of thousands of years of evolution, were the survivors of a number of glacial migrations, whereas literate human civilization has yet to experience its first glaciations. Given that these natural communities existed for all of human recorded history, it seems reasonable that these are the communities that we would want to perpetuate in natural areas. Some interglacial periods have lasted a hundred thousand years, and we are only 10,000 years in the current cycle, so the idea of abandonment of presettlement natural community types is probably premature by up to 90 millennia".

"Neither is it appropriate to despair knowing what presettlement vegetation existed on a particular site. The goal of presettlement vegetation methods should be to get to some resolution useful at the site level".

In the Southeastern U.S., it is possible to reconstruct original vegetation and natural fire regimes, even where human land uses have radically transformed upland vegetation. Given modern soil maps as a basis for examination of vegetation, and available historical background, a close approximation of the original forest can be obtained (Frost 1997). The "Pyrographic Method of Mapping Presettlement Vegetation" (Frost 1996) which was used on the Croatan includes steps:

a. Assemble soil photomaps and historical data relating to disturbance and vegetation distribution.
b. Sample remnant natural vegetation on each of the 51 soil series found on the Croatan.
c. Characterize fire effects in each kind of vegetation on each soil series.
d. Identify fire-frequency indicator species and fire-frequency indicator plant communities.
e. Develop a fire-frequency map.

f. Use soil series to put boundaries on vegetation types.
g. Reevaluate in the field and adjust; the method proceeds in an iterative manner recycling through steps 4-6.

Much of the field data for analysis were collected over a period of 12 years prior to this study. Approximately 90 days were spent in the field in the Croatan, and several times this amount in surrounding counties.

A second approximation map of presettlement vegetation provided the starting point for ecological classification on the Croatan. There were 12 mappable types identified on the Croatan. They included: 1) Hardwood Forests, 2) Hardwood Slopes, 3) Longleaf Pine Forest and Savanna (xeric, dry & mesic), 4) Longleaf Pine Wet Savanna, 5) Salt Marsh, 6) Brackish Marsh, 7) Oligohaline Marsh, 8) Maritime Forest, 9) Mixed Pine Savanna and Pyrophytic Woodland, 10) Pond Pine/Pocosin, 11) Pond Pine Forest and Savanna, and 12) Swamp Forest and Bottomland Hardwoods. These tentative ecological types were termed "soil/vegetation" groups.

Defining Ecological Mapping Units from Soil Surveys

Each soil series was labelled with its corresponding vegetation type in a geographic information system (GIS). Since topography influences the spread and intensity of fires and therefore the potential vegetation type, there is not always a one-to-one relationship between soil series and vegetation. For example, vegetation on the well-drained Autryville loamy sand ranges broadly depending upon landscape position and degree of slope. On rolling sands in the northwestern part of the Croatan, pure longleaf pine and mixed pine stands would occur. Along the White Oak River, on more steeply sloping sites, partially protected from fire by slope and bodies of water, hardwood slope forests would occur with mixed oak, hickories, and distinctly non-pyrophytic species like red buckeye and umbrella magnolia. The GIS was used to calculate acres within each soil series/vegetation map unit. These data were combined in a database along with soil series name, drainage, surface texture, subsurface texture, soil classification, vegetation type, rare species occurrence, and tree productivity. Data analysis and map displays revealed additional soil and vegetation correlations and patterns. Some types were aggregated into Landtypes (all Marshes), and most were further separated into Landtype Phases. Soil drainage and texture were the primary criteria used for separating types. Some examples include: Mixed Pine - separated into 5 Landtype Phases, Longleaf Pine Forest and Savanna - 3 Landtype Phases, and Pond Pine/Pocosin - 3 Landtype Phases.

A total of 10 Landtype Associations, 13 Landtypes and 26 Landtype Phases were classified and mapped in the Croatan area.

- Landtype Associations (LTAs) were mapped by aggregating Landtypes. Most LTAs were identified using a variety of factors. These factors included topography (3 LTAs), stream density (2 LTAs), vegetation diversity (2 LTAs), Landtype pattern (2 LTAs), aquatic systems (2 LTAs), geology (1 LTA), and landform (1 LTA). Landtype Associations are summarized in Table 1 and described in Section 2.1.

- Landtypes were based on the refinement of soil/vegetation groups using soil drainage and texture as primary design criteria. Landtypes are described in Section 2.2.

- Landtype Phases were subdivisions of Landtypes based on soil organic matter, soil drainage and texture, and timber productivity. Landtype Phases are described in Section 2.2.

Ecological Classification Hierarchy

National Hierarchy of Ecological Units

DOMAIN 200 - HUMID TEMPERATE
DIVISION 230 - SUBTROPICAL
PROVINCE 232 - OUTER COASTAL PLAIN MIXED FOREST
SECTION 232C - ATLANTIC COASTAL FLATWOODS
SUBSECTION 232Cb - LOWER TERRACES

LANDTYPE ASSOCIATION 232Cb01 - New Bern-Havelock Dissected Lowlands
LANDTYPE ASSOCIATION 232Cb02 - Central Pocosin and Lakes
LANDTYPE ASSOCIATION 232Cb03 - Stella-White Oak Dissected Lowlands
LANDTYPE ASSOCIATION 232Cb04 - Bogue-Newport Paleo Shoreline
LANDTYPE ASSOCIATION 232Cb05 - Newport River Tidal Transition
LANDTYPE ASSOCIATION 232Cb06 - Neuse River System
LANDTYPE ASSOCIATION 232Cb07 - Wet Forest-Pocosin Transition
LANDTYPE ASSOCIATION 232Cb09 - Onslow-Outer Banks
LANDTYPE ASSOCIATION 232Cb10 - Simmons Corner Wet Forest Transition

SUBSECTION 232Ch - TIDAL AREA

LANDTYPE ASSOCIATION 232Ch08 - Pamlico Terrace
A complete description of the Landtype Associations can be found in Appendix A of the Croatan Land and Resource Mangement Plan.

Landtypes and Landtype Phases - LIST

01 - TIDAL STREAMS AND ESTUARIES (landtype)
0101 - Salt and brackish marshes (landtype phase)
0102 - Brackish to oligohaline marshes
0103 - Oligohaline marshes

02 - LAKE AND STREAM SWAMPS
0204 - Deep organic stream and lake cypress-gum swamps
0205 - Mucky small stream cypress-gum swamps

03 - STREAM AND RIVER TERRACES
0306 - Partially protected, dry-mesic hardwoods on well-drained loamy sands
0307 - Very protected, mesic hardwoods on somewhat poorly drained loams

04 - DRAINAGE SLOPES
0408 - Well-drained dry-mesic hardwood slopes
0409 - Well-drained to mod. well-drained dry-mesic hardwood lower slopes

05 - DRAINAGE HEADLANDS AND INTERSTREAM FLATS

0510 - Well-drained dry-mesic mixed hardwood-pine on sands
0511 - Mod. well-drained mesic mixed hardwood-pine on loams and sands
0512 - Somewhat poorly drained mixed hardwood-pine on loams

06 - BROAD INTERSTREAM FLATS
0613 - Somewhat poorly drained mesic mixed pine on loams
0614 - Poorly to very poorly drained wet mixed pine on loams and sands

07 - PEAT-MANTLED FORESTED WETLANDS
0715 - Poorly drained pond pine forest on fine sandy and silt loams
0716 - Very poorly drained pond pine forest on fine sandy loams

08 - RAISED PEATLANDS
0817 - Low pocosin on broad, very deep peatlands
0818 - High pocosin and canebrake on broad, moderately deep peatlands
0819 - Low to high pocosin & canebrake on mucky mineral soils

09 - WET SAVANNAS AND FLATWOODS
0920 - Poorly drained longleaf pine ridges and flats on loams
0921 - Poorly drained longleaf pine ridges and flats on sands

10 - MESIC SAVANNAS AND FLATWOODS
1022 - Moderately well-drained longleaf pine flats on sands and loams
1023 - Somewhat poorly drained longleaf pine flats on sands and loams

11 - DRY-MESIC SAVANNAS
1124 - Well-drained longleaf pine ridges and flats on fine and loamy sands

12 - XERIC SAVANNAS
1225 - Excessively drained longleaf pine sand ridges

13 - MARITIME RIDGE AND DUNE FOREST
1326- Well-drained to moderately well-drained maritime oak-pine sand ridges

14 - BEACHES & DUNES (not on Forest)

15 - WATER

16 - URBAN AREAS and other HIGHLY DISTURBED AREAS

A complete description of the Landtypes and Landtype Phases can be found in Appendix A of the Croatan Land and Resource Management Plan.

Use of the Ecological Classification System (ECS)

Introduction

Like all maps, those produced by the Ecological Classification System (ECS) are imperfect representations of the land, and accuracy depends upon the application and the scale being used. Landtype Associations accurately describe landscape patterns at the broadest scale on the Croatan and have been used to define management areas based on dominate ecological factors such as topography and landform/vegetation diversity. Since the ECS was derived from soil maps, the major factor controlling map unit reliability at the finer scales is the accuracy of the three county soil surveys. It is important to note that the objective of soil and ecosystem

mapping is not to outline pure types but rather to separate the landscape into areas that have similar use and management requirements. As a result, "on site investigation is needed to plan for intensive uses in small areas" (USDA 1987).

Ecological Interpretations

Landtype Associations
LTAs were used by the interdisciplinary Croatan planning team to help define Management Areas. The LTAs clearly defined broad categories of land having distinct management opportunities and limitation such as the large central pocosin and highly dissected landscapes on the Forest's periphery. Some LTAs were split (LTA 1) to reflect differences in human use patterns and some were aggregated (LTA 7) to combine areas having similar limitations due to high water tables. Adjustments are apparent by comparing the LTA map (at the end of ECS section) with the Management Area map.

Landtypes
Landtypes were used to address many issues on the Croatan. They were useful for delineating Management Prescription boundaries since many of these emphasized management of ecosystems, e.g. Cypress-Hardwoods wetlands and Hardwood Restoration. The LTs were also used to map different RCW capabilities (density objectives), as a tool in setting population objectives, and in designing the RCW Habitat Management Area. They were used in the Scenic Management System to aid in mapping 'inherent scenic quality' and formed the basis for mapping fuel types. They were also used to analyze natural areas representation, and to locate old growth restoration and conservation areas.

Landtype Phases
Landtype Phases were used to set forestwide objectives in silvicultural prescriptions, restoration opportunities, recreation site location, harvest scheduling, thinning guidelines, and in locating suitable sites for pine straw raking. They are currently being used to identify probability of rare species occurrence, and restoration potentials within natural areas.

Reliability of Mapping
Although soils occur in an orderly pattern that is related to geology, landform, relief, climate and plant associations, soil scientists must determine the boundaries based on an understanding of the soil-landscape relationships. Furthermore, the ECS incorporates this boundary along with an understanding of the complex relationships between landscape, vegetation, and fire regimes to determine the boundary of ecological units.

Most ECS map units are dominated by one major soil type having the same potential vegetation and fire regime. Inclusions of other soil-vegetation types mostly have properties and behavior similar to those of the dominant type. However, these differences may be important at the project level and field review and county soil surveys should be consulted to determine how extensive these differences might be.

Additional factors may affect mapping accuracy. Soil surveys in the Croatan area are considered to have an 80% mapping reliability (level 2) and the minimum map unit size is 10 acres. The

surveys were completed over a 10 year period and there are some minor inconsistencies in soil mapping across county lines. In addition, landscapes with complex patterns, such as along river bluffs or other highly dissected topography, have more inclusions and finer-scale mosaics than have been identified. Soil maps and consequently the ECS, do not therefore identify small swampy floodplains, limestone outcrops, small areas of limestone-influenced soil, or small drainage slopes. Some of these micro-sites may limit management opportunities. Some may contain rare and unique species and could provide opportunities to add to the overall biological diversity of the Croatan.

Reliability of Interpretation

Interpretations of ECS map units were derived from county soil surveys, from Frost's "Presettlement Vegetation and Natural Fire Regimes of the Croatan National Forest" (1996), and from overlaying other resource maps (rare species, cultural resources, and CISC) with the ECS. These interpretations are generally rather broad but still applicable for project level planning (Tables B-20, B-21, B-22). For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within a certain depth in most years, but they cannot assure that a high water table will always be at a specific level in the soils on a specific date (USDA 1987). In addition, the relative occurrence of rare species and cultural resources found within ecological units can be used to identify sites where there is a low or high probability of occurrence of these features. They can not, however, be used to predict with 100 percent accuracy the presence or absence of rare species or cultural sites.

Site index, derived from both CISC data and soil surveys, was used to judge the relative productivity of ecological units at the Landtype Phase level. The major tree species or species groups within an ecological type were placed into four classes, low (L), medium (M), high (H), and unsuitable (U). It was not possible to make a more exact prediction of growth and yield without more intensive field measurements. Still, these relative classes should be useful in determining appropriate stocking levels for different sites and in evaluating species suitability options.

Potential natural vegetation (PNV) types are broad classes of vegetation derived from the presettlement vegetation maps. As with soil types, landscape variability and minimum map unit size will affect the reliability of PNV prediction. Furthermore, where past land use has altered site capability especially through erosion, these potentials may no longer exist. The greatest variability in PNV occurs in Drainage Headlands and Interstream Flats and Broad Interstream Flats (Landtypes 5 and 6). These LTs can support mixed pine-hardwood and mixed pine communities but their exact composition and placement on the landscape is problematic. This is partly because only small remnants persist of these mixed pine communities to help predict their natural pattern and the fact that they are readily confused with fire-suppressed former longleaf pine communities that have been logged and invaded by other pine species. Their interpretation as distinct ecological units is therefore less precise than other types.

Project Level Planning and Analysis

The ECS can be an important tool at the project level for project planning, design, and analysis of the effects of proposed actions. Landtype Phase map units represent the greatest amount of detail on site and biological factors. Because these map units are derived from soil surveys but

combine fire disturbance regimes and vegetation potentials, they can be used to interpret each component separately or together as a unit. The ECS is therefore not just an inventory and evaluation of the soils on the Croatan, but also the biological components and potentials of ecosystems. As with a soil survey, "it can be used to adjust land uses to the limitations and potentials of natural resources and the environment" (USDA Soil Conservation Service, 1981, 1987, 1989).

Detailed tables found in Appendix A of the draft Croatan Revised Plan define how soil factors that such as texture, drainage and water table depth may affect management. These factors are interpreted to identify equipment limitations and seedling mortality with map units. The tables also include predictions of potential vegetation type, probability of rare species occurrence, timber productvity, and probability of cultural resources for each of the 25 Landtype Phases. This information can be used to evaluate the feasibility and probable effects of a proposed action in all or part of the Croatan. Combined with the ecological maps and descriptions (ESC Chapter 2), opportunities and limitations are apparent for a variety of proposed actions including wildlife habitat manipulation, timber stand improvement, timber harvest, recreational development, and road or trail location.

Although the ECS identifies and describes distinct land units and their biological potentials, it does not describe the current vegetation condition. This information is provided in the compartment and stand maps of Continuous Inventory of Stand Condition (CISC). By combining the ECS and CISC, one can map areas of the landscape where current condition differs from potential condition and begin to locate opportunities for change and evaluate the range of options available for individual sites. Although the ECS can be used to identify species best adapted to sites and their performance, it <u>is</u> <u>not</u> a prescription for desired future condition. Land use decisions will be improved by use of the ECS, but they should not be dictated by it. These decisions are based on public input, Plan direction, and the balance of uses appropriate for the Croatan.

An example may help to explain this distinction. Pine savannas and flatwoods occur along a wide soil drainage-fertility gradient. They have been described in 6 Landtype Phases and can support a large variety of trees, shrubs, herbs and their related fauna. Production and longevity of trees adapted to these types is also highly variable. Fewer species are adapted to the harsh conditions at the xeric and less fertile end of the gradient, where well-drained and excessively drained sands are dominant (LTP 1225). Nearly 90% of these sites are currently dominated by longleaf pine (CISC data). On sites dominated by loblolly pine, pond pine, or hardwoods tree growth is poor, regeneration is sparse, and the long-term sustainability of these species is questionable. At the other extreme, poorly drained sands and loams support savannas and flatwoods dominated by longleaf, pond, or loblolly pine, or a combination of these species (LTP 920-921). Growth is moderate to poor, tree form is good, and natural regeneration is moderate. In the middle of the gradient, mesic sites support loblolly, longleaf, and hardwoods (LTP 1022-1124). Growth is good, tree form is good, and natural regeneration of all species is rapid. The natural vegetation type in all these LTPs is longleaf pine, but, it is evident that many species are capable of regenerating, although growth rates differ.

There are many management options in LTPs 1022-1124 since these types will support a variety of species and have few limitations (not poorly drained, not too droughty). The choice of species for management is dependent upon the desired condition. If RCW nest sites are the primary emphasis, then longleaf pine would be the preferred species; if short-rotation fiber production is the emphasis, then loblolly pine might be preferred; if turkey and deer are the primary emphasis, then a mixed oak-hickory-pine composition may be preferable. Fewer options are available at the extremes of the gradient, xeric and wet. However, the same logic applies - the ECS does not determine desired condition but it CAN determine where a desired condition might best be achieved.

B.4.4. Fuel Models

Fuel Model Description

Several variables were incorporated in the development of a fuels analysis on the Croatan National Forest. The primary variables included forest type and fire history (1979-1996). Complete prescribed fire records only dated back to 1979. District personnel, working from memory, outlined large wildfires from 1979 to present (1996) as well. ``Fire occurrence" is used to describe both prescribed fire and wildfire activity in this analysis. Other variables used in the analysis included potential natural vegetation (PNV), soil map units, site index, and thinning treatments.

Fuel models (Anderson, 1982) were selected to best describe these conditions. A fuel model is a list of numbers that describe the fuel bed in such terms as fuel bed depth, load and heat content. It provides a means of organizing fuels data for input into the fire behavior model. The fire behavior model is used to help predict characteristics that a fire might display under specified conditions. The following fuel models (FM), based on Anderson's ``Aids to Determining Fuel Models For Estimating Fire Behavior" (1982), were determined to be of interest:

Fuel Model 2, A grass fuel model (FM2) occurring in longleaf pine stands that have been in a "3-year or less" burning rotation for several years. In FM 2, fire is spread primarily through the fine herbaceous fuels, either curing or dead. These are surface fires where the herbaceous material, besides litter and dead-down stemwood from the open shrub or timber overstory, contribute to the fire intensity.(8,200 acres current)

Fuel Model 4, High pocosin conditions (FM4) occur in areas of very poorly drained soils including Croatan, Murville and Bayboro, which support pond pine and loblolly pine forest types , and have a Potential Natural Vegetation (PNV) of Pocosin, but have had no fire occurrence in at least 17 years (since 1979). Fire intensity and fast-spreading fires in this fuel type involve the foliage and live and dead fine woody material in the crowns of a nearly continuous secondary overstory. In addition to flammable foliage, dead woody material contributes significantly to fire intensity. The height of stands qualifying for this model depends on local conditions. There may also be a deep litter layer or organic soil that confounds suppression efforts. (42,400 acres current)

Fuel Model 6, Low pocosin (FM 6) represents areas of deep organic soils (organic > 51") such as Dare, which support pond pine forest types and have a PNV of Pocosin. Fire carries through the shrub layer where the foliage is generally flammable, but requires moderate winds (8mi/h at midflame height). Fire will drop to the ground at low windspeeds or openings in the stand. The shrubs are older, but not as tall as shrub types of FM 4, nor do they contain as much fuel as FM 4. However, once the deep organic soil ignites, fires become very difficult to extinguish, and causes severe smoke management problems.(26,100 acres current)

Fuel Model 7, A southern rough fuel condition (FM 7) exists in pine forest types which have had infrequent fire occurrences. Also included in FM 7 are pine stands which are fairly productive or have had thinning treatments. These stands are assumed to have somewhat open canopies which allow for substantial shrub layer development. Fires burn through the surface and shrub strata with equal ease and can occur at higher dead fuel moisture contents because of the flammable nature or live foliage and other live material. Stands of shrubs are generally between 2 and 6 ft. high. (36,500 acres current)

Fuel Model 9, A hardwood/pine leaf litter fuel model (FM 9) is found in hardwood drainages and swamps, and mixed hardwood/pine types. This fuel model also captures other pine forest types with relatively closed canopies, as well as those that have had regular prescribed fire treatments. In general, these stands do not have the well developed shrub understories found in those depicted by FM 7. Fires run through the surface litter at moderate rates of spread, but high winds will actually cause higher rates of spread than predicted by the fire behavior model. This is due to spotting caused by rolling and blowing leaves. Concentrations of dead-down woody material will contribute to possible torching out of trees, spotting, and crowning. (39,300 acres current)

A complete description of the derivation of these models is found in Appendix B of the Draft Revision of the Croatan Land and Resource Management Plan.

B.4.5. Scenery Management System

Background

For inventory and analysis of the aesthetic values of national forest lands, the Forest Service uses a system called the Scenery Management System (SMS), Agriculture Handbook 701, *Landscape Aesthetics. A Handbook for Scenery Management*. This system, released in 1996, evolved from and replaces the Visual Management System, Agriculture Handbook 462, *National Forest Landscape Management, Volume 2, Chapter 1*, which was used for the existing Croatan and Uwharrie Land and Resource Management Plan, 1986. The SMS differs from the VMS in that it borrows from and is integrated with the basic concepts and terminology of ecosystem management. SMS integrates aesthetics with biological, physical and other social/cultural resources in the planning process.

SMS Components

The Scenery Management System process involves identifying scenery components as they relate to people, mapping these components, and developing a value unit for aesthetics from the data gathered. This value unit provides information for planning and leads to rational decisions relative to scenery as a part of ecosystems. These components include:

Existing Landscape Character

Landscape character is the visual and cultural image of a geographic area and consists of the combination of distinct physical, biological and cultural attributes that make each landscape identifiable or unique. Landscape character descriptions use base information from ecological unit descriptions supplemented with existing land use patterns or themes. These existing landscape character descriptions are used to:

Scenic Attractiveness

Scenic attractiveness classes are developed to determine the relative scenic value of the lands within a particular landscape character. They are the primary indicator of the intrinsic beauty of the landscape and the positive responses it evokes in people. The three classes are Class A,

Distinctive; Class B, Typical; Class C, Indistinctive. The landscape elements of landform, vegetation, rocks, water features and positive cultural features, are described for each of these classes. Class A landscapes are areas where these features combine to provide unusual, unique or outstanding scenic quality. Class B landscapes are areas where these features combine to provide ordinary or common scenic quality. They have generally positive, yet common, attributes. Class C landscapes are areas where natural and cultural features have low scenic quality. These landscapes have weak or missing attributes.

Existing Scenic Integrity

Scenic integrity is a measure of the degree to which a landscape is visually perceived to be intact or whole. It indicates the current status of a landscape; and indicates the existing degrees of alteration from the attributes - form, line, color, and texture - of the landscape character. The highest scenic integrity ratings are given to those landscapes which have little or no deviation from the existing character valued by people for its aesthetic appeal. Scenic integrity is used in forest planning to describe an existing situation, standard for management or desired future conditions. The six scenic integrity levels are:
Very High (VH), unaltered; High (H), appears unaltered; Moderate (M), slightly altered; Low (L), moderately altered; Very Low (VL), heavily altered; Unacceptably Low (UL), appears extremely altered.

Landscape Visibility

Landscape visibility is composed of two parts: human values as they relate to the relative importance to the public of various scenes and the relative sensitivity of scenes based on distance from the observer.

Scenic Classes

All national forest landscapes have value as scenery - some more than others. Scenic classes measure the relative importance, or value, of discrete landscape areas. These classes are used during forest planning to compare the value of scenery with the value of other resources. The higher the scenic class, the more important it is to maintain the highest scenic value.

Scenic classes are determined by combining the three classes of scenic attractiveness with distance zones and concern levels. A numerical Scenic Class rating (1 - 7) is assigned to all lands. Generally Scenic Classes 1-2 have high public value (Table B-26), Classes 3-5 have moderate value, and Classes 6-7 have low value. This does not include Wildernesses since they are managed to allow natural processes to occur.

Scenic Integrity Objectives

The components described above are the inventory phase of the Scenery Management System. Development of Scenic Integrity Objectives moves into the implementation phase that integrates SMS into the forest plan revision process. As stated earlier, the concept of scenic integrity can be used to describe varying degrees of wholeness or completeness and level of scenic condition from very high to unacceptably low. Scenic Integrity Objectives describe the long term level of integrity achievable or the desired condition.

ROS and SMS Compatibility

There is no systematic approach to establish a value for attractiveness for different landscapes and recreation opportunities within a single ROS class. There are, though, some combinations of scenic integrity objectives and ROS classes that are more compatible than others. Page F-3 of the SMS handbook contains a chart that links ROS class and scenic integrity objectives.

A detailed discussion and analysis of these components specific to the Croatan is found in Appendix F of the Draft Revised Croatan Land and Resource Management Plan.

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[1]John F. Dwyer. Consumer Diversity and the Future Demand for Outdoor Recreation. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, General Technical Report RM-252. August 1994.

[2]Division of Parks and Recreation. North Carolina Outdoor Recreation Plan 1995-2000. N.C. Department of Environment, Health, and Natural Resources. Raleigh, North Carolina. September 1995.

[3]Donald B.K. English, et al. Regional Demand and Supply Projections for Outdoor Recreation. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, General Technical Report RM-230. August 1993.

[4]Curtis H. Flather and Thomas W. Hoekstra. An Analysis of the Wildlife and Fish Situation in the United States: A Technical Document Supporting the 1989 USDA Forest Service RPA Assessment. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, General Technical Report RM-178. September 1989.

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FEIS APPENDIX C: EVALUATION OF ROADLESS AREAS ON THE CROATAN NATIONAL FOREST

C.1. PURPOSE FOR STUDY

The Croatan National Forest has six inventoried roadless areas totaling 20,771 acres. Although referred to as roadless areas, some of them contain roads as permitted in FSH 1909.12, "Land and Resource Management Planning Handbook."

The roadless areas were evaluated for their potential wilderness suitability, using a report format in accord with CFR 219.17. These reports consider wilderness suitability in three categories: capability (the qualities that make an area suitable or unsuitable for wilderness), availability (assessing the wilderness and nonwilderness resources and local demands on the area), and need (existence of other wilderness in the area and trends in use). All six roadless areas are reported together in this evaluation due to their close proximity and similar characteristics.

Two tracts, Masontown Pocosin and Union Point Pocosin, were evaluated and excluded from the roadless inventory for not satisfying the criteria of solitude because of their proximity to Cherry Point Marine Air Corps Station and the incoming and outgoing flights.

The following is a list of the roadless areas that were studied, their numbers, names and acreages:

11301	Catfish Lake North	11,294 acres
11302	Catfish Lake South Addition A	172 acres
11303	Catfish Lake South Addition B	233 acres
11304	Sheep Ridge Addition	5,806 acres
11306	Pond Pine Addition B	2,980 acres
11307	Pocosin Addition	286 acres

C.2. DESCRIPTION

Location and vicinity:
The roadless areas are within 17 miles of each other and have partial boundaries to existing Wildernesses.

- Catfish Lake North has the Catfish Lake Impoundment as a western boundary, and two roads (Catfish Lake Road & Catfish Lake Farm Road) on the south. Little Road is the eastern boundary, with national forest boundary on the north.
- Catfish Lake South Additions A&B are land acquisitions since the designation of Catfish Lake South Wilderness, and protrude into the wilderness off Catfish Lake Road.
- Sheep Ridge Addition has roads surrounding it including OHV trails on the west, Seaborn Road 174 on the south, Lake Road 126 (and Pond Pine Wilderness) on the east, and Great Lake and Road 513 on the north.
- Pond Pine Addition B is adjacent Pond Pine Wilderness on the west, Great Lake on the north, national forest boundary on the east and the U.S. Marine Corps railroad on the south.

- Pocosin Addition is a boundary adjustment on the southeast side of Pocosin Wilderness bounded by Mairey Branch and Juniper Branch.

General Geographic Description Of The Area:
The areas are mostly coastal plain pocosins. Topography is nearly level, indicative of coastal wetland systems. The east edge of Catfish Lake North, Catfish Lake South Additions A & B, and part of Pond Pine Addition B are swamp forest areas.

General Description Of The Area Vegetation, Including The Ecosystem Types:
Pocosins are defined as "freshwater wetland ecosystems characterized by broadleaved evergreen shrubs or low-growing trees, commonly including pond pine, and commonly growing on highly organic soils that have developed in areas of poor drainage" (Sharitz and Gibbons, 1982). These areas include a mix of low and high pocosin. Low pocosins are dominated by low-growing shrubs, typically 2-3 feet high. High pocosin includes taller shrubs and trees. Pocosin vegetation is typically dense, almost impenetrable.

Pocosins are biologically rich and diverse with plants. Dominant trees are ordinarily pond pines with some loblolly bays, red bays, and sweet bays. The most frequent shrubs are titi, honeycup, fetterbush, bitter gallberry, and sweet gallberry growing with the bamboo-briar vine (McDonald, Ash, and Kane 1983). The presence of abundant and diverse insectivorous plants is a unique feature of pocosin vegetation.

Key Attractions, Including Sensitive Wildlife And Scenic Landmarks:
There are no special attractions in the areas that are not found in other places on the forest. The areas are all part of black bear habitat and some are part of the bear sanctuary. A segment of West Prong Creek runs through Catfish Lake North. This segment is eligible for wild & scenic river designation. There are existing and proposed Special Interest Areas (SIA)through cooperation with the NC Natural Heritage Program. These include: Catfish Lake North, a proposed area in the western part; Sheep Ridge Addition, an existing SIA in the north half; Pond Pine Addition B, existing and proposed SIA's covering all of the area; Pocosin Addition, an existing SIA covering the whole area. Catfish Lake North has existing RCW colonies along Little Road, and a recruitment area off the north end of the Waterfowl Impoundment.

C.3. INVENTORY

Human Influence
To what degree have humans and past and present human activity affected natural ecological processes and conditions?

The natural ecological processes for the areas are largely intact, with the exception of the need for fire in these systems. There has been logging in some areas as recently as 1990. Two of the areas, Catfish Lake North and Sheep Ridge Addition have had prescribed fire in the past. Catfish Lake South Addition A has RCW colonies and artificial nesting cavities.

To what degree is the area natural or natural appearing and free from disturbance?

All of the areas have had some level of disturbance, with most of it from road systems and activities associated with the roads surrounding the areas. Catfish Lake North has timber harvest units along Little Road and Catfish Lake Road with plantations as young as 10 yrs. There are also many fire lines in the eastern third of the area. Catfish Lake South Addition A is undisturbed except for an older harvest unit along the eastern edge. Catfish Lake South Addition B is undisturbed. Sheep Ridge Addition has older timber harvest units along the southern edge, wildlife fields on the east boundary, and extensive plow lines in the northern half. These were created in the l994 Fish Day Fire when the entire area burned. Pond Pine Addition B is relatively undisturbed with an old fire line in the SE corner. Pocosin Addition has an old harvest unit in the northern half.

Does the existing or attainable National Forest System ownership pattern, both surface and subsurface, ensure perpetuation of identified wilderness values?

The surface and subsurface are in Forest Service ownership.

Improvements, Structures, and Nonconforming Uses
There are no areas with evidence of historic mining and there are no areas under current mineral lease that contain a "no surface occupancy" stipulation or where the lessee has not exercised development and occupancy rights.

Catfish Lake North has dispersed hunting camps along Catfish Lake Farm Road and an OHV trail extending into the area one mile. There are no other trails within any of the areas. There are no private inholdings or dwellings, non-conforming structures, utilities or watershed treatment areas. Three areas have improved road miles within them: They are Catfish Lake North (0.8 miles), Sheep Ridge Addition (1.3 miles), and Pocosin Addition (0.15 miles). Existing nonconforming uses can be mitigated or terminated through closing interior roads and OHV trails.

C.4. EVALUATION

Capability Experiential Benefits.

*Do the areas provide the opportunity for solitude and serenity***?**

There are many opportunities for solitude and serenity in the areas. Factors detracting from solitude and serenity are military overflights, roads that bound most of the areas, the military railroad along Pond Pine Addition B, and the presence of motorboats on Catfish Lake and Great Lake.

Challenge.

Do the areas offer visitors the opportunity to experience adventure, challenge, or self-reliance? Is access easy or difficult?

Access is by system roads which bound most of the areas. Opportunities to experience adventure are similar to those for other relatively small undisturbed areas of the southeastern U.S. There are no trails within any of these areas. Access within the areas is by cross-country travel through dense vegetation

on boggy soils. Traversing a pocosin requires a high level of orienteering skills and provides the wilderness visitor many opportunities to experience solitude, challenge and self-reliance.

Recreation opportunities include primitive camping along the boundaries, hunting with dogs within the areas, fishing and boating in Catfish and Great Lakes, cross-country hiking or horseback riding, photography and nature study.

Opportunities exist to do outdoor education and scientific study of the pocosin ecosystem and wildlife, formally and informally in these areas.

What are the characteristics of the surrounding areas in terms of recreation opportunity spectrum (ROS) classifications?

The acres of semi-primitive non-motorized and semi-primitive motorized acres are as follows:

Table C-1. Acres of semi-primitive motorized and non-motorized settings for roadless areas.

AREA	SPNM Acres	SPM Acres
Catfish Lake North	6,779	0
Catfish Lake South Addition A	0	0
Catfish Lake South Addition B	0	0
Sheep Ridge Addition	2,429	459
Pond Pine Addition B	0	727
Pocosin Addition	150	0

The areas surrounding the roadless areas, other than Wildernesses are all roaded natural, except for the railroad along Pond Pine Addition B, and Catfish Lake South Additions A&B, which are within the 1/4 mile rural designation.

Do boundary locations conflict with important existing or potential public uses outside the boundary that might result in demands to allow nonconforming structures and/or activities in the wilderness?

There are no conflicts with potential public uses outside the areas, except for the military railroad along Pond Pine Addition B. The ability to do maintenance of the track and to fight fires that are often started along the railroad, would be hampered by restricted access and the prohibition on motorized equipment use in the wilderness.

The boundaries can be accurately described and established on the ground, conform with terrain or vegetation that constitute a barrier to prohibited use, and act as a shield to protect the wilderness environment inside the boundary from the sights and sounds of civilization.

Availability
What current uses exist? What are the non-wilderness demands and uses?

Recreation: Hunting, boating and fishing on Catfish & Great Lakes. The soils in the pocosin areas prohibit any kind of recreational development because of their unstable, saturated condition. Even primitive trails are difficult to maintain. The areas do not contain natural phenomena of such unique or outstanding nature that general public access and special development should be available. Because of

this and the condition of the soils, the recreation component is not a major factor in wilderness designation.

Wildlife: All the areas are habitat for black bear, and Sheep Ridge Addition and Pond Pine Addition B are currently in the bear sanctuary. There are RCW habitat management areas on the east boundary and along the Catfish Lake Waterfowl Impoundment adjacent Catfish Lake North. Only burning to retain the habitat would be allowed if the area were wilderness. Wilderness designation would not restrict or prevent the application of wildlife management measures.

Timber: The areas are tentatively suitable for timber production except for Pocosin Addition and fall in the 71 - 100 year age class. These lands are not needed to meet the timber resource demands.

Urban interface: Catfish Lake North has a fire urban interface zone along the national forest boundary on the north. If the area is designated wilderness it will be difficult to maintain that zone through burning because of the difficulty in maintaining firelines within the wilderness.

Heritage Resources: There have been surveys done in Catfish Lake North, and along Catfish Lake Road. Total acres surveyed was low and no Class II sites were found.

Need

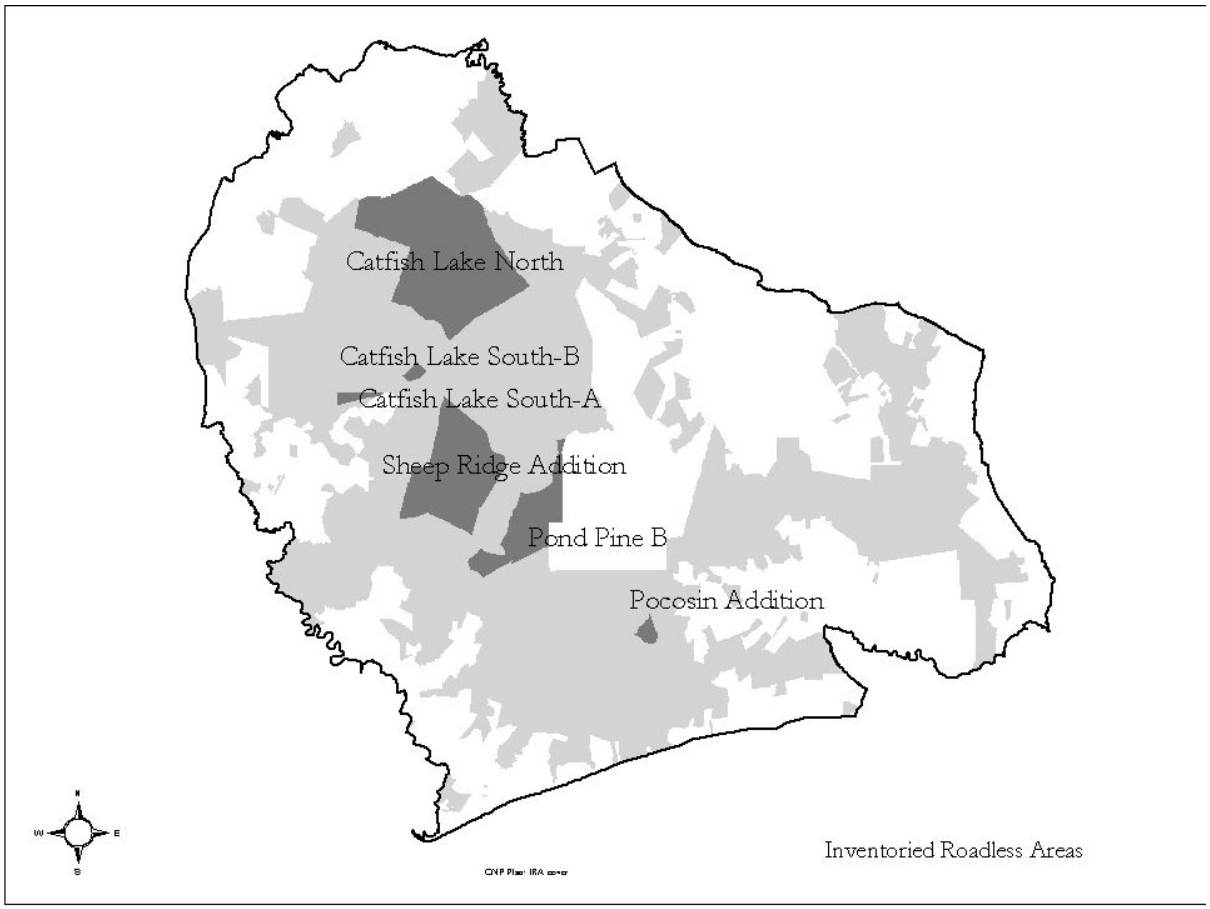
These roadless areas are adjacent to the four existing Wildernesses (31,221 acres), although some of them are separated by roads or a railroad. The existing Wildernesses receive approximately 2600 visitors each year. The three county region of the forest is growing much faster than the State of North Carolina and the national average. Hunting, which occurs in part in the Wildernesses, is the largest single recreational use of the forest. Although hunting is increasing, other uses of wilderness are experiencing no upward trend. Therefore, the need for wilderness to meet the need for semi-primitive recreational experiences is not necessary. In addition, the two roadless areas that were considered, but excluded from wilderness consideration are available for a vehicle-restricted and primitive recreational experience.

It is important to provide sanctuary for the black bear whose habitat requires low road density. As development continues on land surrounding the National Forest, it will become more important to provide large unroaded settings. Existing Wildernesses and roadless areas have the same ecological landtypes. Therefore, none of the roadless areas offer unique ecological attributes that would become the basis for wilderness designation.

The allocations of roadless areas to management prescriptions are shown in Table C-2. Due to the desired conditions of the management prescriptions, the characteristic of ‘roadless’ is not likely to be significantly affected in any alternative.

Table C-2. Management prescription allocations by roadless area by alternative

Catfish Lake North	**Alternatives**				
	B	**C**	**C-mod**	**D**	**E**
Prescriptions					
Wilderness	11294				
Hardwood Cypress Wetlands		61	61	801	61
River Corridors Eligible for Wild and Scenic River Status		740	740		740
RCW HMA		1077	1077	1077	1077
Wildland Urban Interface		1401	1401	1401	1401
Bear		7789	7789	7789	7789
Developed Areas		2	2	2	2
Small Pocosin Patches		224	224	224	224
Catfish Lake South B					
Wilderness	233	233	233	233	233
Catfish Lake South A					
Wilderness	172	172	172	172	172
Pocosin Addition					
Wilderness	286	286	286	286	286
Sheep Ridge Addition					
Wilderness	5716	0	0	0	0
RCW	77	77	77	77	77
Bear	0	5716	5716	5716	5716
Developed	3	3	3	3	3
Small pocosin	10	10	10	10	10
Pond Pine B					
Wilderness	2980		2980		
wetlands		587		587	587
Lakes		3		3	3
RCW		273		273	273
Bear		2076		2076	2076
Small pocosin		41		41	41


Catfish Lake North
Catfish Lake South-B
Catfish Lake South-A
Sheep Ridge Addition
Pond Pine B
Pocosin Addition
Inventoried Roadless Areas

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FEIS APPENDIX D: PRELIMINARY ANALYSIS OF BRICE CREEK AND WHITE OAK RIVER

D.1: PRELIMINARY ANALYSIS OF BRICE CREEK INCLUDING WEST AND EAST PRONG CREEKS

D.1.1. PURPOSE FOR STUDY

This report documents the results of the analysis conducted to determine eligibility of Brice Creek (including East and West Prong Creeks) as a potential component of the National Wild and Scenic Rivers System and, preliminary analysis of its suitability classifications.

Brice Creek was not identified through the Nationwide River Inventory, developed by the National Park Service, U.S. Department of Interior (January 1982), as a potential wild and scenic study river. Nor was it studied for eligibility in the 1986 Final Environmental Impact Statement (FEIS) for the Land and Resource Management Plan for the Croatan and Uwharrie National Forests. As part of the Croatan Plan Revision Process, this river system was identified for study by the USDA Forest Service.

Brice Creek has been evaluated in a manner that is consistent with the U.S. Department of Interior and U.S Department of Agriculture jointly issued *Final Revised Guidelines For Eligibility, Classification, and Management of River Areas*. (See 47 Federal Register 34457, September 7, 1982.)

D.1.2. SUMMARY OF FINDINGS

Brice Creek is eligible for designation based on its free-flowing condition and outstandingly remarkable scenic, botanical, wildlife, and historical and cultural values. Since CNF land comprises less than 35% of the river corridor, the Forest Service recommends further study of its suitability in cooperation with the State of North Carolina, who will lead the effort.

The length of river in free-flowing condition (27.4 miles) and the characteristics of the river corridor are worthy of addition to the national system. Brice Creek would be a sustainable high quality example of Southern coastal blackwater streams, which are currently not represented in the national rivers system. Current land uses and management on national forest are compatible with potential WSR management. Increases in administrative costs should not be significant unless recreation use dramatically increases as a result of designation due to increased popularity.

D.1.3. LOCATION AND DESCRIPTION OF STUDY AREA

Brice Creek system flows north 27.4 miles through pocosin and hardwood and pine forests to its confluence with the Trent River. It begins with West Prong Creek and East Prong Creek where they cross Catfish Lake Rd. Brice Creek is the CNF proclamation boundary and the creek system is located entirely in Craven County. The study corridor includes the area extending the length of the designated segments of this river (27.4 miles) and 1/4 mile in width from each bank of the river. It totals 8,768 acres.

Refer to Chapter 3, Affected Environment, of the accompanying Draft Environmental Impact Statement for a description of the biological and physical resources within the study corridor.

D.1.4. FINDINGS OF ELIGIBILITY

To be eligible for designation as a component of the National Wild and Scenic Rivers System, a river must be free-flowing and possess one or more of the following as outstandingly remarkable values: (1) scenic, (2) recreational, (3) geological, (4) fish and wildlife, (5) historic and cultural, or (6) other values, including ecological.

The Wild and Scenic Rivers Act defines "free-flowing" as existing or flowing in a natural condition without impoundment, diversion, straightening, rip-rapping, or other modification of the waterway. The existence of low dams, diversion works, or other minor structures at the time a river is proposed for inclusion in the national rivers system does not automatically disqualify it for designation. A river segment flowing between large impoundments may qualify for designation if conditions within the segment meet the eligibility criteria.

There are no specific requirements concerning the length or flow of an eligible river segment. The length or flow are sufficient if they sustain or complement the outstandingly remarkable values for which the river would be designated to protect.

Description Of Values For Brice Creek

Scenic: Scenic and botanical values are co-existent. Areas directly adjacent to the streams consist of lake and stream swamps where the vegetation is cypress and closed canopy hardwoods, and tannins color the water. Along Brice Creek are many areas of dry mesic hardwood-pine with only small remnants of mixed pine-hardwood, mainly loblolly, sweetgum and oaks. Along Brice Creek are some areas of drainage slopes where oak, and hickory dominate. West Prong Creek is within low pocosin on very deep peatlands which is typified by stunted pond pine with dense, short evergreen shrubs of bay. In addition to lake and stream swamps and mesic hardwood-pine, East Prong Creek includes stream and river terraces. Characteristics include predominantly beech, poplar, hickory, and oak. The Class A - Distinctive rating is assigned to the scenic values.

Recreational: Current recreational use includes fishing, hunting, picnicking, canoeing and motorboating (bass boats and jet skis). Developed recreation sites include a National Forest boat ramp and picnic area at Brice Creek Boat Ramp, and Craven County Park, which is under construction. The Class B - Common rating is assigned to the recreational values.

Geologic: The river provides no exposure to the coastal group of formations. The stream bank and surrounding corridor are almost entirely vegetated. The Class C - Minimal rating is assigned to the geological value.

Fish and Wildlife: Rare animals include American alligator, eastern cougar, Bachman's sparrow, Croatan crayfish and RCW among others. It is habitat for black bear, wild turkey, double breasted cormorant, Neuse river waterdog, and many bird species. As part of the Neuse River

system it is very diverse in fishery species, more so than other coastal plain drainages. The waters support sport fishing. The Class A - Distinctive rating is assigned to the fish and wildlife value.

Historic and Cultural: The Brice Creek corridor has a high probability for historical and archeological sites. There are 17 sites that may qualify for listing on the National Register of Historic Places. Many of these sites are located in the riverbed or along the streambank. The Class A - Distinctive rating is assigned to the historical and cultural values.

Criteria For Outstandingly Remarkable Values

Dictionary definitions of "outstandingly remarkable" indicate that such a value would be one that is a conspicuous example of a value from among a number of similar values that are themselves uncommon. Based on these definitions, a comparison system for evaluating stream values was developed on the premise that all streams have some value, but when compared to each other, some stream values will be more outstanding. Using the "scenic attractiveness" concept for describing physical features from the Forest Service Scenery Management System, the following three categories were developed for comparing values:

- Class A - Distinctive which refers to those rivers/streams whose features and values are of unusual or outstanding quality when compared to others in the North Carolina coastal area.
- Class B - Common which refers to those rivers/streams whose features and values are common to most streams in the North Carolina coastal region.
- Class C - Undistinguished which refers to those rivers/streams with few features and values.

A value must meet the criteria for the Class A - Distinctive category to be considered outstandingly remarkable. Only one value is needed for eligibility. The following criteria were developed for the three categories for each of the values listed in the Wild and Scenic Rivers Act, Sections 1(b) and 2(b).

Scenic

Class A - Distinctive. The landform is complex with unusual or outstanding topographic features. Rock features, when present, stand out on the landform and are unusual or outstanding in size, color, or location. Forest cover is continuous or broken with a high degree of patterns and an unusual or outstanding diversity in plant species; large or old-growth timber may be present. The streambed varies in width from medium to large. The stream volume ranges from medium to high with a variety of flow characteristics.

Class B - Common. The terrain has some variety, but landform features are typical of the coastal region. Rock features, when present, are obvious, but do not stand out and have no unusual or outstanding characteristics. Forest cover is continuous with some variety in vegetative patterns and a common diversity in plant species. The stream volume ranges from medium to low with some variety in flow characteristics.

Class C - Minimal. The terrain has little variety in slope, dissection or features; rock features are generally lacking. Forest cover is continuous with little diversity in the number or pattern of plant species. The stream is generally small with low volume and little or no variety in flow characteristics.

Recreational

Class A - Distinctive. The river provides opportunities for water-oriented activities and recreation experiences which are unique to that stream or a limited number of streams or which can occur only because of the character of the stream. The river contains a high quality sport fishing experience.

Class B - Common. The river provides opportunities for water-oriented activities typical of most coastal streams including fishing, swimming, boating (motorized and non-motorized), and waterfowl hunting.

Class C - Minimal. Stream size, flow or other characteristics limit opportunities or attractiveness for water-oriented recreation activities.

Geologic

Class A - Distinctive. The river corridor clearly displays significant or unusual geomorphic or structural features. It also includes those rivers clearly exposing geologic formations which are visible in few or no other sites. The amount of exposed rock is significant which provides excellent opportunities for geologic study.

Class B - Common. The geomorphic features and formations are typical of those commonly found in the Coastal Plain. There is some opportunity for geologic study.

Class C - Minimal. The river provides few or no exposed rock formations and no significant geologic features.

Fish And Wildlife

Class A - Distinctive. Resident fish and wildlife populations, including known populations of proposed endangered, threatened and sensitive species (PETS), occur only because of the quality and character of the stream or riparian area.
Class B - Common. Resident fish and wildlife populations are common to most coastal streams.
Class C - Minimal. Stream characteristics limit the number and type of species present. Populations of game fish species are largely absent. The fish community may be dominated by more pollution tolerant species. The total number of fish species is less than in comparable, higher quality streams.

Historical And Cultural

Class A - Distinctive. The river corridor has a high probability for prehistoric sites. It contains Class I prehistoric or historic sites, which are listed in the National Register of Historic Places, or known Class II sites, which are eligible for listing on the National Register but require further study, or known sites that may not be unique in character or content, but are in a unique state of

preservation. In addition, these sites are located in or along the riverbed or are integrally associated with the river.

Class B - Common. The river corridor has a moderate probability for archeological sites. Known sites are similar to other known sites and contain limited information; some sites may have been disturbed prior to scientific investigation. Some sites may meet the criteria for listing or are listed in the National Register of Historic Places, but are not located in or along the riverbed and are not integrally associated with the river.

Class C - Minimal. The river corridor has a low probability for archeological sites. Known sites do not meet the criteria for listing in the National Register of Historic Places and are not integrally associated with the river.

Findings Of Eligibility

Brice Creek is eligible for designation under the Wild and Scenic Rivers Act because it is free-flowing and has been determined to have outstandingly remarkable scenic, botanical, wildlife, historical and cultural values.

D.1.5. POTENTIAL CLASSIFICATION

If a river has been determined to be eligible for designation, the next step is to determine the potential classification that would result from designation. There are three classifications of rivers, or river segments, in the National Wild and Scenic Rivers System--wild, scenic, and recreational. Classification is based on the condition of the river and the adjacent lands at the time of the study. The following criteria are used.

Wild River. The river should be free of impoundments. The shoreline should be essentially primitive with little or no evidence of human activity; however, the presence of a few inconspicuous structures is acceptable. There should be little or no evidence of past timber harvest and no ongoing timber harvest. The river area should be generally inaccessible except by trail. There should be no roads, railroads or other provision for vehicular travel; however, a few existing roads leading to the boundary of the river area are acceptable. Water quality meets or exceeds criteria of federally approved State standards for aesthetics, propagation of fish and wildlife normally adapted to the river, and primary contact recreation.

Scenic River. The river should be free of impoundments. The shoreline should be largely primitive and undeveloped with no substantial evidence of human activity; however, the presence of small communities, dispersed dwellings or farm structures is acceptable. Evidence of past or ongoing timber harvest is acceptable if the forest appears natural from the river bank. The river area may be accessible in places by roads and roads may occasionally reach or bridge the river. The existence of short stretches of conspicuous or longer stretches of inconspicuous roads or railroads is acceptable. No criteria for water quality is prescribed in the Act. Poor water quality does not preclude classification provided a water quality improvement plan exists or is being developed.

Recreational River. The river may have some development with substantial evidence of human activity. The presence of extensive residential developments and a few commercial structures is acceptable. Lands may have been developed for a full range of agricultural or forestry uses and may show evidence of past or ongoing timber harvest. The river area may be readily accessible by roads or railroads. The existence of parallel roads or railroads on one or both banks and bridge crossings is acceptable. No criteria for water quality is prescribed in the Act. Poor water quality does not preclude classification provided a water quality improvement plan exists or is being developed.

Potential Classification. Since CNF land comprises less than 35% of the river corridor, the Forest Service recommends further study of suitability in cooperation with the State of North Carolina, who would lead the effort. The following discussion of characteristics could be useful for that study.

Characteristics Worthy of Addition to the National Rivers System

Brice Creek is typical of the blackwater Coastal Rivers that drain swampy or marshy areas of the lower Coastal Plain in North Carolina. It is a well-preserved example of a stream system that transitions between fresh and salt water. The headwaters are relatively inaccessible, and West Prong in particular, meanders undisturbed through pocosin roadless areas. This type of river in the preserved condition of Brice Creek is an infrequent resource in North Carolina.

In the Neuse River system Brice Creek is the most outstanding for fishery habitat qualities. It is very diverse in fish species, exceeding other coastal plain drainages. Striped bass, american shad, hickory shad and herring are found in Brice Creek. This is a good indication of the high quality habitat. Currently there are no representatives of Southern Coastal Plain blackwater streams in the national wild and scenic rivers system. This is a unique ecosystem that warrants inclusion in the system.

Brice Creek offers a regionally unique, wide variety of plant life in a setting rarely available for public observation. Primary vegetation components include cypress swamp, dry mesic hardwood, low pocosin and mesic longleaf savannah & flatwoods. Approximately 25% of the cypress swamp ecological landtype and 65% of the mesic hardwood-pine in the forest are found in Brice Creek. The river is very scenic because of this diversity. Other scenic attributes are the large old growth cedars and hardwoods along some stretches.

Opportunities for canoeing coastal blackwater streams are limited in North Carolina because stream sizes are often too small, clogged with vegetation, or too large with a lot of large motorized boat traffic, too short in length, too much shoreline development to provide a quality recreation experience, or has limited public access. A significant length of Brice Creek is canoeable and an interpretive canoe trail is being designed. It begins at the boat launch and travels upstream to the junction with Black Branch, approximately 4 miles, although the creek is boatable for many more miles upstream. Craven County is developing a park approximately 5.5 miles upstream from the mouth. Boat access will be limited to canoes, kayaks or other small boats. This enhances the opportunity for a high quality non-motorized recreation experience. All sections have public access, either at bridge crossings, developments open to the public, and the National Forest boat ramp.

Brice Creek fishery can be characterized as bass, brim, pickerel with some catfish. Sport fishing is popular for a variety of species including large mouth bass, redfin pickerel, chain pickerel, catfish, long nose gar and crappy. The creek is of statewide importance for fishing. During fishing tournaments on the Neuse anglers are regularly attracted up Brice because of the outstanding habitat.

Brice Creek has regional and national archeological and cultural significance. It includes 17 known archeological sites that are potentially eligible for the National Register of Historic Places. Most of the known prehistoric sites are from the Woodland Period and could be as much as 3,000 years old. Included in historic sites is a cemetery and homesite. Battles of New Bern were decisive in the Civil War. Many took place between N.Cape Fear River and Pamlico River. Within the river corridor are Civil War fortifications associated with the Civil War activities in New Bern.

Need for Legal Protection Afforded by Designation. A primary objective of the Wild and Scenic Rivers Act is to preserve the free-flowing condition of certain selected rivers of the Nation. The Act prohibits water resources projects (dam, water conduit, reservoir, powerhouse, transmission line, etc) that would have a direct and adverse affect on a river's free-flowing condition or on the values for which such river was designated.

Nearly all estuarine rivers in NC and SC coastal plain have been improved for navigation or have been dredged, channeled or dammed. This has not occurred on Brice Creek.

Historical and cultural sites and artifacts and threatened and endangered species are protected by law. Legal protection afforded by wild and scenic river designation is not necessary for perpetuation of these resources, but could enhance it.

Forest Plan objectives are to perpetuate riparian areas, floodplains, wetlands and their ecosystems in their natural condition. However, the Forest Plan does not provide legal protection from water resources projects proposed under the Federal Power Act that could alter the free-flowing condition of streams.

National Forest Lands - Uses and Values Enhanced, Foreclosed or Curtailed by Designation. The following discusses the uses and values that would be enhanced, foreclosed, curtailed or not changed by designation on national forest lands within the study corridor. These changes are based on the potential scenic and recreational classifications.

Enhanced. The specialty of designation may enhance the recreation experience for some visitors. The permanence afforded by legal designation is desirable to many people. Although the outstandingly remarkable scenic, recreational, botanical, fishery, historical and cultural values are currently protected by the Forest Plan and federal law where applicable, designation provides a sense of permanent and consistent direction for these resources.

Foreclosed. Designation prohibits any new water resources projects that would adversely affect the free-flowing condition of the river or the values for which the river was designated.

Curtailed. The amount of timber production within the river corridor may be reduced and new utilities would be discouraged. New mining leases or claims may be curtailed to protect river resources, however the area has no active mineral operations and low potential for commercially significant mineral deposits.

No Change. The type of recreation activities permitted and wildlife habitat management activities within the river corridor would remain essentially the same under designation or nondesignation. TES species are protected by the Forest Plan and federal law for federally listed species. Historical and archeological sites are protected by law and the Forest Plan.

Private Lands - Uses and Values Enhanced, Foreclosed or Curtailed by Designation The following discusses the uses and values that would be enhanced, foreclosed, curtailed or not changed by designation on privately owned lands within the study corridor. The effects are based on the potential scenic and recreational classifications.

Enhanced. The notoriety of designation and some measure of protection from future incompatible land uses and development could have a positive impact on property values and marketability.

Foreclosed. Major water resources projects, such as dams and reservoirs, would be prohibited, same as for public lands. Development of new small water resources projects, such as diversions for farm pond water supply, that are subject to federal regulations or assistance (such as Corps of Engineers dredge and fill permits) could be modified or prohibited. Determination would be on a case-by-case basis.

Curtailed. Any local government or state land use ordinances enacted to protect river values could limit the type or amount of land uses and developments allowed. Otherwise current land uses would prevail. The Wild and Scenic Rivers Act limits the amount of land within the river corridor that could be purchased by the federal government for river protection to an average of 100 acres per mile (Sec.6.(a)(1)).

No change. The ability to buy and sell property is not affected by designation. Property owners retain control of their property. Designation does not open private lands to public access. Landowners can continue to post their property. Ongoing regular uses of private lands, including agriculture, forestry and residential use, would continue. The Act has no intent to remove use, development or inhabitants from the river corridor.

State and Local Government and Public Interest. Public scoping indicated strong support for designation if the State of North Carolina leads the study of suitability. Adjacent landowners, elected officials, and other participants would help determine the classifications.

Cost to Administer Designated River. The estimated cost to prepare the river management plan, including the legal boundary description, is $30,000. Current average annual cost to administer the Brice Creek corridor on national forest lands, excluding one-time resource management projects, is $6,000. Costs to administer the river on national forest lands would remain

essentially the same as current management, unless recreation use were to increase significantly as a result of designation. The estimated cost for adequate staffing to administer increased recreation use is $9,500. The initial cost for signing the river corridor is estimated at $10,000. Annual administrative costs would need to include funds for sign repair and replacement. If further study of the recreational section continues, the administrative cost of working with state and local governments and private landowners to develop land use guidelines for privately owned lands along the rivers would be approximately $3,000 to $5,000 annually for the first 5 years. After that time costs are expected to be minimal. State and local governments would be responsible for administering any land use ordinances for private lands.

Private Land. Approximately 65% of the land within the study corridor is privately owned. Much of the river corridor is largely undeveloped because of wetlands. On the high grounds, forestland is the predominant use interspersed with agriculture. Some clusters of medium-density residential housing occur in the scenic segment, one off state road 1116 and the other where Unnamed road crosses Brice Creek. Current uses are compatible with the potential wild, scenic, and recreation classifications.

D.2: WHITE OAK RIVER SYSTEM

D.2.1. PURPOSE FOR STUDY

The purpose of this Wild and Scenic River Study Report is to document the results of the analysis conducted to determine eligibility of the While Oak River as a potential component of the National Wild and Scenic Rivers System. Since more than 80% of the river corridor is privately owned, further study is recommended for the suitability determination in cooperation with the State of North Carolina, who would lead the effort.

The Nationwide River Inventory developed by the National Park Service, U.S. Department of Interior (January 1982) identified the While Oak River as a potential wild and scenic study river.

The 1986 Final Environmental Impact Statement (FEIS) for the Land and Resource Management Plan for the Croatan and Uwharrie National Forests determined White Oak River to be eligible for designation. The river was determined to be potentially suitable for designation pending further study. This document also includes the eligibility and potential classification analysis from the Forest Plan.

A challenge of the analysis of eligibility for wild and scenic rivers in the FEIS (Appendix H) of the Forest Plan brought about further study. A new determination of eligibility and potential suitability was completed and documented in Appendix B of the Environmental Assessment for Interim Protection of Rivers Eligible for Wild and Scenic River Study, Croatan and Uwharrie National Forests; which also updates information in the FEIS, Appendix H.

The White Oak River has been evaluated in a manner that is consistent with the U.S. Department of Interior and U.S Department of Agriculture jointly issued *Final Revised Guidelines For Eligibility, Classification, and Management of River Areas*. (See 47 Federal Register 34457, September 7, 1982.)

D.2.2. Summary Of Findings

White Oak River is eligible for designation based on its free-flowing condition and outstandingly remarkable scenic, botanical, wildlife, historical and cultural values. Since more than 80% of the river corridor is privately owned, further study is recommended for the suitability determination in cooperation with the State of North Carolina.

D.2.3. Location And Description Of Study Area

White Oak begins at the confluence of North Prong and South Prong in the headwaters on the Croatan National Forest and flows 39.5 miles southeast to its confluence with the Atlantic Ocean, (river mile 0). The river is the boundary between Onslow County on the west, and Jones and Cartaret on the east.

The lower 27.1 miles of the White Oak is the Proclamation Boundary for the Croatan National Forest, while the upper 12.4 miles is outside the National Forest Proclamation Boundary.

The study corridor includes the area extending the length of the designated segments of this river (39.5 miles) and 1/4 mile in width from each bank of the river. It totals 12,640 acres.

Refer to Chapter 3, Affected Environment, of the accompanying Final Environmental Impact Statement for a description of the resources within the study corridor.

D.2.4. Findings Of Eligibility

To be eligible for designation as a component of the National Wild and Scenic Rivers System, a river must be free-flowing and possess one or more of the following as outstandingly remarkable values: (1) scenic, (2) recreational, (3) geological, (4) fish and wildlife, (5) historic and cultural, or (6) other values, including ecological.

The Wild and Scenic Rivers Act defines "free-flowing" as existing or flowing in a natural condition without impoundment, diversion, straightening, rip-rapping, or other modification of the waterway. The existence of low dams, diversion works, or other minor structures at the time a river is proposed for inclusion in the national rivers system does not automatically disqualify it for designation. A river segment flowing between large impoundments may qualify for designation if conditions within the segment meet the eligibility criteria.

There are no specific requirements concerning the length or flow of an eligible river segment. The length or flow are sufficient if they sustain or complement the outstandingly remarkable values for which the river would be designated to protect.

Description Of Values For The White Oak River

Scenic: The section of river from Belgrade to Stella includes four distinct ecotypes: saltwater marsh, cypress swamp, mesic hardwood forest and pond pine forest. The river changes from a fast-flowing, narrow, meandering, piedmont creek within an upland hardwood forest to a broad,

sluggish, coastal blackwater river lined with tidal cordgrass marsh. Each ecotype has a significant diversity of plant families and the concentration of plant diversity within the relatively small area of the river is regionally unique (Krochmal, 1976). The forest cover includes large growth oaks and cedars. A Class A - Distinctive rating is assigned to the scenic values.

Recreational: Current recreational use includes fishing, hunting, picnicking, camping, canoeing and motorboating (small boats used for fishing). Developed recreation sites include a National Forest boat ramp and picnic area at Haywood Landing, a user developed picnic and camping area at Long Point (both of these are ROS class semi-primitive motorized), and a campground and tideland trail at Cedar Point (ROS class rural). A Class B - Common rating is assigned to the recreational values.

Geologic: The river provides no exposure to the coastal group of formations. The stream bank and surrounding corridor are almost entirely vegetated. A Class C - Minimal rating is assigned to the geological value.

Fish and Wildlife: The river is an important habitat for the American alligator and a number of wading birds and waterfowl. It also provides habitat for seven threatened or endangered wildlife species listed on federal or state registers. The waters support sport fishing and commercial shellfishing. A Class A - Distinctive rating is assigned to the fish and wildlife value.

Historic and Cultural: The White Oak River corridor has a high probability for historical and archeological sites. There are seventy known sites, thirty-six of which may qualify for listing on the National Register of Historic Places. A number of these sites are located in or along the riverbed. A Class A - Distinctive rating is assigned to the historical and cultural values. The White Oak River corridor is one of twelve Heritage Resource zones on the CNF where archeological resources are unusually numerous and important to the regional prehistory and history of North Carolina. Management of these resources includes interpretation and restricted timber management.

Criteria For Outstandingly Remarkable Values

Dictionary definitions of "outstandingly remarkable" indicate that such a value would be one that is a conspicuous example of a value from among a number of similar values that are themselves uncommon. Based on these definitions, a comparison system for evaluating stream values was developed on the premise that all streams have some value, but when compared to each other, some stream values will be more outstanding. Using the "scenic attractiveness" concept for describing physical features from the Forest Service Scenery Management System, the following three categories were developed for comparing values:

- Class A - Distinctive which refers to those rivers/streams whose features and values are of unusual or outstanding quality when compared to others in the North Carolina coastal area.
- Class B - Common which refers to those rivers/streams whose features and values are common to most streams in the North Carolina coastal region.

- Class C - Undistinguished which refers to those rivers/streams with few features and values.

A value must meet the criteria for the Class A - Distinctive category to be considered outstandingly remarkable. Only one value is needed for eligibility. The following criteria were developed for the three categories for each of the values listed in the Wild and Scenic Rivers Act, Sections 1(b) and 2(b).

Scenic
Class A - Distinctive. The landform is complex with unusual or outstanding topographic features. Rock features, when present, stand out on the landform and are unusual or outstanding in size, color, or location. Forest cover is continuous or broken with a high degree of patterns and an unusual or outstanding diversity in plant species; large or old-growth timber may be present. The streambed varies in width from medium to large. The stream volume ranges from medium to high with a variety of flow characteristics.
Class B - Common. The terrain has some variety, but landform features are typical of the coastal region. Rock features, when present, are obvious, but do not stand out and have no unusual or outstanding characteristics. Forest cover is continuous with some variety in vegetative patterns and a common diversity in plant species. The stream volume ranges from medium to low with some variety in flow characteristics.
Class C - Minimal. The terrain has little variety in slope, dissection or features; rock features are generally lacking. Forest cover is continuous with little diversity in the number or pattern of plant species. The stream is generally small with low volume and little or no variety in flow characteristics.

Recreational
Class A - Distinctive. The river provides opportunities for water-oriented activities and recreation experiences which are unique to that stream or a limited number of streams or which can occur only because of the character of the stream. The river contains a high quality sport fishing experience.
Class B - Common. The river provides opportunities for water-oriented activities typical of most coastal streams including fishing, swimming, boating (motorized and non-motorized), and waterfowl hunting.
Class C - Minimal. Stream size, flow or other characteristics limit opportunities or attractiveness for water-oriented recreation activities.

Geologic
Class A - Distinctive. The river corridor clearly displays significant or unusual geomorphic or structural features. It also includes those rivers clearly exposing geologic formations which are visible in few or no other sites. The amount of exposed rock is significant which provides excellent opportunities for geologic study.
Class B - Common. The geomorphic features and formations are typical of those commonly found in the Coastal Plain. There is some opportunity for geologic study.
Class C - Minimal. The river provides few or no exposed rock formations and no significant geologic features.

Fish And Wildlife
Class A - Distinctive. Resident fish and wildlife populations, including known populations of proposed endangered, threatened and sensitive species (PETS), occur only because of the quality and character of the stream or riparian area.
Class B - Common. Resident fish and wildlife populations are common to most coastal streams.
Class C - Minimal. Stream characteristics limit the number and type of species present. Populations of game fish species are largely absent. The fish community may be dominated by more pollution tolerant species. The total number of fish species is less than in comparable, higher quality streams.

Historical And Cultural
Class A - Distinctive. The river corridor has a high probability for prehistoric sites. It contains Class I prehistoric or historic sites, which are listed in the National Register of Historic Places, or known Class II sites, which are eligible for listing on the National Register but require further study, or known sites that may not be unique in character or content, but are in a unique state of preservation. In addition, these sites are located in or along the riverbed or are integrally associated with the river.
Class B - Common. The river corridor has a moderate probability for archeological sites. Known sites are similar to other known sites and contain limited information; some sites may have been disturbed prior to scientific investigation. Some sites may meet the criteria for listing or are listed in the National Register of Historic Places, but are not located in or along the riverbed and are not integrally associated with the river.
Class C - Minimal. The river corridor has a low probability for archeological sites. Known sites do not meet the criteria for listing in the National Register of Historic Places and are not integrally associated with the river.

Findings Of Eligibility

The White Oak River is eligible for designation under the Wild and Scenic Rivers Act because it is free-flowing and has been determined to have outstandingly remarkable scenic, botanical, wildlife, historical and cultural values.

D.2.5. POTENTIAL CLASSIFICATION

If a river has been determined to be eligible for designation, the next step is to determine the potential classification that would result from designation. There are three classifications of rivers, or river segments, in the National Wild and Scenic Rivers System--wild, scenic, and recreational. Classification is based on the condition of the river and the adjacent lands at the time of the study. The following criteria for determining classification is from the revised guidelines.

Wild River. The river should be free of impoundments. The shoreline should be essentially primitive with little or no evidence of human activity; however, the presence of a few inconspicuous structures is acceptable. There should be little or no evidence of past timber harvest and no ongoing timber harvest. The river area should be generally inaccessible except by trail. There should be no roads, railroads or other provision for vehicular travel; however, a few existing roads leading to the boundary of the river area are acceptable. Water quality meets or

exceeds criteria of federally approved State standards for aesthetics, propagation of fish and wildlife normally adapted to the river, and primary contact recreation.

Scenic River. The river should be free of impoundments. The shoreline should be largely primitive and undeveloped with no substantial evidence of human activity; however, the presence of small communities, dispersed dwellings or farm structures is acceptable. Evidence of past or ongoing timber harvest is acceptable if the forest appears natural from the river bank. The river area may be accessible in places by roads and roads may occasionally reach or bridge the river. The existence of short stretches of conspicuous or longer stretches of inconspicuous roads or railroads is acceptable. No criteria for water quality is prescribed in the Act. Poor water quality does not preclude classification provided a water quality improvement plan exists or is being developed.

Recreational River. The river may have some development with substantial evidence of human activity. The presence of extensive residential developments and a few commercial structures is acceptable. Lands may have been developed for a full range of agricultural or forestry uses and may show evidence of past or ongoing timber harvest. The river area may be readily accessible by roads or railroads. The existence of parallel roads or railroads on one or both banks and bridge crossings is acceptable. No criteria for water quality is prescribed in the Act. Poor water quality does not preclude classification provided a water quality improvement plan exists or is being developed.

Classification to carry forward to Suitability Analysis

During the Forest Plan Revision process eligibility of all four segments of the White Oak River was reviewed. All segments are recommended for further study of suitability.

D.2.6. FURTHER STUDY OF SUITABILITY

Less than 20 percent of the river corridor is in Federal Ownership. Since most of the river corridor is privately owned, the State of NC assumes the lead on suitability determinations and recommendations for river corridors eligible for wild and scenic river status.

Characteristics Worthy of Addition to the National Rivers System

White Oak River is typical of the blackwater Coastal Rivers that drain swampy or marshy areas of the lower Coastal Plain in North Carolina. However these types of rivers are an infrequent resource in North Carolina. Of these, White Oak River is one of the best and in relatively undisturbed condition. The headwaters are largely rural yet, have had accelerated agricultural development. This growth is less than some adjacent basins, and plans call for rigid waste treatment. Strict waste treatment when combined with the high percent of public ownership on the White Oak could lead to improved water quality over time. Therefore there is less potential for future pollution events and water quality and associated fisheries habitat is higher than the other rivers. Riparian area is less disturbed so the ecosystem is more intact and sustainable.

Currently there are no representatives of Southern Coastal Plain blackwater streams in the national wild and scenic rivers system. This is a unique ecosystem that warrants inclusion in the system.

White Oak River offers a regionally unique, wide variety of plant life in a setting rarely available for public observation. To date six natural community types or variants have been identified as occurring within the site. One of particular interest is the Tidal Freshwater Marsh Freshwater Variant, a species rich community that is rare in southeastern North Carolina. This concentration of plant diversity within a relatively small area is unique. The river is very scenic because of this diversity. Other scenic attributes are the large old growth cedars and hardwoods along some stretches.

Opportunities for canoeing coastal blackwater streams is limited because of stream size (too small, clogged with vegetation or too large with a lot of large motorized boat traffic), length (too short), too much shoreline development to provide a quality recreation experience, or limited public access. A significant length of the White Oak is canoeable even at the headwaters and results in 23.7 miles, from the first bridge crossing in headwaters down to Stella. Below Stella is not desirable because of width of stream and motorized boat traffic. The river above powerline near Black Swamp Creek is not suitable for motorized boats, so a high quality non-motorized recreational experience is provided. All sections have public access, either at bridge crossings, commercial developments open to the public (campground at Maysville, quarry ponds at Maysville), and National Forest boat ramps at Haywood Landing and Long Point. The river is currently maintained by NCWRC to maintain canoe access. The section from the bridge at Maysville to Haywood Boat Landing (9.9 miles) is most popular.

The White Oak river corridor has state, regional, and national archeological significance. The river corridor contains some of the best preserved bluff-type sites, both on and off national forest lands, in the lower North Carolina coastal plain. Similar sites on private lands and along other rivers have been disturbed by development. The area is well suited to continued archeological research and public interpretation.

The White Oak is one of the more important prehistoric and historic travel routes to the North Carolina interior. Prehistoric and early historic settlement used the rivers as highways. Rivers also served as cultural barriers. People traveled up and down the rivers, but seldom across. Through time, different prehistoric populations inhabited the area, with the White Oak Serving as a cultural barrier. Similarly, the White Oak was the boundary between the Union occupation and the Confederate forces during the American Civil War.

Need for Legal Protection Afforded by Designation. A primary objective of the Wild and Scenic Rivers Act is to preserve the free-flowing condition of certain selected rivers of the Nation. The Act prohibits water resources projects (dam, water conduit, reservoir, powerhouse, transmission line, etc) that would have a direct and adverse affect on a river's free-flowing condition or on the values for which such river was designated.

Nearly all estuarine rivers in NC and SC coastal plain have been improved for navigation or have been dredged, channeled or dammed. This has not occurred on the White Oak. Although there are no current proposals, the potential is always present considering other estuarine rivers.

Historical and cultural sites and artifacts and threatened and endangered species are protected by law. Legal protection afforded by wild and scenic river designation is not necessary for perpetuation of these resources, but could enhance it.

Forest Plan objectives are to perpetuate riparian areas, floodplains, wetlands and their ecosystems in their natural condition. However, the Forest Plan does not provide legal protection from water resources projects proposed under the Federal Power Act that could alter the free-flowing condition of streams.

National Forest Lands - Uses and Values Enhanced, Foreclosed or Curtailed by Designation. The following discusses the uses and values that would be enhanced, foreclosed, curtailed or not changed by designation on national forest lands within the study corridor. These changes are based on the potential scenic and recreational classifications.

Enhanced. The speciality of designation may enhance the recreation experience for some visitors. The permanence afforded by legal designation is desirable to many people. Although the outstandingly remarkable scenic, recreational, botanical, fishery, historical and cultural values are currently protected by the Forest Plan and federal law where applicable, designation provides a sense of permanent and consistent direction for these resources.

Foreclosed. Designation prohibits any new water resources projects that would adversely affect the free-flowing condition of the river or the values for which the river was designated.

Curtailed. The amount of timber production within the river corridor may be reduced and new utilities would be discouraged. New mining leases or claims may be curtailed to protect river resources, however the area has no active mineral operations and low potential for commercially significant mineral deposits.

No Change. The type of recreation activities permitted and wildlife habitat management activities within the river corridor would remain essentially the same under designation or nondesignation. PETS species are protected by the Forest Plan and federal law for federally listed species. Historical and archeological sites are protected by law and the Forest Plan.

Private Lands - Uses and Values Enhanced, Foreclosed or Curtailed by Designation. The following discusses the uses and values that would be enhanced, foreclosed, curtailed or not changed by designation on privately owned lands within the study corridor. The affects are based on the potential scenic and recreational classifications.

Enhanced. The notoriety of designation and some measure of protection from future incompatible land uses and development could have a positive impact on property values and marketability.
Foreclosed. Major water resources projects, such as dams and reservoirs, would be prohibited, same as for public lands. Development of new small water resources projects, such as diversions for farm pond water supply, that are subject to federal regulations or assistance (such as Corps of Engineers dredge and fill permits) could be modified or prohibited. Determination would be on a case-by-case basis.

Curtailed. Any local government or state land use ordinances enacted to protect river values could limit the type or amount of land uses and developments allowed. Otherwise current land uses would prevail. The Wild and Scenic Rivers Act limits the amount of land within the river corridor that could be purchased by the federal government for river protection to an average of 100 acres per mile (Sec.6.(a)(1)).

No change. The ability to buy and sell property is not affected by designation. Property owners retain control of their property. Designation does not open private lands to public access. Landowners can continue to post their property. Ongoing regular uses of private lands, including agriculture, forestry and residential use, would continue. The Act has no intent to remove use, development or inhabitants from the river corridor.

State and Local Government and Public Interest. White Oak River is listed by the State of North Carolina for possible inclusion as a State Natural and Scenic River (based on most current listing from 1975). Public scoping has indicated strong support for designation.

Cost to Administer Designated River. The estimated cost to prepare the river management plan, including the legal boundary description, is $30,000. Current average annual cost to administer the White Oak River corridor on national forest lands, excluding one-time resource management projects, is $4,500. Costs to administer the river on national forest lands would remain essentially the same as current management, unless recreation use were to increase significantly as a result of designation. The estimated cost for adequate staffing to administer increased recreation use is $3,900. The initial cost for signing the river corridor is estimated at $10,000. Annual administrative costs would need to include funds for sign repair and replacement. The administrative cost of working with state and local governments and private landowners to develop land use guidelines for privately owned lands along the rivers would be approximately $3,000 to $5,000 annually for the first 5 years. After that time costs are expected to be minimal. State and local governments would be responsible for administering any land use ordinances for private lands.

Private Land. Approximately 86% of the land within the study corridor is privately owned. Much of the river corridor is largely undeveloped because of wetlands. On the high grounds, agriculture is the predominant use interspersed with forestland. Some clusters of low-density residential areas occur below Stella. The most noticeable modification to the stream corridor is from the quarry around Maysville. The quarry has been in operation since 1939 and meets all State requirements. It does not affect water quality. A segment of the river flows through four old quarry ponds, which have revegetated to the point that they are near-natural in appearance. Neither the ponds, nor quarry bridges, affect the free flow of the river or impede canoeing traffic. Current uses are compatible with the potential scenic and recreation classifications. Stewardship by landowners along the river has been very good to date. There is concern that the current shift to hog farming on agricultural lands could pose a future threat to river water quality.

FINDINGS OF SUITABILITY

White Oak River is determined to be suitable for designation as a national wild and scenic river. The length of river in free-flowing condition (27.9 miles) and the characteristics of the river

environment are worthy of addition to the national system. White Oak River would be a sustainable high quality example of Southern coastal blackwater streams, which are currently not represented in the national rivers system. Legal protection afforded by designation is desirable to reinforce the need to maintain the river's water quality. Current land uses and management on national forest and private lands are compatible with potential river classifications, so uses foreclosed or curtailed would be minor. There is demonstrated public support for designation. Increases in administrative costs should not be significant unless recreation use dramatically increases as a result of designation.

FEIS APPENDIX E: BIOLOGICAL ASSESSMENT

For Federally Proposed, Threatened, And Endangered Species

E.1. Introduction

This programmatic Biological Assessment (BA) evaluates the effects of implementing management activities proposed in the Croatan National Forest (CNF) revised Land and Resource Management Plan (LRMP). The planning area lies in the eastern portion of North Carolina within the Atlantic Coastal Plain and includes all lands within the CNF proclaimed boundary that are currently administered or managed by the National Forests in North Carolina (NFsNC). This area is approximately 161,000 acres in size and contains portions of 3 counties: Carteret, Jones, and Craven.

Project-specific analysis will be conducted at the time of a project proposal to determine site-specific effects. The purpose of this analysis is to assess potential effects on federally designated threatened or endangered species that occur or could occur within the CNF. Effects to U.S. Forest Service (USFS) sensitive and locally rare species are included in the Biological Evaluation, a separate document.

This BA was prepared in accordance with USFS manual 2671.44 and 2672.42 and regulations set forth in Section 7(a)(2) of the Endangered Species Act. Determinations of effects by species are made based on best available information. As significant new information becomes available through inventory, monitoring and research, a revision of this assessment will be done through consultation with the USDI Fish and Wildlife Service (Service) as appropriate.

E.2 Consultation History

Croatan and Uwharrie Land and Resource Management Plan 1986-2000. The Service reviewed the proposed LRMP and Final Environmental Impact Statement in August 1985. The Service was primarily concerned with the following: 1) proposal to drain 5,370 acres of land on the CNF, 2) lack of population data presented for RCW, 3) too much attention given to production of early successional species by increasing timber harvesting and site conversion, and 4) lack of natural areas designation for pocosins.

Newport Triangle Land Exchange, CNF. In 1996, a land exchange was approved, after consultation with the Service, which exchanged a site on the CNF that was difficult to manage due to proximity of roads and residential areas. One rough-leaved loosestrife (*Lysimachia asperulifolia*) population was on the USFS tract to be exchanged. The CNF received ecologically similar land with fewer rough-leaved loosestrife plants but a significantly greater amount of suitable habitat in pocosin-savanna ecotones.

Draft Environmental Impact Statement for the Revised Land and Resource Management Plan, CNF. In March 2000, the Service concurred with the USFS that implementing the proposed LRMP "is not likely to adversely affect the bald eagle (*Haliaeetus leucocephalus*), American alligator (*Alligator mississippensis*), and rough-leaved loosestrife" and "will have no effect on the red wolf (*Canis rufus*), eastern cougar (*Puma concolor couguar*), and sensitive jointvetch

(*Aeschynomene virginica*)". The Service did not concur with the determination that the proposed action is not likely to adversely affect the Red-cockaded woodpecker (*Picoides borealis*) (RCW). The Service requested that the USFS address the proposed reduction of forage requirements from 8,400 to 6,000 sq. ft. basal area and from 6,350 to 4,000 pine stems on sites having severe soil limitations and the proposed deviation to close all unauthorized roads in nest areas. They stated that "only with additional information describing the potential affects these modifications might have on the species could the Service attempt to concur with the determination that the proposed project is not likely to adversely impact the RCW". This led the USFS to drop the request for reducing RCW forage standards. The final LRMP includes all RCW standards from the 1995 RCW DEIS (USFS 1995). However, to reduce potential impacts to RCW nest trees, the LRMP still sets a goal of closing all unauthorized roads in RCW nest areas.

Multi-agency field review of longleaf pine (Pinus palustris) restoration methods in RCW habitat. In September 2000, Ralph Costa from the Service participated in a field review on the CNF and Camp Lejeune to discuss longleaf pine restoration methods. Other participants included the North Carolina Wildlife Commission, North Carolina Natural Heritage Program, Camp Lejeune wildlife and timber staff, botanical consultants from the Coastal Plain, USFS researches from Clemson, and USFS staff from the NFsNC. Primary longleaf pine restoration issues discussed were the use of a shelterwood with reserve trees technique to retain RCW forage and nesting structure and less intensive site preparation methods following clearcutting that would retain native understory plant composition.

Forest-wide Prescribed Burning Program, CNF. In December 2001, the Service concurred with the USFS that implementing a forest-wide prescribed burning program on the CNF "is not likely to adversely affect rough-leaved loosestrife, red wolf, bald eagle, or American alligator". The Service also concurred with the USFS that the prescribed burning program would have "no effect on the sensitive joint vetch and eastern cougar". The Service did not concur with the "not likely to adversely affect" determination for the RCW because "surveys for this species had not yet been conducted in pond pine (*Pinus serotina*) pocosin habitat on the CNF". The Service stated that 'emerging information and knowledge regarding RCW occupancy of pond pine forests indicates this habitat must be considered as an issue in RCW management" and that "presently, aerial surveying by helicopter is the only practical technique for locating RCW cavity trees in pond pine pocosin habitat". In February 2001, the Service reviewed additional information provided by the USFS on RCW habitat preference on the CNF, results of 12 years of RCW inventory and monitoring which included RCW population and dispersion trends from 1988 to the present, detailed maps of the proposed prescribed burn units in pond pine ecosystems, and records of unbanded bird locations since 1998. Following this review, the Service concurred with the USFS that implementing a forest-wide prescribed burning program on the CNF is not likely to adversely affect the RCW.

Albert Toon Land Exchange. In July 2001 John Hammond, from the Service, met on a USFS tract proposed for exchange with Mr. Albert Toon and USFS representatives Lauren Hillman, Dennis Foster, and Steve Simon. The meeting was held to discuss ways of reducing the impact of foraging habitat loss that could potentially occur if the land exchange was implemented. It was concluded that retaining blocks of reserved forest in an open park-like condition within the USFS exchanged tract would be an appropriate method of maintaining some habitat suitable for

the RCW. As part of the consultation process, the USFS is completing a BA for review by the Service that includes a requirement to retain blocks of reserved forest.

E.3. Proposed Action

Implementation of the LRMP is the proposed action. The LRMP represents alternative E, the preferred alternative. Alternative E includes the following major actions:

- Recover and sustain a viable RCW population through establishment of a RCW HMA approximately 69,000 acres in size and by following all standards and guidelines in the RCW FEIS (USFS 1995) and Service Recovery Plans (Service 1985, 2000). Habitat management within the HMA will focus on restoring longleaf pine on appropriate soils, and prescribed burning to reduce and control midstory hardwoods and to promote maintenance of a native grass/forb understory. Mechanical control of midstory hardwoods may be allowed to facilitate restoration efforts. Specific goals are to meet a long-term RCW population objective of 151-169 clusters; establish 20-26 new clusters over the next 10 years and 50 to 63 clusters during the next 30 years.

- Restore longleaf pine on appropriate soils on approximately 2,650 to 3,600 acres across the CNF. Longleaf restoration efforts will focus on maintaining some overstory structure by using a shelterwood with reserve trees method to gradually convert existing mature loblolly pine (*Pinus taeda*) to longleaf pine stands. Use thinning, burning, and natural and artificial regeneration to convert off-site pine plantations to longleaf pine. Clearcutting will be retained as an option on 500-750 acres that have a low probability of success using the shelterwood with reserve trees method. Thinning will be used on 1,800-2,100 acres of existing pine plantations to maintain stocking levels suitable for RCW.

- Register 5,800 acres of new natural areas identified by the North Carolina Natural Heritage Program and include in a landscape design with the existing 43,000 acres of natural areas, with the RCW HMA, longleaf pine old growth management areas, wilderness, and other ecosystem-based prescriptions. Manage this landscape, which represents the range of ecological conditions on the CNF, as a core conservation area to recover and sustain viable populations of rare species through protection and active management designed to restore suitable habitat conditions for a large variety of species. Retain across the CNF in old-growth condition, at least one-third of all Southern Wet Pine Forests, Woodlands, and Savannas, Cypress-Tupelo Swamp, and Upland Mesic Hardwoods. Other resource management activities, including timber harvest and recreational use, will be concentrated away from these and other sensitive habitats that currently support or could support threatened and endangered species.
- Use site-specific analyses, biological evaluations, and consultation with the Service to insure that management actions that occur in the core conservation area and in all other areas on the CNF do not jeopardize the continued existence of any threatened or endangered species.

Use prescribed fire on:

- a 5-12 year rotation in 25,000 acres of pocosin ecological types within previously burned fire compartments; as research results become available, expand the use of fire in an

additional 48,000 acres of pocosin. No new fire plowlines will be allowed along savanna-pocosin ecotones.

- a 3-5 year rotation in 22,500 acres of mixed pine and pond pine woodland ecological types in previously burned fire compartments; as wildfire risks are reduced in adjacent stands, expand the use of fire in an additional 19,000 acres of mixed pine and pond pine.
- a 2-4 year rotation in 21,000 in longleaf pine ecological types in previously burned fire compartments; expand the prescribed burning program to include an additional 5,500 acres of longleaf pine. No new fire plowlines will be allowed along savanna-pocosin ecotones. Increase recreational opportunities primarily in or surrounding existing sites. Site-specific project analysis will be required before implementation of recreational projects.

Allow pine straw raking on a limited basis (600 acres) but prohibit near rare species element occurrences, in wet savannas and flatwoods (ecological types 0920 and 0921), natural areas, old growth patches, and within ¼ mile of active RCW nest areas. Close at least 15 to 20 miles of system roads and phase out all unauthorized access to forest resources through road closures and directing OHV use to only one designated OHV area outside the RCW HMA. Closed roads may be designated as hiking, biking, or horse trails. Adjust land ownership to consolidate national forest holdings, to protect natural resources including rare species habitat and riparian ecosystems, and to enhance or promote recreation management. Site-specific project analysis will be required before land adjustments can occur. Color band all RCW nestlings and adult birds, conduct nest checks at 7-11 day intervals and conduct fledgling and adult checks to determine number and sex of birds. Set yearly goals to survey habitats that have not been traditionally considered suitable RCW habitats. Continue annual monitoring of Rough-leaved Loosestrife populations, Bald Eagle nest sites, and continue to coordinate with North Carolina Wildlife Commission to monitor black bear (*Urses americanus*) on the CNF. Monitor density and cover of wiregrass (*Aristida stricta*) to evaluate the effectiveness of management practices to maintain pine savanna ecosystem composition and structure.

E.4. Species Considered And Species Evaluated

Four federally endangered species and three threatened species either occur now or could potentially occur in the future within the administrative boundaries of the CNF (Table E.1). The CNF shares, with Camp Lejeune and Holly Shelter Wildlife Refuge, one of the 12 RCW recovery populations designated by the Service.

Table E.1. Occurrence and Status of Federally Listed Proposed, Threatened, or Endangered Species that occur or could occur on the Croatan National Forest (U.S. Fish and Wildlife Service, 2001).

Common Name (Scientific Name)	Status Lifetype	Brief Description of Habitat Requirements	CNF Occurrence
Red-cockaded Woodpecker (*Picoides borealis*)	Endangered Bird	Open pine savannas	Known to occur
Rough-leaved Loosestrife (*Lysimachia asperulifolia*)	Endangered Perennial Plant	Pine Savanna/Pocosin Ecotone	Known to occur
Eastern Cougar (*Puma concolor couguar*)	Endangered Mammal	Large tracts of undisturbed habitat	May Occur
Red Wolf (*Canis rufus*)	Endangered Mammal	Large tracts of habitat with heavy vegetation	Extirpated
American Alligator (*Alligator mississippensis*)	Threatened[1] Reptile	Permanent water	Known to occur
Bald Eagle (*Haliaeetus leucocephalus*)	Threatened[2] Bird	Large trees near permanent water	Known to occur
Sensitive Jointvetch (*Aeschynomene virginica*)	Threatened Plant	Tidal rivers and tributaries	May Occur

[1] Status is T(S/A), endangered due to similarity in appearance to another species and is not subject to the Service's Section 7 consultation. [2] Species is proposed for delisting.
Of the seven listed species evaluated for potential management impacts, four presently occur on the CNF and all of these are permanent residents. The disclosure of effects for those species without documented occurrences on the CNF will be related to the effects of LRMP implementation on their potential habitats rather than to populations.

E.5. Evaluated Species Survey Information

The Nature Conservancy's Biological Conservation Database, North Carolina Natural Heritage Program Element Occurrence (EO) records, species Recovery Plans, NatureServe© (2001) web application, and scientific literature were reviewed to determine the distribution, abundance and habitat requirements of species included in the analysis. The databases include all current survey information collected by private individuals, USFS personnel, and other federal and state agencies. A geographic information system was used to examine the distribution of EOs on CNF and general vicinity.

Other survey information utilized in this report include an11-year database of RCW population monitoring, recent (2001) field reconnaissance to confirm Bald Eagle nesting reports, informal sightings of listed species by USFS personnel, and North Carolina Plant Conservation Program data from a recently established (2000) Rough-leaved Loosestrife population monitoring program.

E.6. Environmental Baseline For Species Evaluated

Landscape. The CNF is located on the Coastal Plain of North Carolina and is part of the Atlantic Coastal Flatwoods Section, Lower Terraces Subsection. The landscape is a predominately flat, weakly dissected alluvial plain consisting of marine sediments and many soils with poor drainage. The vegetation is typically needle-leaved evergreen and broad-leaved evergreen forest and shrubland. Hardwood forests account for only 20 percent of the land on the CNF and these plant communities are confined chiefly to fire-protected drainage courses in swamps and sideslopes.

Climate. In the Croatan area, climate is characterized by hot summers and cool winters with adequate moisture throughout the year (Trewartha 1954). Precipitation is high in July, August,

and September with over one third of the annual average rainfall of 55 inches falling during these months. The mean length of the freeze-free period is greater that 240 days (Nelson and Zillgit 1969) and winter temperatures are moderated by the nearby Gulf Stream.

Disturbance Regimes. Wildfire and hurricanes are the two primary large-scale natural disturbances on the CNF. Fire-dependent ecosystems occupy an estimated 86% (138,400 acres) of CNF and include longleaf pine savannas and flatwoods, pond pine forests, and pocosin. Historically, the coastal landscape experienced frequent, low intensity fires at intervals of 1 to 3 years (Frost, 1995; Frost 1996). Fire ignitions were most likely caused by lightning strikes during spring and summer. Frost (1995) estimates that probably less than 5% of the coastal landscape was completely fire-protected.

Hurricanes are responsible for extensive areas of windthrown trees. Such storms passed through the CNF approximately 20 times between 1901 and 1955 (Bradley 1972). On average in 100 years, 45 hurricanes are expected to deliver at least category I force winds and six of these hurricanes are expected to bring at least category III force winds (Hooper and McAdie 1995). Presettlement Vegetation. The frequency and severity of natural disturbances were the primary factors that shaped the type and distribution of vegetation types and conditions prior to European settlement. Frequent wildfires maintained open grass-dominated longleaf pine uplands and confined hardwood-dominated forest types to transitional hardwood slopes and more mesic to hydric bottomlands. Pocosin wetlands and pond pine forests also had an open understory maintained by fire with varying cover and density of low shrubs, tall shrubs, grasses, forbs, and cane. Hurricanes created patches of early-successional habitat across the landscape.

Periodic wildfires and cyclonic storms ensured that native plant and animal species were adapted to relatively frequent disturbance. Gaps and forest edge habitats were a natural part of the landscape. Early-successional habitats ebbed and flowed across the landscape, causing rises and falls in species diversity and abundance and affecting species distribution. While a variety of successional stages were present across the landscape, coastal forests were most likely dominated by late successional habitat conditions and species assemblages.

Changes in the Presettlement Landscape. Habitat conditions and the pattern of successional stages changed significantly after European settlement. Land clearing and conversion to farmland and settlements and extensive logging changed the forest landscape from predominately late-successional forest conditions with patches of early to mid-successional stages to predominately early to mid-successional conditions and a concurrent increase in early and mid-successional species assemblages.

In the last 150 years, most of the stands on the CNF have been logged at least once. During this time period, the absence of periodic fire caused a significant reduction in mixed pine and longleaf pine forests. Extensive logging almost eliminated mature bottomland hardwoods, bald cypress (*Taxodium distichum*) swamps, and Atlantic white cedar (*Chamaecyparis thyoides*) forest types on the CNF. Homogeneous stands of loblolly pine, as well as mixed loblolly pine-hardwood stands, became more common across the CNF compared to presettlement conditions. Even under USFS administration in the last 50 years, some longleaf pine forests on the CNF have been converted to loblolly pine. Pocosin habitats, which were once much more common

throughout the North Carolina Coastal Plain, have also been altered on the CNF but to a lesser extent. Ditching and draining, road construction, conversion to off-site pine plantations, off-road vehicle traffic, and absence of fire have modified small pocosin patches.

Present Condition. Current habitat conditions across much of the CNF again tend to favor species associated with mid to late-successional stages as found in presettlement condition. These successional stages occupy approximately 63 percent of the CNF, about 10 percent is considered late successional. Approximately 91 percent of hardwood and mixed pine-hardwood forests and 57 percent of pine forests are in mid to late-successional stages.
Prior to a recent southern pine beetle outbreak, early-successional habitats were limited in quantity and distribution across the CNF. Early-successional habitat (0-10 years) constitutes about 2.1 percent of terrestrial habitats and is not evenly distributed among habitat types. The greatest percentage of early-successional habitat is in pocosin and pond pine habitat types (81 percent). Early-successional stages constitute approximately 3.3 percent of the oak-gum-cypress habitat group, 3.9 percent of the mixed pine-hardwood group, and 10 percent in the longleaf pine group. Some early-successional habitat is provided through permanently maintained grass/forb wildlife openings, powerline rights-of-way, mowed road rights-of-way, regularly burned pond pine/pocosin wetlands, naturally occurring forest gaps, and timber regeneration areas.

Two wildfires swept through large portions of the CNF within the past 10 years and prescribed fire has been applied primarily within the RCW HMA within the past 20 years. Data on fire frequency collected for both active and inactive RCW clusters over an 11-year period can be used as an indicator of prescribed fire frequency on the CNF. Fifty six percent of the RCW clusters were burned three or more times, 34% were burned twice, and 10% were burned only once or not at all. Sites that have been burned at least three times in the past 11 years have a more open midstory and a higher diversity of herbs and grasses than those sites burned less than 3 times or not at all. The density, height, and composition of woody plants depends upon soil texture and drainage class. In general, the wetter landtypes (mixed pines, pond pine, and pocosin) have developed a nearly closed canopy of pine, a well-developed hardwood/evergreen midstories, and a dense shrub and hardwood understory in the absence of fire and in areas with a low fire frequency. Woody shrubs and hardwoods in the drier savannas have responded more slowly to an absence of fire and these sites have remained relatively open for many years. They may remain dominated by grass, however, grass/forb diversity is lower and scrub oaks will eventually increase in height and density.

Expected Future Condition. Early-successional habitat will be somewhat less abundant than current conditions because; 1) longleaf pine restoration will focus on maintaining some overstory structure, 2) there will be no new wildlife openings implemented under the new LRMP, and 3) clearcutting would be greatly reduced. Over the 10-year planning period, only 500-750 acres may be clearcut that would provide additional early-successional habitat in the short-term. Early-successional habitat would continue to be available in wildlife openings, powerline rights-of-way, agricultural fields, regularly burned pond pine-pocosin wetlands, and naturally occurring forest gaps. In addition, by increasing the extent of open pine savanna conditions, habitat suitability for early successional species would be increased. Over time, the acreage of mature longleaf pine savannas and flatwoods would increase as existing loblolly pine plantations and

mature loblolly pine and mixed-pine forests are gradually converted to longleaf pine by thinning and prescribed burning.

Prescribed burning would be applied on a greater number of acres in both dormant and growing seasons on a regular rotation creating and maintaining the open, park-like stands preferred by species native to pine savannas and flatwoods. Prescribed fire in organic pocosins and pond pine forests would cause a shift from predominantly deciduous trees and tall shrubs to varying cover and density of low shrubs, tall shrubs, grasses, forbs, and cane.

Existing hardwood-dominated forests and bottomland hardwood-cypress wetlands would be maintained and well distributed through many sections of the CNF. These habitats would be managed as not suited for timber production. These habitat types are naturally fire-protected and are used as natural fire breaks during prescribed burning.

E.7. Effects Of Proposed Management Actions On Species

The LRMP is a programmatic document that provides management direction for the next 10 years. The disclosure of effects to listed species from implementation of the LRMP relate to the proposed activities and to the measures designed to avoid the effects of these activities.
The LRMP directs the CNF to follow threatened and endangered species Recovery Plans during LRMP implementation. Recovery Plans address the effects of resource management activities and present the most effective measures of promoting listed species recovery. Management activities proposed for individual projects, such as recreational, special uses, ecosystem restoration, or any other ground disturbing projects, would undergo site-specific environmental analysis and concurrence from the Service, and must adhere to both the LRMP and to species Recovery Plans. Any proposed land ownership adjustments must also undergo site-specific analysis before they are implemented. As Recovery Plans are updated, Forest Standards and Guidelines would be amended to incorporate new mitigation.

Natural areas, old growth management areas, wilderness, and other ecosystem-based management prescriptions would provide a core-conservation area for rare species and rare communities. This coarse-filter approach to species conservation provides suitable habitat conditions in management areas not suited for timber production for about 57 percent of all sites where threatened, endangered, sensitive and locally rare species occur, and 77 percent of all sites where rare communities occur on the CNF. The remainder of rare species and rare communities occur in areas suited for timber production within the RCW HMA. Longleaf pine restoration, midstory control, and maintenance of a native grass and herb understory is the primary management emphasis in this area. The primary focus of management is to move forest composition and structure to a condition more like that found in presettlement forests in the Coastal Plain.

The following is a discussion of the potential effects of LRMP implementation for each listed species.

Red-Cockaded Woodpecker (*Picoides borealis*)

Determination of Effect. Implementation of the LRMP is "not likely to adversely affect" the RCW. Over the long term, management actions are expected to be beneficial to this species, and there is a high probability that viability on the CNF would be maintained. These conclusions are based on the current stable RCW population trend on the CNF, management activities proposed in the LRMP to maintain and enhance RCW habitat, the strength of Standards and Guidelines directed at protecting this species, and the record of CNF compliance with similar direction.

Population and Reproduction Parameters. Beginning in 1996, there was a notable decline in the total number of adult RCWs and average group size on the CNF (Table E.2). Possible reasons for a loss of adults are natural disaster, lack of suitable cavities for roosting, disease, or human-induced death. The initial decline predates the hurricanes by a year, but the hurricanes certainly contributed to continued decline in 1997. By 2001, the RCW population appeared stable. The number of active clusters and group size returned to levels prior to the decline in 1996, however, the total number of adult RCWs is still 9% below the 1996 level.

Table E.2. RCW Population parameters, 1990-2001, CNF.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Active Clusters	44	50	53	54	57	59	64	62	60	58	62	62
Potential Breeding Pairs	36	43	47	49	52	53	55	50	48	45	52	53
% Solitary Males	9.1	8.0	9.4	3.7	5.3	8.5	9.4	12.9	10.0	6.9	9.7	9.8
Avg. Group Size	2.69	2.44	2.53	2.55	2.58	2.64	2.47	2.42	2.31	2.36	2.54	2.62
# Adults	111	125	133	135	151	165	158	139	137	121	142	144

The draft RCW Recovery Plan (Service 2000) identifies some average values for various reproductive parameters that can be compared with reproductive values on CNF. On average, approximately 10% of breeding pairs do not attempt a nest and generally 30% of nest failures are followed by an attempt to renest. Typical clutches range from 2 to 4 eggs. Overall, reproduction on CNF has been within the normal range of reproductive values (Table E.3). The proportion of groups that did not attempt a nest has, for the most part, remained below 10%. Annual mean clutch size has been around 3 eggs per nest (range 2.98 – 3.48), and the mean number of young produced has been around 1.5 per group (range 1.31 – 1.83). Furthermore, partial brood reduction has primarily remained at or below the average of 40% loss.

Table E.3. RCW Reproductive parameters, 1990-2001, CNF

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Potential Breeding Pairs	36	43	47	49	52	53	55	50	48	45	52	53
% no nest	8	7	9	16	12	9	9	8	8	2	4	15
Clutch size	3.45	3.48	2.98	3.17	3.22	3.13	3.16	3.04	3.16	3.23	3.28	3.2
% fail	21	12.5	21	29	26	21	20	32.6	13.6	13.6	14	6.6
% renest	29	60	22	25	41.6	60	60	67	16.6	16.6	28.6	0
% Partial Brood loss	40	41	37	33	28	40	38	35	44	37	36	41
Brood size	1.93	2.00	1.72	2.13	2.21	1.85	1.93	1.95	1.70	2.00	2.16	1.85
Fledglings	52	72	62	64	84	76	85	74	63	78	95	79
Young/group	1.44	1.67	1.32	1.31	1.62	1.43	1.55	1.48	1.31	1.73	1.83	1.72

Direct Effects. Direct mortality can occur during growing season prescribed burning from fire destroying eggs, or killing nestlings and/or adults. Adult and nestling RCW's can also die as a result of capturing, handling, or moving birds during monitoring and translocation. Direct effects associated with improper installation of artificial cavities or cavity restrictor plates are also a possibility. These potential effects are reduced significantly because: 1) the CNF practices, and will continue to practice, all permit regulations related to handling birds, and 2) the CNF has followed, and will continue to follow, procedures that minimize incidental take that may occur during monitoring and cavity management activities. These include: limiting human presence within the nest area, protection of cavity trees during prescribed burning, scheduling prescribed burning for late afternoon/early evening when humidity is higher, careful post-installation monitoring of cavity status, blocking unsuitable cavities to prevent entrance by RCWs, and proper training and certification of personnel that are handling birds and performing cavity management tasks.

Indirect Effects. Indirect effects occur from changes in habitat availability and suitability resulting from LRMP implementation. These may be beneficial or detrimental.

Potential Beneficial Effects. Prescribed burning is an essential management tool for restoring and maintaining the pine savannas and flatwoods on which RCW's depend (U.S. Fish and Wildlife Service 2000). The primary benefit of prescribed burning is controlling height and density of woody shrubs and trees. Longleaf pine restoration would have beneficial indirect effects by reducing basal areas, retaining some overstory trees, favoring longleaf pine, and therefore, improving foraging and future nesting habitat. Combined with prescribed burning and mechanical hardwood midstory control, restoration efforts will also improve understory and midstory conditions. Prescribed burning would promote flowering, fruiting, and growth of native grasses and forbs while also limiting growth of woody vegetation and mechanical midstory control immediately removes midstory hardwoods that deter RCWs. These restoration activities, therefore, create suitable foraging and nesting habitat for RCW's. Thinning of existing

stands would also improve the health of trees, decrease the likelihood of southern pine beetle attack, and stimulate growth of younger stands.

The LRMP also proposes to reduce the numerous unauthorized motorized access roads across the forest that are located within RCW clusters. Reducing motorized traffic can be beneficial to RCW by reducing the current human disturbances in the vicinity of active cluster sites that include discharging firearms, and direct damage to nest trees and native understory vegetation.

Potential Detrimental Effects. Prescribed fire also has the potential to kill cavity trees from complete combustion, or through reduced vigor from crown scorch. Fire induced tree mortality may result due to the sometimes unpredictable nature of fire and the presence of unknown active cavity trees not protected at the time of burning. Following standards in the RCW Draft Revised Recovery Plan (USFWS, 2000) and the RCW DEIS (USFS, 1995), all known active and inactive cavity trees will be protected during prescribed burning and, if damage does occur, will be replaced using artificial cavities. In addition, the LRMP sets yearly goals for surveying suitable RCW habitat where cavity trees have not been found in the past, and for surveying habitats that have not been traditionally considered suitable RCW habitats.

When clearcutting is used as a tool for restoring longleaf pine, fragmentation of forage areas and reductions in the native grass-forb understory composition and density may occur. The severity of these effects depends upon patch size, proximity to active RCW clusters sites, and number or density of patches. In the LRMP, clearcutting is retained as an option only on sites that have a low probability of successful longleaf pine regeneration using the shelterwood method due to soil type, past fire frequency, and current vegetation composition. Clearcutting will only be considered for sites that are at least 1/4 mile from an active cluster. In addition, site preparation methods that have less ground disturbance, i.e. flat planting versus bedding, are emphasized in the LRMP.

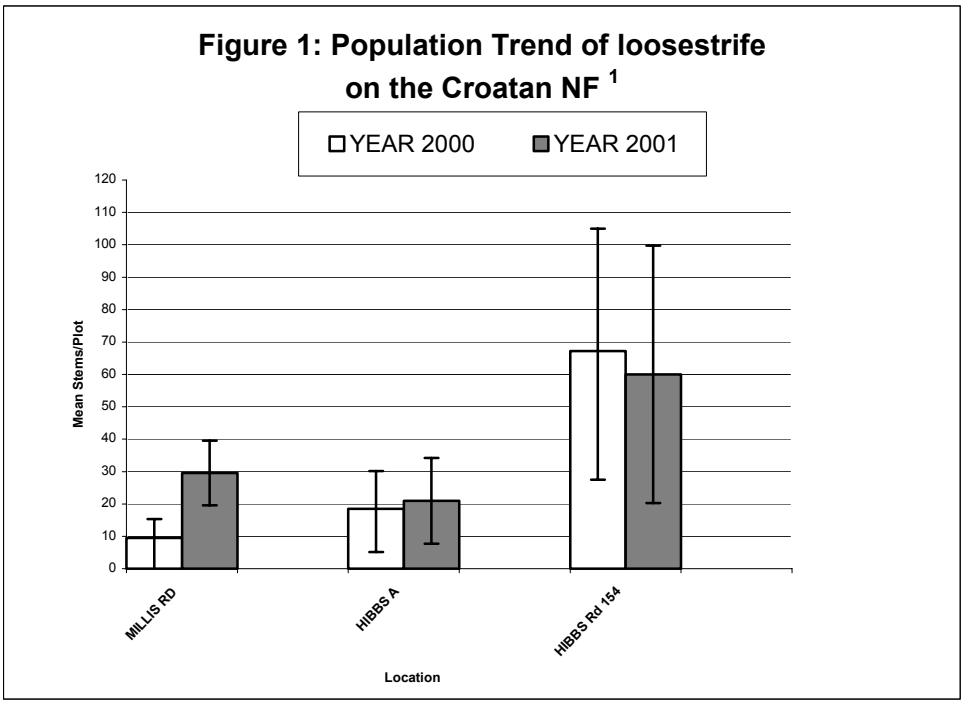
Human disturbance associated with prescribed burning, monitoring, habitat management, unauthorized OHV traffic, trails, and unauthorized camping can have detrimental effects on RCW in the cluster site. Indirect effects may include preventing an adult from entering a cavity in the evening, disrupting adults feeding nestlings, or increasing predator detection of a nest. The LRMP would minimize these effects by phasing out unauthorized forest access through RCW clusters and scheduling management activities outside the breeding season. In addition, time spent within clusters during monitoring and prescribed burning will be kept to the minimum to complete a specific task.

Cumulative Effects. In the long term, longleaf pine restoration, prescribed burning and mechanical treatments in forage and nest areas to control midstory competition, and cavity management would be beneficial to the RCW. The extent of mature longleaf pine savannas and flatwoods would increase and a greater number of acres of foraging and nesting habitat would be maintained in the open, park-like condition that RCWs prefer. Midstory hardwoods will be reduced or eliminated through prescribed burning and mechanical removal. Native grasses and forbs with varying cover and density of shrubs would dominate the understory.

Rough-Leaved Loosestrife (*Lysimachia asperulaefolia*)

Determination of Effects. Implementation of the LRMP is "not likely to adversely affect" this endangered plant. It is expected that management actions would be beneficial to this species. There is a high probability of maintaining species viability on the CNF. These conclusions are based on the recognition of new natural areas that support this species, an expanded prescribed burning program, and Standards that address protection of pocosin/savanna ecotones and of natural areas.

Population Parameters. Currently there are 6 sites that support rough-leaved loosestrife on the CNF. Three of these populations have been intensively monitored since 2000. Loosestrife plants increased in number at two of the three sites and decreased at one site (Figure 1). The increase in number of plants was statistically significant at the Millis Road Savanna site but population changes at the other sites were not. The differences in response of loosestrife to prescribed burning may be explained by fire intensity and fire behavior. Only the Millis Road Savanna site received a 'hot' fire in 2001 that burned thoroughly into the savanna-pocosin ecotone.



[1] *the graph shows the mean number of stems/plot with 90% confidence bars. If the confidence interval bars overlap between 2000 and 2001, then the two years do not differ in mean stem number/plot. If theintervals do not overlap, as in the Millis Rd. location, then the statistics differ between years.*

Background and Potential Effects. The LRMP will establish 8 new natural areas that contain 5 of the 6 sites supporting rough-leaved loosestrife on the CNF. These include the Hibbs Road Pine Ridges, Nine Foot Road/Broad Creek Pinewoods, and Pringle Road Bay Rims Natural Areas. These areas will be managed to allow natural disturbances to function, as much as possible, as natural processes. Although Natural Areas are not suitable for timber production, vegetation management to maintain RCW habitat conditions would be allowed. This would

include more frequent and extensive prescribed burning than is currently occurring. The LRMP also identifies a population objective for rough-leaved loosestrife nearly double the current level. Further protection is provided by a standard that limits the impact of fire plowlines in the pocosin-pine savanna ecotone.

Rough-leaved loosestrife is a species endemic to the Southeastern coastal plain and sandhills. It is found at the savanna-pocosin or flatwoods-pocosin ecotone where the water table is near the surface during winter and early spring and where dry-season fires burn in the edge of the pocosin. As long as fires are not suppressed, the ecotone remains open and suitable for rough-leaved loosestrife. If fire is suppressed, the shrubs already present in the ecotone will attain their full height. Complete fire suppression may result in extirpation from a site, though evidence suggests that it may persist for years or decades under a fairly dense shrub layer.

Drainage and conversion of habitat to agricultural uses and pine plantations, residential and industrial development, and fire suppression have all contributed to the decline in habitat for rough-leaved loosestrife. In 1993, fifty-nine sites were known to support this species; 58 of them in North Carolina and one in South Carolina (USDI Fish and Wildlife Service, 1993). In 1996, a land exchange was approved, after consultation with the Service, which exchanged one of these sites on the CNF that was difficult to manage due to proximity of roads and residential areas. In exchange, the CNF received ecologically similar land with fewer rough-leaved loosestrife plants but a significantly greater amount of suitable habitat in pocosin-savanna ecotones.

Bald Eagle (*Haliaeetus leucocephalus*)

Implementation of the LRMP is "not likely to adversely affect" the bald eagle. Management actions should be beneficial to this species. There is only a moderate probability of maintaining viability on the CNF because the species is primarily a transient on the Forest; only one nest site occurs. These conclusions are based on implementing monitoring and protection standards for the current nest site, standards to maintain large 'supra-canopy' trees adjacent to water bodies, and the extent of suitable habitat within the designated Pocosin Lakes, Hardwood and Cypress Wetlands, and old growth. Extended timber rotation lengths and management of White Oak River and Brice's Creek to retain the resource values that may allow for future Wild and Scenic Rivers designation would also have beneficial effects on bald eagles.

Background and Potential Effects. An opportunistic predator, the bald eagle feeds primarily on fish but also takes a variety of birds, mammals, and turtles when fish are not readily available (Dugoni, 1980; McEwan, 1977). The bald eagle uses a large area for hunting and is sensitive to chemical contaminants in the food chain. Nests are often in the ecotone of forest and marsh or water, and are constructed in older, dominant or codominant living pines or bald cypress 3 kilometers or less from open water (McEwan and Hirth 1979). Most nests are located in the upper 30 feet of the tree with canopy cover above a clear view of open water (USDI Fish and Wildlife Service, 1989).

Habitat alterations and human encroachment resulted in slow eagle population decline for many decades. Perhaps the most dramatic declines in eagle populations nationwide resulted from environmental contaminants. Since a ban on the use of DDT in the U.S. in 1972, a slow

recovery in eagle productivity has occurred. The most significant limiting factors in the Southeast is the accelerated pace of development of eagle habitat and the extensive area involved.

Implementation of the LRMP would result in protection of a considerable amount of habitat suitable for the bald eagle. All areas of older, large diameter trees near open water would be retained and managed to protect this condition. The LRMP allocates nearly 7,000 acres in the Hardwood-Cypress Wetlands prescription and manages two river corridors eligible for Wild and Scenic river status within these areas. These areas are not suitable for timber production, and tree harvest would occur only if it enhances old growth structure. Suitable habitat will also exist in 2,000 acres of longleaf pine savanna and nearly 10,000 acres of pond pine woodlands managed as old growth forest. The 30,000 acres of Wilderness areas on the CNF are also expected to supply some amount of suitable habitat for the bald eagle. Additionally, potential nesting and roosting habitat will be created as a result of extended rotation lengths (80 years for loblolly pine, 120 years for longleaf pine) and treating hardwoods as unsuitable for timber production.

American Alligator (*Alligator mississippiensis*)

Implementation of the LRMP is "not likely to adversely affect" the American alligator. Management actions should be beneficial to this species. There is a high probability of maintaining viability on the CNF. These conclusions are based on protection of habitat suitable for this species, recognition of Natural Areas that contain suitable alligator habitat, Standards that prevent alteration of wetlands, and goals and objectives that specify wetlands restoration.

Population Parameters. There are 11 documented occurrences of the American alligator on the CNF although most of these records are greater than 15 years old. Although the USFS has not completed extensive surveys on the CNF for the alligator, based on numerous citings during this period, the species is not considered uncommon. The American alligator is threatened due to similarity of appearance with other rare crocodilians, and is listed for trade purposes. The species is no longer biologically endangered or threatened, and is not subject to Section 7 consultation.

Background and Potential Effects. The American alligator ranges throughout wetland habitats in the coastal region of the southeastern United States from central North Carolina to Texas and into extreme southeastern Oklahoma and southern Arkansas (Joanen 1974). Coastal marshes are the most common habitat supporting alligators. They build nests of mounds of vegetation and eat any animals small enough to be captured and swallowed (McIlhenny, 1935). Small alligators feed extensively on invertebrates, including crayfish, aquatic and terrestrial insects, and mollusks (Valentine et al. 1972) while larger individuals feed primarily on wading birds, snakes, turtles, and small mammals. Alligators have been known to take deer, cow, and even man (Hines and Keenlyne 1977). The impact of alligator populations on other species in their environment is an area of considerable concern and interest but has been poorly studied. Alligators do not begin to breed until they reach a size representing an apparent threat to humans (6 ft. or larger).

The range of the American alligator is only slightly reduced from the historic limits, however, population levels are reduced due to loss of habitat and over harvest. The primary threat is now rapid urbanization throughout its range and the increasing conversion of habitat to recreational use and development.

Alligators have made substantial recoveries in most of its range and the species has been downlisted from endangered to threatened. The American Alligator Recovery Team (USDI Fish and Wildlife Service 1979) concluded that 3 main factors are critical to the long range survival of the species: 1) the maintenance and proper management of essential wetlands throughout its range, 2) the continuation and enforcement of laws regulating the harvest and movement of skins and other parts through commerce, and 3) the creation of a high level of tolerance toward the species by citizens who must live in frequent contact with the species.

The LRMP provides protection of habitats used by alligators, such as lakes, riparian areas, and bottomlands. This protection is provided in over 7,000 acres of hardwood-cypress swamps, 4,000 acres of lakes, and 1,300 acres of marshes. Objectives are also set for restoring 800 acres of estuarine marshes, the primary habitat for this species. These land allocations and management practices, have the potential for increases in the CNF alligator population.

Red Wolf (*Canis rufus*)

Implementation of the LRMP will have "no effect" on the red wolf. Suitable habitat will be maintained and this will enable future recovery efforts to occur. These conclusions are based on the current arrangement of habitat conditions found on the CNF suitable for the red wolf, Standards that limit alterations of these habitats except for the purpose of restoring more natural conditions, and the extent and remoteness of areas managed as Wilderness on the CNF.

Background and Potential Effects. Any habitat area in the southeastern United States of sufficient size, which provides adequate food, water, and basic cover requirement of heavy vegetation, should be suitable habitat for the red wolf (U.S. Fish and Wildlife Service 1990). Telemetry studies indicate that red wolf home range requirements vary from about 25 to 50 square miles. Prey studies indicate that the diet of the red wolf includes any abundant small to medium-sized mammals (U.S. Forest Service 1995). In North Carolina, at the Alligator River National Wildlife Refuge, red wolves were also found to be heavily dependent on white-tailed deer. Red wolves have been known to establish dens in hollow tree trunks, stream banks, abandoned dens of other animals, drain pipes, culverts, and sandy knolls in coastal areas.

The red wolf was once found throughout the southeastern United States, from the Atlantic coast to central Texas and from the gulf Coast to central Missouri and southern Illinois. Between the period of 1900 and 1920, red wolves were extirpated from most of the eastern portion of their range. The last red wolves were found in coastal prairie and marsh habitat because this was the last area in which the animals were allowed to remain. The disappearance of the last red wolves from the wild is attributed to two factors: habitat changes which favored expansion of the historic coyote range into red wolf territory, and the local breakdown of red wolf social structure (caused by extensive trapping, poisoning, and shooting).

In 1975, it was concluded that red wolves could not be maintained in their limited range in Texas and Louisiana. Therefore, recovery efforts were directed toward using captive stock to re-establish red wolf populations in other areas of the species' historic range. Successful reintroductions have occurred at the Cape Romain National Wildlife Refuge in South Carolina in 1978 and the Alligator River National Wildlife Refuge in North Carolina in 1987 (U.S. Fish and Wildlife Service 1990). Both areas have significant non-forest habitat. The more recent reintroduction of red wolves in the Great Smoky Mountain National Park has not been nearly as successful and this has been attributed to the extent of interior forest habitat and shortage of open habitat (USDI Fish and Wildlife Service, 1997).

It is estimated that major red wolf reintroduction areas should be at least 225 square miles (144,000 acres) in size. Although the CNF exceeds this size, ownership is fragmented especially in its eastern portions. The LRMP would not result in greater fragmentation of potential red wolf habitat and provides standards that direct management in large contiguous management areas. Any potential recovery efforts would require more detailed project level analysis and extensive involvement and commitment by the local community.

Eastern Cougar (*Felis concolor couguar*)

Implementation of the LRMP will have "no effect" on the eastern cougar. Suitable habitat for this species will be maintained. These conclusions are based on the extent and remoteness of areas managed as Wilderness on the CNF and the availability of prey species.

Background and Potential Effects. Although no preference for specific habitat requirements has been noted, the primary need is apparently for a large remote area with an adequate food supply. Cougars feed primarily on deer, but their diet may also include small mammals, wild turkeys, and occasionally domestic livestock. Male cougars of other subspecies have been observed to occupy a range of 25 or more square miles (16,000 acres).

The eastern cougar is one of 27 subspecies. Although the exact range is unknown, it is thought to have originally occurred within South Carolina, Tennessee, Kentucky, Indiana, and all states to the north and east (Young and Goldman 1946). Cougars were virtually eliminated from these areas soon after they became settled by European immigrants (U.S. Fish and Wildlife Service 1981). Much of the cougars habitat has been eliminated through land development, and its primary prey, the white-tailed deer, has also been reduced in number and range. Cougars have survived in a few areas having rugged terrain and lack of access.

The last major stronghold of another cougar subspecies, the Florida panther, is in Coastal Plain swamp habitats. There are extensive unroaded pocosins in North Carolina that have never been devoid of deer or bear and many of these occur on the CNF. These areas would presumably be suitable habitat for the eastern cougar.

The LRMP would designate additional Wilderness that would further limit access into its large and inaccessible central pocosin. This area is 32,000 acres in size and along with areas suitable for black bear management of 39,000 acres would provide considerable pocosin and pond pine

woodland habitat for the eastern cougar. Additional habitat suitable for the eastern cougar exists in the 13,000 acres of small and medium-sized patches of pocosin.

Sensitive Jointvetch *(Aeschynomene virginica)*

Implementation of the LRMP will have "no effect" on this threatened plant. This conclusion is based habitat improvement goals related to marsh restoration, management of Brice's Creek and the White Oak River to retain resource values that may lead to Wild and Scenic River designation, and Standards and that prohibit alteration of wetlands.

Background and Potential Effects. Sensitive jointvetch is an annual legume that may grow as tall as 2.4 meters. It occurs in freshwater tidal river systems, within the intertidal zone where populations are flooded twice daily (U.S. Fish and Wildlife Service, 1994). Historically this species occurred in 6 eastern states and is now known at only 24 sites; one in Maryland, one in New Jersey, two in North Carolina, and 20 in Virginia. Sensitive jointvetch seems to favor microhabitats having little competition from other plants but where species diversity is high. Bare to sparsely vegetated substrates appear to be the critical habitat requirement.

Direct habitat destruction has occurred during dam construction, dredging, filling, and shoreline stabilization. Highway and bridge construction have resulted in excessive sediment loading into river habitats where sensitive jointvetch occurs. It is believed that the closest site from the CNF that once supported this species may have been destroyed during the realignment of U.S. 70 in Craven County. The species was last observed there in 1949. The only remaining populations in North Carolina occur in two ditches connected to Lake Mattamuskeet in Hyde County, approximately 60 air miles from the CNF.

There are only a few freshwater tidal streams on the CNF and therefore limited potential habitat for sensitive jointvetch. Marshes along the White Oak River north of Long Point, at the mouth of Hancock creek, and along lower Brice's Creek may provide suitable habitat. The LRMP directs management in these areas to include protection of hydrologic function and restoration of native marsh vegetation composition and structure through prescribed burning. Additional protection of these potential habitats will be provided for within the Brice's Creek Wild and Scenic River corridor.

E.8. Conclusion And Determination Of Effect

Based on the land allocation, goals and objectives, and standard and guidelines, it is anticipated that implementation of the LRMP would benefit all of the threatened and endangered species that occur on the Forest and would maintain suitable habitat for threatened and endangered species that could occur on the Forest.

Management activities directed by the LRMP are "not likely to adversely affect" the:

- red-cockaded woodpecker (*Picoides borealis*),
- rough-leaved loosestrife (*Lysimachia asperulifolia*),
- bald eagle (*Haliaeetus leucocephalus*), and the
- American alligator (*Alligator mississippiensis*).

Management activities will have "no effect" on the:

- red wolf (*Canis rufus*),
- eastern cougar (*Felis concolor couguar*), and
- sensitive jointvetch (*Aeschynomene virginica*).

Prepared by :

Steven A. Simon
/ STEVEN A. SIMON/ April, 2002
Forest Ecologist
National Forest in North Carolina

E.9. Letter of Concurrence from Fish and Wildlife Service

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Raleigh Field Office
Post Office Box 33726
Raleigh, North Carolina 27636-3726

June 14, 2002

RECEIVED
JUN 17 2002

Mr. John F. Ramey
160A Zillicoa Street
Post Office Box 2750
Asheville, North Carolina 28802

Dear Mr. Ramey:

The U.S. Fish and Wildlife Service (Service) has reviewed your letter of April 9, 2002 and biological assessment (BA) evaluating the biological effects of implementing the Land and Resources Management Plan (LRMP) for the Croatan National Forest. Based on the information contained in the BA, the US Forest Service (USFS) has determined that implementation of the LRMP is not likely to adversely affect the red-cockaded woodpecker (*Picoides borealis*, RCW), rough-leaved loosestrife (*Lysimachia asperulaefolia*) or southeastern bald eagle (*Haliaeetus leucocephalus*) and will not affect the red wolf (*Canis rufus*), eastern cougar (*Felis concolor couguar*) or sensitive jointvetch (*Aeschynomene virginica*). Our comments are provided in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 USC 1531 et seq.).

A major element of the LRMP will be to direct the USFS effort to conserve and recover the RCW. The RCW recovery effort would be directed by guidelines contained in the USFS's RCW Final Environmental Impact Statement for the Management of the Red-cockaded Woodpecker and it's Habitat on National Forests in the Southern Region and the Service's Technical/Agency Draft Revised Recovery Plan for the Red-cockaded Woodpecker. In accordance with the proposed LRMP, the RCW population on the Croatan National Forest will continue to be monitored with the use of color bands to mark individuals. Although not specifically discussed in the BA, it appears that Level IV RCW monitoring will be applied, as described in the Service's Technical/Agency Draft Revised Recovery Plan for the Red-cockaded Woodpecker. This monitoring level provides the best information on population trends, reproductive effort and success. Level IV b is suggested in the BA, since all individuals on the Croatan National Forest would be marked.

According to the BA, the LRMP to be implemented will include steps to recover and sustain a viable RCW population through the establishment of a RCW habitat management area (HMA) encompassing approximately 69,000 acres within the Croatan National Forest. The BA states a long-term population objective for the Croatan National Forest of between 151 and 169 active clusters. The USFS would establish 20 to 26 new clusters within the first 10 years of implementation and 50 to 63 clusters in the following 30 years. The Service's interest in the Croatan National Forest exhibiting a higher initial growth rate in the number of breeding pairs was

discussed between Mr. John Hammond of this office and Ms. Kim Kennedy of the USFS (May 29, 2002). It appears that efforts to convert loblolly pine (*Pinus taeda*) to longleaf pine *(Pinus palustris*) will account in part for this population growth rate. The rate of conversion to longleaf described in the LRMP is expected to be optimal for minimizing impacts to the existing RCW groups.

The LRMP will include plans to restore longleaf pine (*Pinus palustris*) on 2,650 to 3,600 acres within the Croatan National Forest, where appropriate soils are found. Two-aged shelterwood cuts would be used to convert stands currently forested in mature loblolly pine (*Pinus taeda*) to longleaf pine. The USFS estimates that clearcutting might be necessary on 500 to 750 acres which are expected to have a low probability of successful conversion using the two-aged shelterwood treatment. Between 1,800 and 2,100 acres of existing pine plantations will be thinned for improving suitability as RCW habitat. As described in conversations between Mr. Hammond and Ms. Kennedy (June 10, 2002), the USFS intends to promote conversion to longleaf pine via prescribed burning and other methods that will favor survival of longleaf regeneration over off-site species with minimal impacts to the forest floor.

According to the BA, the USFS plans to register with the State of North Carolina 5,800 acres of new natural areas identified by the North Carolina Natural Heritage Program. Prescribed burning would be applied on appropriate fire return rotations in pond pine woodlands, pocosin, longleaf pine and other fire-adapted natural community types. Approximately 15 to 20 miles of system roads will be removed from use by off-highway vehicles and designated as hiking, biking or horse trails.

The LRMP would provide the general public with additional recreational opportunities on the Croatan National Forest and the USFS will conduct environmental review on each proposed recreational project. Pine straw raking would be authorized on a limited basis within a total of 600 acres of the Croatan National Forest. The USFS would prohibit pine straw raking near rare species element occurrences, wet savannas, flatwoods, natural areas, old growth patches, and within 1/4 mile of active RCW cluster sites.

The USFS proposes to work with neighboring property owners to consolidate national forest holdings for protecting natural resources including rare species habitat and riparian ecosystems, and to improve recreation management. As with planning for recreational activities, environmental reviews for these proposed actions will be conducted on a project by project basis.

The Service considers the prescribed burning activities presented in the BA for the LRMP to be generally favorable to rare and federally-listed species, with overall benefits accrued by the ecosystems present on the Croatan National Forest. As stated in our February 22, 2002 letter, the Service remains interested in potential fire effects to undetected RCW groups/clusters that may exist in pond pine woodlands and pocosins. The BA indicates that the USFS plans to establish yearly goals to survey habitat, including habitat that was not previously considered suitable for RCW

foraging or nesting. We are interested in how yearly goals, in terms of acreage, would be determined as well as what criteria the USFS will use to determine which areas will and will not be surveyed.

In executing prescribed burning activities, the Service urges the USFS to seek opportunities to work with the North Carolina Natural Heritage Program as well as other partners as appropriate, to conserve rare species that occur naturally in the Croatan National Forest's fire-maintained communities but also require pockets of infrequently burned habitat. One such species is the Arogos skipper (*Atrytone arogos arogos*). This cooperation will likely help preclude the need to list such species in the future.

The BA indicates that management actions described in the LRMP should be favorable to the bald eagle. Presently, one nest is known for the Croatan National Forest. Complimentary management would include extended timber rotations and protection prescribed for sections of the White Oak River and Brice's Creek.

The sensitive jointvetch is known to occur Beaufort and Hyde Counties, with historic records of the plant in Craven and Lenoir Counties. The BA identifies suitable habitat along the White Oak River north of Long Point, at the Mouth of Hancock Creek, and along lower Brice's Creek. It appears that the actions proposed in the LRMP would potentially favorable to conservation of this species.

Suitable habitat exists for the red wolf in the Croatan National Forest, however, the species is currently considered extirpated in Carteret, Craven and Jones Counties. Suitable habitat will be maintained under the LRMP, enabling future recovery efforts as determined. The suitable habitat is most likely contained in designated wilderness areas in the Croatan National Forest. USFS directives limit alterations to these habitats except for the purpose of restoring more natural conditions. As for the red wolf, suitable habitat for the eastern cougar will also be maintained.

The Service looks forward to working with the USFS to review recreational projects, land consolidation and other undertakings as they are proposed for the Croatan National Forest. We appreciate the opportunity to assist the USFS as the LRMP is implemented. Based on the information contained in the April 2002 BA, the Service believes that this project is not likely to adversely affect the bald eagle, RCW, rough-leaved loosestrife, or any other federally listed species, their formally designated critical habitat, or species currently proposed for federal listing under the Endangered Species Act, as amended. We believe that the requirements of section 7(a)(2) of the Act have been satisfied. We remind you that obligations under section 7 consultation must be reconsidered if: (1) new information reveals impacts of this identified action that may affect listed species or critical habitat in a manner not previously considered; (2) this action is subsequently modified in a manner that was not considered in this review; or, (3) a new species is listed or critical habitat determined that may be affected by the identified action.

If you have any questions regarding this matter, please contact Mr. John Hammond at (919) 856-4520 (Ext. 28). Thank you for your continued cooperation with our agency.

Sincerely,

Garland B. Pardue, Ph.D.
Ecological Services Supervisor

cc: Ralph Costa, FWS

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FEIS APPENDIX F: BIOLOGICAL EVALUATION

For Regional Forester's Sensitive Species And Locally Rare Species
April 2002

F.1. Introduction

This programmatic Biological Evaluation (BE) assesses the effects of implementing management activities proposed in the revised Croatan National Forest Land and Resource Management Plan (Plan). The planning area includes all federal land managed or administered by the Croatan National Forest (CNF) in the Coastal Plain of North Carolina. Project-specific analysis will be conducted at the time of a project proposal to determine site-specific effects. The purpose of this analysis is to assess potential effects on Forest Service sensitive and locally rare species that occur or could occur within the CNF. Federally threatened and endangered species are evaluated in the Biological Assessment, a separate document.

This BE was prepared in accordance with U.S. Forest Service (USFS) manual 2670 and is guided by requirements set forth in the National Forest Management Act. Determinations of effects by habitat and species are made based on best available information. As new information becomes available through inventory, monitoring and research, this evaluation will be updated.

F.2. Proposed Action

Implementation of the CNF Plan (Plan) is the proposed action. The Plan represents alternative E, the preferred alternative. This alternative emphasizes restoration of natural plant community composition and structure and the species that these Coastal Plain communities support. It provides protection and maintenance of rare species within a network of Special Interest Areas (NC registered natural areas) that represent the range of ecosystems occurring on the CNF and more active management within other Management Prescriptions designed to restore suitable habitat conditions for native species. Other resource management activities, including timber harvest and recreational use, are concentrated away from sensitive habitats that currently support or could support sensitive or locally rare species. Specific proposed actions can be found in Chapters 2-4 of the Plan.

Planning Area
The planning area lies in the eastern portion of North Carolina within the Atlantic Coastal Plain. The planning area includes all lands within the CNF proclaimed boundary that are currently administered or managed by the CNF. This area is approximately 161,000 acres in sizes and contains portions of 3 counties: Carteret, Jones, and Craven.

F.3. Effects On Habitat And Species

One hundred and thirty-five Sensitive or Locally Rare species either occur now or could potentially occur in the future within the administrative boundaries of the CNF (Attachment 1 and Table F-1). Sixty-one of these species are designated by the USFS as Sensitive and 74 are designated as locally rare. Sensitive species are considered rare on a range-wide basis but may be locally abundant. They are designated by the Regional Forester and have a global rank (Attachment 2) of G1, G2, or G3 and are considered at risk of extinction in a portion of their

range as evidenced by downward trends in population numbers or density, or downward trends in habitat capability. The Forest Supervisor designates locally rare species. They are rare species having a state rank (Attachment 2) of S1, S2, or S3. They are not at risk of extinction, even in a portion of their range, and do not show a downward population trend over their range as a whole. However, they are uncommon within North Carolina and on the CNF and add to the locally biological diversity on the CNF.

Of the 135 species evaluated for potential management impacts, 59 presently occur on the CNF. Sixteen of these are Sensitive and 43 are Locally Rare. Hereinafter, both sensitive and locally rare species will be referred to as "rare species". The remaining 76 species are considered likely to occur based upon their habitat preference and proximity to the CNF. There are eight general habitat types suitable for rare species on the CNF (Table F-1). They include: 1) marl outcrops or marl influenced areas, 2) small depression ponds, 3) maritime forests, 4) marshes, 5) swamps, 6) pocosins, 7) streams, lakes, and riparian areas, and, 8) pine savannas and pine sandhills. The disclosure of effects of Plan implementation to rare species will be related primarily to the effects of probable activities on these habitats.

Table F-1: *Number of rare species that are documented on the CNF (59 total) and rare species that may occur (76 total) based on their habitat preference.*

	ALL SPECIES	PLANT	INSECT	BIRD	MOLLUSK	FISH	REPTILE	CRUSTACEAN	MAMMALS	AMPHIBIAN
Marl outcorps	5	5	-	-	-	-	-	-	-	-
Ponds	15	12	1	1	-	-	1	-	-	-
Maritime forests & shrub	7	6	-	1	-	-	-	-	-	-
Marshes	11	4	3	3	-	-	1	-	-	-
Swamps	5	5	-	-	-	-	-	-	-	-
Pocosins and other bogs	8	5	1	1	-	-	-	-	1	-
Streams, lakes, riparian areas	29	2	2	3	9	9	-	3	-	1
Pine savannas and sandhills	49	34	10	1	-	-	3	-	-	1
Other habitats	6	-	2	1	-	-	-	1	2	-
All habitats	**135**	**73**	**19**	**11**	**9**	**9**	**5**	**4**	**3**	**2**

The 59 rare species that occur on the CNF are documented at 229 element occurrences. An element occurrence represents the site where the species occurs and may contain more than one rare species. In addition, a species may be represented by numerous individuals at each site and these individuals may occur at several locations within the site.

Of the 229 documented element occurrences on the CNF, 157 or about 70% are within areas not suited for timber production and protected from most ground disturbing activities (Tables F-2 & F-3). These locations include 18 Special Interest Areas (NC registered natural areas), 13 Red-cockaded woodpecker (*Picoides borealis*) – (RCW) nest areas, 5 old growth areas, and 2 Wildernesses.

Table F-2: *Number of documented rare species element occurrences within habitat groups and the percent that are within Special Interest Areas (NC registered natural areas), RCW nest clusters, designated oldgrowth, and other management prescriptions that are not suitable for timber production.*

HABITAT	ALL SPECIES	PLANT	BIRD	REPTILE	CRUSTACEAN	AMPHIBIAN	INSECT	FISH and MOLLUSK
marl outcrops	7 86%	7 86%						
ponds	27 93%	23 91%		2 100%			2 100%	
marshes & maritime	4 75%		2- 50%				2 100%	
swamps	8 75%	8 75%						
pocosin	6 67%	5 80%	1 0%					
streams, lakes	8 25%		2 100%		6 0%			
pine savanna	169 66%	135 67%	12 100%	8 25%		5 40%	9 50%	
All Habitats	**229 69%**	178 72%	17 88%	10 40%	6 0%	5 40%	13 53%	None documented

Table F-3*: Number of documented rare species element occurrences on the CNF. Total (TOT), within Special Interest Areas (NC registered natural areas) (NAT), RCW nest areas (RCW nest), RCW forage areas suitable for timber production (RCW forage), designated oldgrowth areas (OG), and other areas not suited for timber production (OTH).*

SPECIES	TOT	NAT	OG	OTH	RCW Nest	RCW Forage	HABITAT	LIFEFORM
Acronicta sinescripta	1	1					savanna	insect
Agalinis aphylla	4	2			1	1	savanna	plant
Agalinis virgata	13	5	3	1	3	1	savanna	plant
Agrotis n. sp. 1	3	1				2	savanna	insect
Aimophila aestivalis	12	5	5		2		savanna	bird
Ammodramus henslowii	1					1	pocosin	bird
Andropogon mohrii	1					1	savanna	plant

***Table F-3**: Continued*

SPECIES	TOT	NAT	OG	OTH	RCW Nest	RCW Forage	HABITAT	LIFEFORM
Anhinga anhinga	1	1					water	bird
Asclepias pedicellata	7	3	2		1	1	savanna	plant
Asplenium heteroresiliens	1	1					marl	plant
Atrytone arogos arogos	1	1					savanna	insect
Calephelis virginiensis	4	1				3	savanna	insect
Carex basiantha	1	1					marl	plant
Crotalus adamanteus	2					2	savanna	reptile
Cystopteris tennesseensis	1	1					marl	plant
Dionaea muscipula	22	7	5		5	5	savanna	plant
Eleocharis robbinsii	1	1					ponds	plant
Euphyes berryi	2	2					ponds	insect
Euphyes bimacula	2	2					marsh	insect
Lachnocaulon beyrichianum	3	2				1	sandhills	plant
Lejeunea bermudiana	1					1	marl	plant
Litsea aestivalis	6	3	1		1	1	ponds	plant
Ludwigia linifolia	1	1					ponds	plant
Malaxis spicata	1			1			swamp	plant
Myriophyllum laxum	1	1					ponds	plant
Ophisarus mimicus	6	2				4	savanna	reptile
Panicum tenerum	2	1	1				savanna	plant
Passerina ciris	2	1				1	tidal areas	bird
Peltandra sagittifolia	3	2		1			pocosin	plant
Phalacrocorax auritus	1	1					Lakes	bird
Pinguicula pumila	6	5				1	savanna	plant
Platanthera integra	3	1				2	savanna	plant
Platanthera nivea	1					1	savanna	plant
Polygala hookeri	2	2					savanna	plant
Polygonum hirsutum	1		1				ponds	plant
Ponthieva racemosa	7	1		4		2	swamp	plant
Procambarus plumimanus	6					6	water	crustacean
Rana capito capito	5	1	1			3	savanna	amphibian
Rhexia cubensis	5	2	2		1		ponds	plant
Rhynchospora harperi	1		1				ponds	plant
Rhynchospora macra	1	1					savanna	plat
Rhynchospora oligantha	5	4			1		savanna	plant
Rhynchospora pleiantha	2	1	1				Ponds	plant
Rhynchospora scirpoides	1	1					ponds	plant
Sagittaria graminea	1					1	ponds	plant
Scirpus lineatus	3	1		1	1		marl	plant
Scleria baldwinii	1	1					savanna	plant
Scleria georgiana	2					2	savanna	plant
Seminatrix pygaea	2	1		1			ponds	reptile
Solidago gracillima	2	2					savanna	plant
Solidago leavenworthii	1	1					savanna	plant
Solidago pulchra	19	11	2		1	5	savanna	plant
Solidago verna	27	1	1	4	1	20	savanna	plant
Sphagnum fitzgeraldii	2			1		1	pocosin	plant
Spiranthes longilabris	1					1	savanna	plant
Tofieldia glabra	9	7				2	savanna	plant
Utricularia olivacea	3	2	1				ponds	plant
Xyris flabelliformis	2	2					savanna	plant
Xyris stricta	1	1					savanna	plant
ALL SPECIES	**229**	**98**	**27**	**14**	**18**	**72**		

The following is a brief discussion of the potential effects of Plan implementation on habitats that support rare species. A viability analysis for these rare species is included in Appendix H.

Marl outcrops: Included with these outcrops of limestone are rich forests that occur over marl. Both of these conditions are very rare on the CNF and the size of sites is too small to map in ecological map units. In these habitats, four rare vascular plant species are documented on the CNF. They include Carolina spleenwort (*Asplenium heteroresiliens*), Southern Willdenow's Sedge (*Carex basiantha*), Tennessee bladder-fern (*Cystopteris tennesseensis*), and drooping bulrush (*Scirpus lineatus*). One other species could occur on the CNF in these habitats, a liverwort *Cylindrocolea rhizantha*.

The largest marl outcrop on the CNF occurs within the Island Creek Natural Area and smaller marl associated sites are imbedded in the Hardwood-Cypress Wetlands management prescription. These areas are not suitable for timber production or developed recreation sites and are therefore protected from ground disturbing activities. Implementation of the CNF Plan should be beneficial to rare species that occur or could occur on marl outcrops because of this protection.

Small Depression ponds: These natural ponds occur adjacent to xeric and dry longleaf pine savannas and sandhills and within pocosin/savanna complexes. Small depression ponds occupy less than 1% of the CNF landscape. Within and on the fringe of these ponds, 11 rare plant species, one rare insect, and one rare reptile are documented on the CNF. Plant species include: pondspice (*Litsea aestivalis*), Flaxleaf seedbox (*Ludwigia linifolia*), loose watermilfoil (*Myriophyllum laxum*), West Indies meadow beauty (*Rhexia cubensis*), Harper's beakrush (*Rhynchospora Harperi*), coastal beaksedge (*Rhynchospora pleiantha*), long-beak bald-sedge (*Rhynchospora scirpoides*), Chapman's arrowhead (*Sagittaria graminea Chapmanii),* dwarf bladderwort (*Utricularia olivacea),* Robbins's spikerush (*Eleocharis robbinsii*), and hairy smartweed (*Polygonum hirsutum*). Insects and reptiles include Berry's skipper, (*Euphyes berryi*), and the black swampsnake (*Seminatrix pygaea*). Other species that could occur on the CNF in these habitats include: the black-necked stilt (*Himantopus mexicanus*), and awned meadow-beauty (*Rhexia aristosa*).

The largest complex of small depression ponds on the CNF occurs within the Patsy Ponds Natural Area. Smaller ponds are imbedded within the Pine Savanna and Flatwoods management prescription. Over one-half of the known populations of pond-associated rare species occur within Special Interest Areas (NC registered natural areas) and 93% occur within areas not suited for timber production. These and other populations of pond-associated species are also protected by forest-wide standards. One standard restricts mechanized equipment from crossing any vernal pool, and the other prohibits ground disturbing activities within limesink ponds. Implementation of the CNF Plan should therefore be beneficial to rare species that occur or could occur in depression ponds because these species would be either protected in Special Interest Areas (NC registered natural areas) or by forest-wide standards.

Maritime forests: These habitats fringe salt or brackish waters and are potentially dominated by live oak. They are rare on the CNF and have been mapped at only 4 locations on the periphery of the Forest; total area is about 45 acres. No rare species have been documented in these areas

except the Painted bunting (*Passerina ciris*) that occurs in shrubby areas within this zone. Based on habitat preference, three rare liverworts may occur - *Plagiochila mirandorensis miradorensis*, *Lejeunea dimorphophylla*, and *Metzgeria unciger.* In addition, the sunrise lichen – (*Teloschistes flavicans*), and two rare plants - large-seed pellitory (*Parietaria praetermissa*), and Coastal goldenrod (*Solidago villosacarpa*) may occur.

There are no examples of good quality natural communities in the maritime forest zone on the CNF. The largest remnant occurs in the Cedar Point - White Oak River Marshes Natural Area, and it is not in good condition. The Plan sets a goal of restoring these communities and others scattered across the CNF. Implementation of the Plan should improve habitat conditions for all rare species that may be associated with Maritime forests.

Marshes: These communities occur along tidal streams and estuaries and are uncommon on the CNF. There are approximately 1,200 acres of marshland on the Forest. Although many rare species could occur in these habitats, only one species, the two spotted skipper (*Euphyes bimacula*), an insect, has been documented on the CNF. Ten other species could occur in marshes on the Coastal Plain near the CNF. They include: three vascular plants - (Long's bittercress (*Cardamine longii*), Godfrey's sandwort (*Minuartia godfreyi*), and Chapman's arrowhead (*Sagittaria graminea weatherbiana*), a liverwort - (*Frullaria donnellii*), three birds – the American bittern (*Botaurus lentiginosus*), Northern harrier (*Circus cyaneus*), and Yellow rail (*Coturnicops noveboracensis*), two insects – Duke's skipper (*Euphyes dukesi dukesi*), an owlet moth (*Meropleon diversicolor sullivani*) and a reptile – Carolina salt marsh snake (*Nerodia sipedon williamengelsi*).

Most all marshes on the CNF occur in Special Interest Areas (NC registered natural areas) and in river corridors that would retain the values associated with Wild and Scenic Rivers. A few occur in the Cypress-Hardwood Wetlands management prescription, also not in the suitable timber base. The Plan includes standards that prohibit altering natural hydrology in these areas and sets a goal of restoring marshes that are currently dominated by woody shrubs and trees. Implementation of the Plan should improve habitat conditions for rare species that may be associated with marshes.

Swamps: Swamps are common on the CNF and occupy about 7,900 acres. They occur along small to large streams, on lake margins, and in upland depressions. Three rare species have been documented in these habitats on the CNF, two vascular plants - Florida adder's mouth (*Malaxis spicata*), and shadow-witch (*Ponthieva racemosa*), and one liverwort – swamp liverwort (*Lejeunea bermudiana*). Based on habitat preference and Coastal locale, two other species could occur in swamps on the CNF. They are: Hall's pocket moss (*Fissidens hallii*), and the vascular plant Birds-in-a-nest (*Macbridea caroliniana*).

Many swamp-associated rare species on the CNF occur in Special Interest Areas (NC registered natural areas) (75% of total) and other areas not suited for timber production. In addition, prescription standards limit storm salvage in swamps to only large-scale hurricane events. Also prohibited are new recreation facilities and motorized vehicles. Implementation of the CNF Plan would therefore improve habitat conditions for rare species associated with swamps by providing protection through special designations and standards that limit ground disturbing activities.

Pocosins: These pond pine/evergreen shrub communities are the most common vegetation type on the CNF. Most have not been surveyed intensively for rare species because of their inaccessibility. Three rare species are documented in pocosins on the CNF. They are: Henslow's sparrow (*Ammodramus henslowii*), spoonflower (*Peltandra sagittifolia*), and Fitzgerald's peatmoss (*Sphagnum fitzgeraldii*). Three other rare species could occur in pocosin habitats on the CNF: one rare plant – White wicky (*Kalmia cuneata*), the Dismal Swamp bog lemming, and a bird-dropping moth (*Lithacodia sp*.). In addition, two other rare plants - Piedmont meadowrue (*Thalictrum macrostylum*), and Twig-rush (*Cladium mariscoides*) could occur in other bog habitats.

Nearly 30,000 acres of pocosin habitat is in Wildernesses and the remainder is within areas managed for Black Bear and in pocosin patches within the RCW Habitat Management Area. None of these areas are in the suitable timber base and use is restricted by road closures and the impenetrability of the vegetation.

The CNF Plan sets goals for the extensive use of prescribed burning in pocosins, the restoration of canebrakes, and general maintenance of natural pocosin conditions. Although the use of fire plowlines will be limited, some ground disturbance may occur during prescribed burning operations. Implementation of the CNF Plan would improve habitat conditions for rare species associated with pocosins, especially in the future, but because of the extent of restoration activities, individual rare species may initially be impacted. However, this would not lead to a trend in federal listing of these species and should have an overall positive effect on rare species associated with pocosins.

Streams, Lakes, and Riparian areas: There are approximately 4,900 acres of lakes on the CNF and 190 miles of streams and rivers. Additional aquatic habitats such as rivers, sounds, and estuarine systems occur adjacent to the CNF and could be impacted by management activities on the Forest. Although these aquatic habitats could support a large number of rare species, only three have been documented on the CNF. They are: the Croatan crawfish (*Procambarus plumimanus*), and two birds - the anhinga (*Anhinga anhinga*), and the double-crested cormorant (*Phalacrocorax auritus*).

There are many rare species that are dependent on coastal aquatic environments or environments in close proximity to streams and rivers that could occur on the CNF (Attachment A, Table F-6). They include: nine fishes - Altantic sturgeon (*Acipenser oxyrhinchus*), Spinycheek sleeper (E*leotris pisonis*), Lyre goby (*Evorthodus lyricus*), Freckled blenny (*Hypsoblennius ionthas),* Least brook lamphrey (*Lampetra aepytera*), Pinewoods shiner (*Lythrurus matutinus*), Carolina madtom (*Nopturus furiosus*), Bridle shiner (*Notropis bifrenatus*), and the sandhills chub (*Semotilus lumbee*); nine mollusks - Atlantic pigtoe (*Fusconaia masoni*), Eastern lampmussel (*Lampsilis radiata radiata*), a bivalve (*Lampsilis sp*.), Green floater (*Lasmigona subviridus*), Atlantic geoduck (*Panopea bitruncata*), squawfoot (*Strophitus undulatus*), Savannah lilliput (*Toxolasma pullus*), Triangle floater (*Alasmidonta undulata*), and the blackwater ancylid (*Ferrissia hendersoni*) found in lake margins; three insects - annointed swallow moth (*Pyreferra ceromatica*), a mayfly (*Baetisca laurentina*), and Lemmer's pinion (*Lithophane lemmeri*); two crustaceans – North Carolina spiny crayfish (*Orconectes carolinensis*), Tar River crayfish

(*Procambarus medialis*); one amphibian – Neuse river waterdod (*Necturus lewisi*); one bird and one mammal that could be found in bottomlands associated with streams and rivers – Mississippi kite (*Ictinia mississippiensis*), Rafinesque's big-eared bat (*Corynorhinus rafinesquii*); and two vascular plants - narrowleaf cowlilly (*Nuphar saggitifolia),* a quillwort (*Isoetes microvela*).

The Plan provides direction to maintain and enhance aquatic systems and proposes the establishment of nearly 3,400 acres of river corridors that would retain values associated with Wild and Scenic Rivers. Forest-wide standards require stabilizing erosive uplands adjacent lakes and streams, maintaining natural free-flowing streams in Wilderness and Special Interest Areas (NC registered natural areas), restoring altered hydrologic systems in Special Interest Areas (NC registered natural areas), and stopping the water flow in existing canals and ditches that are no longer needed to control drainage.

In order to provide scientific information that would improve management of the aquatic habitats on the CNF, inventory and monitoring is emphasized in the CNF Plan. The Plan sets an objective of establishing reference site conditions for an aquatic classification, determining the distribution and relative abundance of anadromous fish species, maintaining segments of non-acidic freshwater streams, acidic freshwater streams, and brackish streams and monitoring fish populations within these systems.

The CNF Plan also emphasizes maintenance and improvement of aquatic habitats and follows best management practices to reduce sedimentation from activities in the adjacent uplands. Implementation of the CNF Plan should improve habitats for rare species associated with streams and lakes and riparian habitats. However, total protection of these systems and the species they support may not be feasible because of our lack of more detailed information about the life histories of aquatic species on the CNF, because of the inherent complexity of aquatic systems, and the probability that some mitigation measures designed to reduce aquatic impacts may fail. Therefore, it is expected that some activities implemented through the CNF Plan may impact rare aquatic species but that this would not lead to a trend in federal listing of these species.

Savannas: Pine savannas and sandhills provide suitable habitat for more rare species than any other habitat found on the CNF. Over one-half of the rare species that occur on the CNF and approximately 75% of all the documented rare species element occurrences are in pine savannas, flatwoods, and sandhills.

There are 169 documented rare species occurrences in pine savannas and sandhills on the CNF (Table F-3). Twenty-eight different species are represented by these occurrences. They include: 20 plants - savanna yellow-eyed grass (*Xyris flabelliformis*), Baldwin's nutrush (*Scleria baldwinii*), bog bluestem (*Andropogon mohrii),* branched gerardia (*Agalinis virgata*), Carolina asphodel (*Tofieldia glabra*), Carolina goldenrod (*Solidago pulchra*), feather-bristle beakrush (*Rhynchospora oligantha*), Large beakrush (*Rhynchospora macra*) that occurs in seepy areas within savannas, Georgia nutrush (*Scleria Georgiana*), giant spiral orchid (*Spiranthes longilabris*), graceful goldenrod (*Solidago gracillima*), Hooker's milkwort (*Polygala hookeri*), scale-leaf gerardia (*Agalinis aphylla*), small butterwort (*Pinguicula pumila*), snowy orchid (*Platanthera nivea*), Southern bogbutton (*Lachnocaulon beyrichianum*), spring-flowering

goldenrod (*Solidago verna*), stalked milkweed (*Asclepias pedicellata*), Venus flytrap (*Dionaea muscipula*), and the yellow fringeless orchid (*Platanthera integra*); one bird - Bachman's sparrow (*Aimorphila aestivalis*); four insects - arogos skipper (*Atrytone arogos arogos*), a dagger moth (*Acronicta sinescripta*), a dart moth (*Agrotis n. sp. 1*), and Little metalmark (*Calephelis virginiensis*); two reptiles - eastern diamondback rattlesnake (*Crotalus adamanteus*), and the mimic glass lizard (*Ohisarus mimicus*), and one amphibian - the Carolina gopher frog (*Rano capito capito*).

Rare species that could occur (but have not yet been documented) in savannas on the CNF include 6 insects - a short-winged melanoplus (*Melanoplus nubilus*), Carter's spariniphaga (*Spariniphaga carterae*), dotted skipper (*Hesperia attalus slossonae*), slender-bodied melanoplus (*Melanoplus attenuatus*) that could occur in wet swales within savannas, southern ptichodis (*Ptichodis bistrigata*), and the Venus flytrap cutworm moth (*Hemipachnobia subporphyrea*): 13 vascular plants - Boykin's lobelia (*Lobelia boykinii*), Carolina grass of parnassus (*Parnassia caroliniana*), dissected sneezeweed (*Helinium pinnatifidum*), Hirst's panic grass (*Dichanthelium hirstii*), Leavenworth's goldenrod (*Solidago Leavenworthii*), Many-flower grass pink (*Calopogon multiflorus*), Piedmont cowbane (*Oxpolis ternata*), pineland plantain (*Plantago sparsiflora*), Raven's seedbox (*Ludwigia ravenii*), small spreading pogonia (*Cleistes bifaria*), Southeastern panic grass (*Panicum tenerum*), Thorne's beaksedge (*Rhynchospora thornei*), a yellow eyed grass (*Xyris stricta*); one moss - savanna campylopus (*Campylopus carolinae*); and one reptile - Southern hognose snake (*Heterodon simus*).

Nearly all the current and potential pine savanna and sandhill sites on the CNF are in the RCW Habitat Management Area (HMA). The Plan provides considerable direction for management within this area. For example, (1) pine savannas would be maintained in an open park-like condition through thinning and midstory control, (2) prescribed burning would be used extensively and growing season fires would be promoted, and (3) an objective is set for the restoration of the longleaf pine ecosystem composition and structure on 2,650-3,500 acres on the CNF.

Intensive site preparation may occur on 18% to 21% of the pine savanna and sandhills restoration area but site specific impacts would be evaluated in Biological Evaluations, and potential effects would be mitigated with input from the North Carolina Heritage Program. In addition, much of the RCW HMA and savanna habitat is in Special Interest Areas (NC registered natural areas), old growth areas and RCW nest clusters. These areas are not suited for timber production. Standards also limit the use of plowlines in the ecotone between savannas and pocosins where many rare plants occur. Implementation of the CNF Plan would therefore improve habitat conditions for the 10 rare insects and 13 rare plant species that are not documented on the Forest but that may occur in savannas in the Coastal Plain of North Carolina.

Habitat conditions will also be improved for rare savanna and sandhill species populations that are documented on the CNF, but because of the extent of ground disturbing activities in savannas, some individuals may be impacted. These impacts, however, would not lead to a trend in federal listing of these species for several reasons. Of the 169 documented rare element occurrences associated with savannas and sandhills, nearly one-half occur within Special Interest Areas (NC registered natural areas) where the primary management direction is to protect rare

species and maintain habitat quality and 66% are in areas not suited for timber production (Table F-2). Only five of the 28 documented rare savanna and sandhill species are not within at least one designated Natural Area (Table F-3) on the CNF. Special Interest Areas (NC registered natural areas), which are managed to allow natural disturbances to function, as much as possible, as natural processes, provide the primary core-conservation area for many rare species and would reduce the probability of species extirpation on the CNF.

In total, over two-thirds of all rare savanna and sandhill species occurrences on the CNF are in Special Interest Areas (NC registered natural areas), RCW nest areas, old growth management areas, wilderness, or other lands that are not suited for timber production (Table F-2). Additional standards provide protection for rare species that occur in savannas. For example, herbicides are prohibited in powerline right-of-ways that support rare plants such as spring-flowering goldenrod (*Solidago verna*). Only seven of the 21 spring-flowering goldenrod (*Solidago verna*) populations that occur on the CNF are within Special Interest Areas (NC registered natural areas) or other areas not suited for timber production. This species occurs mostly in coastal plain prairie habitats created by power-line right-of-ways. Prescribed burning and midcanopy control in pine savannas may provide the future conditions for this species to expand into more natural conditions. The Plan also sets a goal of establishing new populations of this species and for other savanna dependent species such as the mimic glass lizard *(Ophisarus mimicus*) and Carolina goldenrod (*Solidago pulchra*).

Other habitats: There are four rare species that may occur on the CNF that could not be placed in any of the above habitats. Implementation of the CNF Plan would provide protection of sites suitable for these species. They include: an owlet moth (*Phragmitiphila interrogans*), an insect that occurs in canebrakes that are identified for restoration in the Plan, the migrant loggerhead shrike (*Lanius ludovicia migrans*) that occurs in fields or other open habitat that is not limited on the CNF, the Eastern woodrat-coastal pop. (*Neotoma floridana* pop. 1), a mammal whose habitat is identified by the North Carolina Heritage Program as "forests", and the graceful clam shrimp (*Lynceus gracilicornis*), that occurs in temporary water depressions which are more then plentiful on the CNF.

F.4. Conclusion And Determination Of Effect

Implementation of the Plan will result in restoration and maintenance of suitable habitat conditions for rare species that occur or that may occur on the CNF. The Plan allocates a large proportion of the CNF in management prescriptions that emphasize species conservation and provides standards intended to minimize the effects of ground disturbing activities to rare species. In addition, analysis will be conducted at the time of a project proposal to determine site-specific effects, and mitigation measures will be designed to minimize potential impacts to rare species.

These actions should have a long-term beneficial effect on all of the sensitive and locally rare species that occur or could occur on the Forest. Over one-half of all rare species on the CNF occur entirely outside of areas suited for timber production. Furthermore, 72% of all rare species element occurrences occur in areas not suited for timber production. Very few ground-disturbing projects would be proposed in these areas. However, 28% of the rare species element occurrences on the CNF occur in areas suited for timber production within the RCW Habitat

Management Area. Ground disturbing activities associated with longleaf pine (*Pinus palustris*) restoration may occur in these areas and may directly impact rare species individuals.

Implementation of the CNF Plan will have **no impacts or beneficial impacts** on four Sensitive species that occur entirely in Special Interest Areas (NC registered natural areas) and other areas not suited for timber production. They include: Bachman's sparrow (*Aimophila aestivalis*), loose watermilfoil (*Myriophyllum laxum*), Hooker's milkwort (*Polygala hookeri*), and coastal beaksedge (*Rhynchospora pleiantha*).

For the 15 Sensitive species that have at least one occurrence in areas suited for timber production, implementation of the CNF Plan **may impact individuals but is not likely to cause a trend to federal listing**. These species include: Carolina spleenwort (*Asplenium heteroresiliens*), Venus flytrap (*Dionaea muscipula*), Southern bogbutton (*Lachnocaulon beyrichianum*), pondspice (*Litsea aestivalis*), mimic glass lizard (*Ophisarus mimicus*), Carolina gopher frog (*Rana capito capito*), Chapman's arrowhead (*Sagittaria graminea Chapmanii*), Carolina goldenrod (*Solidago pulchra*), spring-flowering goldenrod (*Solidago verna*), Fitzgerald's peatmoss (*Sphagnum fitzgeraldii*), giant spiral orchid (*Spiranthes longilabris*), and Carolina asphodel (*Tofieldia glabra*).

For one Sensitive species, the Arogos skipper (*Atrytone arogos arogos*), that occurs entirely in Special Interest Areas (NC registered natural areas), prescribed burning may impact individuals but is not likely to cause a trend to federal listing.

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Attachment F-1. Status and Rank of Sensitive and locally rare species on the CNF.

*Occurrence and status of sensitive and locally rare species on the CNF. (Species with a documented occurrence on the Forest are **highlighted**)*

		STATUS			RANK			
SCIENTIFIC NAME	**COMMON NAME**	**F.S.**	**U.S.**	**N.C.**	**GLOBAL**	**N.C.**	**dominant HABITAT**	**LIFE-FORM**
Acipenser oxyrhinchus	Altantic sturgeon	S		SC	G3	S3	water	fish
Acronicta sinescripta	**a dagger moth**	**LR**		**SR**	**G?**	**S1S3**	**savanna**	**insect**
Agalinis aphylla	**scale-leaf gerardia**	**LR**		**SR-P**	**G3G4**	**S3**	**savanna**	**plant**
Agalinis virgata	**branched gerardia**	**LR**		**SR-P**	**G3G4Q**	**S2**	**savanna**	**plant**
Agrotis n. sp. 1	**a dart moth**	**LR**		**SR**	**G2G3**	**S2S3**	**flatwoods**	**insect**
Aimophila aestivalis	**Bachman's**	**S**	**FSC**	**SC**	**G3**	**S2S3**	**savanna**	**bird**
Alasmidonta undulata	triangle floater	LR		T	G4	S2	rivers	mollusk
Ammodramus henslowii	**Henslow's**	**LR**		**SR**	**G4**	**S2S1**	**pocosin**	**bird**
Andropogon mohrii	**bog bluestem**	**LR**		**SR-P**	**G4?**	**S1**	**savanna**	**plant**
Anhinga anhinga	**anhinga**	**LR**		**SR**	**G5**	**S2SZ**	**water**	**bird**
Asclepias pedicellata	**stalked milkweed**	**LR**		**SR-P**	**G4**	**S2**	**savanna**	**plant**
Asplenium heteroresiliens	**Carolina spleenwort**	**S**	**FSC**	**E**	**G2Q**	**S1**	**marl**	**plant**
Atrytone arogos arogos	**arogos skipper**	**S**	**FSC**	**SR**	**G4T1T2**	**S1**	**savanna**	**insect**
Baetisca laurentina	a mayfly	LR		SR	G5	SU	rivers	insect
Botaurus lentiginosus	American bittern	LR		SR	G4	S1B,S3N	marsh	bird
Calephelis virginiensis	**Little Metalmark**	**LR**		**SR**	**G4**	**S2**	**savanna**	**insect**
Calopogon multiflorus	Many-flower grass	S	FSC	E	G2G3	S1	savanna	plant
Campylopus carolinae	savanna	S	FSC	SR-T	G1G2	S1	savanna	moss
Cardamine longii	Long's bittercress	S		SR-T	G3	S1	marsh	plant
CarexWildenowii megarrhyncha	**Southeren Willdenow's**	**LR**		**SR-T**	**G5T3?**	**S1**	**marl**	**plant**
Circus cyaneus	Northern harrier	LR		SR	G5	S1B,S4N	marsh	bird
Cladium mariscoides	Twig-rush	LR		SR-O	G5	S2	bogs	plant
Cleistes bifaria	Small spreading	S		W7	G3G4	S2?	savanna	plant
Corynorhinus rafinesquii	Rafinesque's big-	S	FSC	(PT)	G3G4	S3	variable	mammal
Coturnicops noveboracensis	Yellow rail	LR		SR	G4	S2N	marsh	bird
Crotalus adamanteus	**E. diamondback**	**LR**		**(PE)**	**G4**	**S1**	**savanna**	**reptile**
Cylindrocolea rhizantha	a liverwort	S		SR-P	G3?	SH	marl	liverwort
Cystopteris tennesseensis	**Tennessee**	**LR**		**E-SC**	**G5**	**S1**	**marl**	**plant**
Dichanthelium hirstii	Hirst's panic grass	S	C	E	G1	S1	savanna	plant
Dionaea muscipula	**Venus flytrap**	**S**	**FSC**	**SR-L**	**G3**	**S3**	**savanna**	**plant**
Eleocharis robbinsii	**Robbins's**	**LR**		**SR-P**	**G4G5**	**S2**	**ponds**	**plant**
Eleotris pisonis	Spinycheek sleeper	LR		SR	G5	S2	water	fish
Euphyes berryi	**Berry's skipper**	**LR**		**SR**	**G3G4**	**S1?**	**ponds**	**insect**
Euphyes bimacula	**two-spotted**	**LR**		**SR**	**G4**	**S2**	**marsh**	**insect**
Euphyes dukesi dukesi	Duke's skipper	S		SR	G3T3	S1S2	marsh	insect
Evorthodus lyricus	lyre goby	LR		SR	G5	S2	water	fish
Ferrissia hendersoni	blackwater ancylid	LR		SC	G?	S1	Lake margin	gastropod

Attachment F-1 *continued….Occurrence and status of sensitive and locally rare species on the CNF. (Species with a documented occurrence on the Forest are highlighted)*

		STATUS			RANK		dominant	LIFE-
SCIENTIFIC NAME	**COMMON NAME**	**F.S.**	**US**	**NC**	**GLOBAL**	**NC**	**HABITAT**	**FORM**
Fissidens hallii	Hall's pocket moss	S		SR-T	G2	S1	swamp	moss
Frullania donnellii	a livervort	S		SR-T	G3?	SH	marsh	liverwort
Fusconaia masoni	Atlantic pigtoe	S	FSC	(PE)	G2	S1	water	mollusk
Hemipachnobia	Venus flytrap cutworm moth	S	FSC	SR	G1	S1?	savanna	insect
Helinium pinnatifidum	dissected sneezeweed	LR		SR-P	G4	S2	savanna	plant
Hesperia attalus slossonae	dotted skipper	S		SR	G3G4T3	S2S3	savanna	insect
Heterodon simus	Southern hognose snake	LR	FSC	(PSC)	G2	S2	sandhills	reptile
Himantopus mexicanus	black-necked stilt	LR		SR	G5	S2B	pond	bird
Hypsoblennius ionthas	freckled blenny	LR		SR	G5	S2	water	fish
Ictinia mississippiensis	Mississippi kite	LR		SR	G5	S2B	bottomland	bird
Isoetes microvela	quillwort	S		SR-L	G1	S1	riverbanks	plant
Kalmia cuneata	white wicky	S	FSC	SR-L	G3	S3	pocosin	plant
Lachnocaulon beyrichianum	**Southern bogbutton**	**S**		**W1**	**G2G3**	**S3**	**sandhills**	**plant**
Lampetra aepytera	least brook lamphrey	S		(PT)	G5	S2	water	fish
Lampsilis radiata radiata	Eastern lampmussel	LR		(PT)	G5	S1S2	water	mollusk
Lampsilis species 2	a bivalve	LR		SR	G1	S1	water	mollusk
Lanius ludovicia migrans	migrant loggerhead shrike	S		SC	G5T3Q	S3B,S	fields	bird
Lasmigona subviridus	green floater	S	FSC	E	G3	S1	water	mollusk
Lejeunea bermudiana	**a liverwort**	**LR**		**SR-P**	**G3G4**	**SH**	**swamp**	**liverwort**
Lejeunea dimorphophylla	a liverwort	S		SR-L	G2G3	S1	maritime	liverwort
Lithacodia sp.	a bird-dropping moth	LR		W3	G4	S1S3	pocosin	insect
Lithophane lemmeri	Lemmer's pinion	LR		SR	G3G4	S1S3	wetlands	insect
Litsea aestivalis	**pondspice**	**S**	**FSC**	**SR-T**	**G3**	**S2**	**pond**	**plant**
Lobelia boykinii	Boykin's lobelia	S	FSC	SR-T	G2G3	S1	savanna	plant
Ludwigia linifolia	**flaxleaf seedbox**	**LR**		**SR-P**	**G4**	**S2**	**pond**	**plant**
Ludwigia ravenii	Raven's seedbox	LR		SR-T	G2?	S2?	savanna	plant
Lynceus gracilicornis	graceful clam shrimp	LR		SR	G?	S2?	temp.water	crustacea
Lythrurus matutinus	pinewoods shiner	LR	FSC	SR	G3	S3	water	fish
Macbridea caroliniana	Birds-in-a-nest	S	FSC	PT	G2G3	S2	swamp	plant
Malaxis spicata	**Florida adder's mouth**	**LR**		**SR-P**	**G4?**	**S1**	**swamp**	**plant**
Melanoplus attenuatus	slender-bodied melanoplus	S		SR	G2G3	S1S3	wet swales	insect
Melanoplus nubilus	a short-winged melanoplus	S		SR	G3?	S2S3	savanna	insect
Meropleon diversicolor sullivani	an owlet moth	LR		SR	G4T1T3	S1S3	marsh	insect
Metzgeria uncigera	a liverwort	S		W7	G3	S1	maritime	liverwort
Minuartia godfreyi	Godfrey's sandwort	S	FSC	E	G1	S1	marsh	plant
Myriophyllum laxum	**loose watermilfoil**	**S**	**FSC**	**T**	**G3**	**S1**	**pond**	**plant**
Necturus lewisi	Neuse river waterdog	LR		SC	G3	S3	water	amphibia
Neotoma floridana pop. 1	Eastern woodrat-coastal pop.	LR		T	G5T5	S1	forests	mammal

Attachment F-1*: continued….Occurrence and status of sensitive and locally rare species on the CNF. (Species with a documented occurrence on the Forest are highlighted)*

		STATUS			RANK			
SCIENTIFIC NAME	**COMMON NAME**	**F.S.**	**U.S.**	**N.C.**	**GLOBAL**	**N.C.**	**dominant HABITAT**	**LIFE-FORM**
Nerodia sipedon williamengelsi	Carolina salt marsh snake	S		SC	G5T3	S3	marsh	reptile
Notropis bifrenatus	bridle shiner	LR		SC	G5	S1	water	fish
Nopturus furiosus	Carolina madtom	S		SC	G3T2Q	S2	water	fish
Nuphar saggitifolia	narrowleaf cowlilly	S		W1	G5T2	S2	water	plant
Ophisarus mimicus	**mimic glass lizard**	**S**	**FSC**	**SC**	**G3**	**S2**	**savanna**	**reptile**
Orconectes carolinensis	N.C spiny crayfish	LR		(PSC)	G3	S4	water	crustacean
Oxpolis ternata	Piedmont cowbane	S	FSC	W1	G3	S3	savanna	plant
Panicum tenerum	**Southeastern panic grass**	**LR**		**SR-P**	**G3**	**S3**	**savanna**	**plant**
Panopea bitruncata	Atlantic geoduck	LR		W3	G3?	S?	water	mollusk
Parietaria praetermissa	large-seed pellitory	S		SR-P	G3G4	S1	maritime	plant
Parnassia caroliniana	Carolina grass of parnassus	S	FSC	E	G3	S2	savanna	plant
Passerina ciris ciris	**Painted bunting**	**LR**	**FSC**	**SR**	**G5T3T4**	**S3B, SZN**	**maritime**	**bird**
Peltandra sagittifolia	**spoonflower**	**LR**		**SR-P**	**G3G4**	**S2S3**	**pocosin**	**plant**
Phalacrocorax auritus	**double-crested cormorant**	**LR**		**SR**	**G5**	**S1B,S5N**	**lake**	**bird**
Phragmitiphila interrogans	an owlet moth	LR		SR	G3G4	S2?	canebrake	insect
Pinguicula pumila	**small butterwort**	**LR**		**SR-P**	**G4**	**S2**	**savanna**	**plant**
Plagiochila miradorensis	A liverwort	LR		SR-P	G4?T4	SH	maritime	liverwort
Plantago sparsiflora	pineland plantain	S	FSC	E	G3	S1	savanna	plant
Platanthera integra	**yellow fringeless orchid**	**LR**		**T**	**G3G4**	**S1**	**savanna**	**plant**
Platanthera nivea	**snowy orchid**	**LR**		**T**	**G5**	**S1**	**savanna**	**plant**
Polygala hookeri	**Hooker's milkwort**	**S**		**SR-T**	**G3**	**S2**	**savanna**	**plant**
Polygonum hirsutum	**hairy smartweed**	**LR**		**SR-P**	**G4G5**	**S1**	**ponds**	**plant**
Ponthieva racemosa	**shadow-witch**	**LR**		**SR-P**	**G4G5**	**S2**	**swamp**	**plant**
Procambarus medialis	Tar River crayfish	S	FSC	W3	G2	S2	water	crustacean
Procambarus	**Croatan crayfish**	**LR**	**FSC**	**W3**	**G3**	**S2S3**	**water**	**crustacea**
Ptichodis bistrigata	southern ptichodis	S		SR	G3	S2S3	savanna	insect
Pyreferra ceromatica	annointed swallow moth	LR	FSC	SR	GU	S1S2	near stream	insect
Rana capito capito	**Carolina gopher frog**	**S**	**FSC**	**(PT)**	**G3T3**	**S2**	**savanna**	**amphibia**
Rhexia aristosa	awned meadow-beauty	S	FSC	T	G3	S3	pond	plant
Rhexia cubensis	**West Indies meadow beauty**	**LR**		**SR-P**	**G4G5**	**S1**	**pond**	**plant**
Rhynchospora Harperi	**Harper's beakrush**	**LR**		**SR-P**	**G4?**	**S1**	**pond**	**plant**
Rhynchospora macra	**Large beakrush**	**LR**		**E**	**G3**	**S1**	**savanna**	**plant**
Rhynchospora oligantha	**feather-bristle beakrush**	**LR**		**SR-P**	**G4**	**S2S3**	**savanna**	**plant**
Rhynchospora pleiantha	**coastal beaksedge**	**S**		**SR-T**	**G2**	**S1**	**pond**	**plant**
Rhynchospora scirpoides	**long-beak bald-sedge**	**LR**		**SR-O**	**G4**	**S2**	**pond**	**plant**
Rhynchospora thornei	Thorne's beaksedge	S	FSC	E	G1G2	S1	savanna	plant
Sagittaria graminea	**Chapman's arrowhead**	**S**		**SR-P**	**G5T3?**	**S1**	**pond**	**plant**
Sagittaria graminea	Chapman's arrowhead	S		SR-T	G5T2	S2	marsh	plant
Scirpus lineatus	**drooping bulrush**	**LR**		**SR-P**	**G4**	**S2**	**marl**	**plant**

Attachment F-1*: continued….Occurrence and status of sensitive and locally rare species on the CNF. (Species with a documented occurrence on the Forest are* ***highlighted****)*

		STATUS		RANK				
SCIENTIFIC NAME	**COMMON NAME**	**F.S.**	**U.S.**	**N.C.**	**GLOBAL**	**N.C.**	**dominant HABITAT**	**LIFE-FORM**
Scleria baldwinii	**Baldwin's nutrush**	**LR**		**SR-P**	**G4**	**S1**	**savanna**	**plant**
Scleria Georgiana	**Georgia nutrush**	**LR**		**SR-P**	**G4**	**S2**	**savanna**	**plant**
Seminatrix pygaea	**black swampsnake**	**LR**		**SR**	**G5**	**S2**	**ponds**	**reptile**
Semotilus lumbee	sandhills chub	S		SC	G3	S3	water	fish
Solidago gracillima	**graceful goldenrod**	**LR**		**W1**	**G4?**	**S3**	**savanna**	**plant**
Solidago Leavenworthii	**Leavenworth's goldenrod**	**LR**		**SR-P**	**G3G4**	**S1**	**savanna**	**plant**
Solidago pulchra	**Carolina goldenrod**	**S**	**FSC**	**E**	**G3**	**S3**	**savanna**	**plant**
Solidago verna	**spring-flowering goldenrod**	**S**	**FSC**	**SR-L**	**G3**	**S3**	**pinelands**	**plant**
Solidago villosacarpa	Coastal goldenrod	S		SR-L	G1	S1	maritime	plant
Spariniphaga carterae	Carter's spariniphaga	S	FSC	SR	G2G3	S2S3	savanna	insect
Sphagnum fitzgeraldii	**Fitzgerald's peatmoss**	**S**		**SR-T**	**G2G3**	**S2S3**	**pocosin**	**plant**
Spiranthes longilabris	**giant spiral orchid**	**S**		**SR-T**	**G3**	**S1**	**savanna**	**plant**
Strophitus undulatus	squawfoot	LR		T	G5G4	S2S3	water	mollusk
Synoptomys cooperi helaletes	Dismal Swamp S. bog lemming	LR		SR	G5T3	S2	pocosin	mammal
Teloschistes flavicans	sunrise lichen	S		SR-P	G3G4	S1	maritime	lichen
Thalictrum macrostylum	Piedmont meadowrue	S		W7	G3G4	S2?	bog	plant
Tofieldia glabra	**Carolina asphodel**	**S**	**FSC**	**W1**	**G3**	**S3**	**savanna**	**plant**
Toxolasma pullus	Savannah lilliput	S	FSC	(PE)	G2	S1	water	mollusk
Utricularia olivacea	**dwarf bladderwort**	**LR**		**T**	**G4**	**S2**	**pond**	**plant**
Xyris flabelliformis	**savanna yellow-eyed**	**LR**		**W1**	**G4**	**S3**	**savanna**	**plant**
Xyris stricta	a yellow-eyed-grass	LR		SR-P	G3G4	S1	savanna	plant

Attachment F-2. Definitions of Status and Rank

Forest Service Status (F.S.) is designated by the U.S. Forest Service. Sensitive and locally rare species are protected under provisions of the National Forest Management Act and direction set forth in FS manual 2670.

STATUS CODE	STATUS	DEFINITION
S	Sensitive	Species at risk of extinction in a portion of their range as evidenced by downward trends in population numbers or density, or downward trends in habitat capability.
LR	Locally Rare	Species not at risk of extinction, even in a portion of their range, and not showing a downward population trend over their range as a whole but uncommon on the CNF and within NC.

United States Status (U.S.) is designated by the U.S. Fish and Wildlife Service. Federally listed Endangered and Threatened species are protected under the provisions of the endangered Species Act of 1973, as amended.

STATUS CODE	STATUS	DEFINITION
C	Candidate	"Taxa for which the [Fish and Wildlife] Service has on file enough substantial information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened." (Federal Register, February 28, 1996). Taxa formerly considered as 'Category 1' are now considered as 'Candidate'.
FSC	(Federal) Species of Concern	"Such species are the pool from which future candidates for listing will be drawn." (Federal Register, February 28, 1996).

North Carolina Status is designated by the North Carolina Natural Heritage Program. Endangered, Threatened, and Special Concern species have legally protected status in North Carolina through the North Carolina Plant Conservation Program.

STATUS CODE	STATUS	DEFINITION
E	Endangered	"Any native or once-native species of wild animal whose continued existence as a viable component of the State's fauna is determined by the Wildlife Resources Commission to be in jeopardy or any species determined to be an 'endangered species pursuant to the Endangered Species Act." (Article 25 of Chapter 113 of the General Statues; 1987). "Any species or higher taxon of plant whose continued existence as a viable component of the State's flora is determine to be in jeopardy" (GS 19B 106: 202.12).
T	Threatened	"Any native or once-native species of wild animal which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range, or one that is designated as a threatened species pursuant to the Endangered Species Act."(Article 25 of Chater 113 of the General Statutes;1987). "Any resident species of plant which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (GS 19B 106:202.12).
SC	Special Concern	"Any species of wild animal native or once-native to North Carolina which is determined by the Wildlife Resources Commission to require monitoring but which may be taken under regulations adopted under the provisions of this Article." (Article 25 of Chapter 113 of the General Statutes; 1987). " Any species of plant in North Carolina which requires monitoring but which may be collected and sold under regulations adopted under the provisions of [the Plant Protection and Conservation Act]" (GS 19B 106:202.12).
P_	Proposed	Species has been proposed by a Scientific Council as a status (Endangered, Threatened, Special Concern, Watch List, or for Delisting) that is different from the current status, but the status has not yet been adopted by the General Assembly as law. In this document, these proposed statuses are listed in parentheses.
SR	Significantly Rare	Any animal species which has been listed by the N.C. Wildlife Resources Commission as an Endangered, Threatened, or Special Concern species, but which exists in the state in small numbers and has been determined by the N.C. Natural Heritage Program to need monitoring – OR - Plant species which are very rare in North Carolina, generally with 1-20 populations in the state, generally substantially reduced in numbers by habitat destruction (and sometimes also by direct exploitation or disease).
-L	Limited	The range of the species is **limited** to North Carolina and adjacent states (endemic or near endemic).
-T	Throughout	These species are rare **throughout** their ranges.
-D	Disjunct	The species is **disjunct** to North Carolina from a main range in a different part of the country or world
-P	Peripheral	The species is at the **periphery** of its range in North Carolina. These species are generally more common somewhere else in their ranges, occurring in North Carolina peripherally to their main ranges, mostly in habitats which are unusual in North Carolina
-O	Other	The range of the species is sporadic or cannot be described by the **other** Significantly Rare categories

North Carolina Status… continued

STATUS CODE	STATUS	DEFINITION
W	Watch List	Any other species believed to be rare and of conservation concern in the state but not warranting active monitoring at this time
W1		**Rare, but relatively secure:** includes rare species whose status in North Carolina is relatively well known and which appear to be relatively secure at this time.
W3		**Rare, but uncertain documentation:** includes species which have been reported from North Carolina without adequate documentation. This category includes sight records, old and vague reports for which no documentation has appeared, and, in a few cases, more recent literature reports for which the North Carolina Natural Heritage Program has not yet received documentation.
W7		Rare and poorly known: includes species with inadequate information about their distribution and rarity in North Carolina. These are generally species which have not been previously listed as rare in North Carolina, but which appear to be so, based on herbarium records and field experience of North Carolina Natural Heritage Program staff, contractors, and cooperating scientists.

Global Rank. A measure of rarity and threat that apply to the status of a species throughout its range, and are based on data on the species' status rangewide.

RANK	NUMBER OF EXTANT POPULATIONS	DESCRIPTION
G1	1-5	Critically imperiled globally because of extreme rarity or because of some factor(s) making it especially vulnerable to extinction.
G2	6-20	Imperiled globally because of rarity or because of some factor(s) making it very vulnerable to extinction throughout its range.
G3	21-100	Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g., a single physiographic region) or because of other factors making it vulnerable to extinction throughout its range.
G4	100-1000	Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.
G5	1000+	Demonstrably secure globally, though it may be quire rare in parts of its range, especially at the periphery.
GU	--	Possibly in peril range-wide, but status uncertain; need more information
G_Q	--	Questionable taxonomic assignment
T_	--	The rank of a subspecies or variety.

North Carolina Rank. A measure of rarity and threat that apply to the status of a species within the State.

RANK	NUMBER OF EXTANT POPULATIONS	DESCRIPTION
S1	1-5	Critically imperiled in NC because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state.
S2	6-20	Imperiled in NC because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state.
S3	21-100	Rare or uncommon in NC.
S4	100-1000	Apparently secure in North Carolina, with many occurrences
SH	0?	Of historical occurrence in NC, perhaps not having been verified in the past 20 years, and suspected to be still extant.
_B	1-?	Rank of the breeding population in the state. Used for migratory species only.
_N	1-?	Rank of the non-breeding population in the state. Used for migratory species only.
SZN	---	Population in the non-breeding seasons (generally in migration or in winter) is transitory, without any regular locales of occurrence whereby the species can be protected.

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FEIS APPENDIX G: Selection of Management Indicator Species

Introduction
The planning regulations (36 CFR 219.19) provide direction for the selection and use of management indicator species in forest planning. Direction includes the following:

- "In order to estimate the effects of each alternative on fish and wildlife populations, certain vertebrate and/or invertebrate species present in the area shall be identified and selected as management indicator species and the reasons for their selection will be stated. These species shall be selected because their population changes are believed to indicate the effects of management activities (219.19(1));
- "Planning alternatives shall be stated and evaluated in terms of both amount and quantity of habitat and of animal population trends of management indicator species."(219.19(2));
- "Population trends of the management indicator species will be monitored and relationships to habitat changes determined" (219.19(6)).

The following criteria were developed to guide the selection of MIS:

- Forestwide population changes are likely due to management activities;
- Represent the following categories where appropriate:
    1. Endangered and threatened plant and animal species identified on State and Federal lists,
    2. Species with special habitat requirements that may be influenced significantly by planned management programs,
    3. Species commonly hunted, fished, or trapped,
    4. Non-game species of special interest.
    5. Other plant or animal species whose population changes are believed to be appropriate indicators of the effects of management activities on other species of a major biological communities or water quality.
- Population trends can be estimated and monitored

Habitat Delineation

Habitats likely to be affected by planned alternatives were identified. Three separate classification systems were evaluated: the ecological classification system (ECS), the continuous inventory of stand condition (CISC), and habitat groupings by Hammel (1992).

The ecological classification system (see Plan, Appendix A) organizes the landscape into units having similar topography, geology, soil, climate, natural disturbance regimes, and plant communities. It provides information needed to predict biological responses, site potentials, and limitations.

The CISC data classifies land units according to the dominate canopy species using forest types of the Society of American Foresters. It is used for timber inventories and provides information about the current condition of forest types (tree species types), age, condition, and density.

The habitat groupings by Hammel are aggregates of CISC forest types and ages most likely to support various wildlife species. The mapped land units are the same as CISC.

The ECS and CISC were integrated by intersecting their mapped GIS layers. The results of this integration are shown in Table 3.20 (FEIS, Chapter 3, Plant Communities). The table shows serial stages of CISC cover types by ECS landtype. We considered this table a powerful tool for delineating habitat. It has the advantages derived from ECS, which includes the likely understory and overstory plant conditions, soils and moisture regimes, along with the CISC current seral stage condition of the canopy . Habitat groupings (CISC aggregates) were also integrated with ECS (Table 3.22, FEIS). When compared, the ECS/CISC and the habitat groupings (CISC aggregates) were similar. For analysis purposes, we used the ECS/CISC database to estimate effects of planning alternatives. The following table displays the current condition of habitats across the CNF.

Table G.1 Habitat delineation: Current Condition of Plant Communities by Landtype and seral stage.

LANDTYPE (Forest Type)	Seral Stage: Early	Mid	Late	Old Growth	Total
RAISED PEATLANDS					
Pond Pine	25,241	8,101	32,921	0	67,670
Other Pine	441	810	747	24	2,023
Hardwood	695	495	3,200	0	4,390
not classified = 1146 acres					
PEAT-MANTLED FORESTED WETLANDS					
Pond Pine	1,400	1,182	5,388	9,793	17,766
Loblolly and Longleaf Pine	815	2,341	4,500	75	7,730
Hardwoods	335	124	5,076	0	5,535
not classified = 811 acres					
XERIC to WET LONGLEAF PINE SAVANNAS AND FLATWOODS					
Longleaf Pine	1,033	2,434	5,743	263	9,475
Loblolly Pine and Pond Pine	1,431	4,604	6,584	0	12,019
Hardwoods	68	38	3,967	0	4,073
Not classified = 804 acres					
DRAINAGE HEADLANDS & BROAD INTERSTREAM FLATS					
Loblolly Pine and Pond Pine	500	1,637	4,537	0	6,675
Hardwoods	0	55	2,310	0	2,365
Longleaf Pine	19	60	1,030	0	1,109
Not classified = 263 acres					
LAKE AND STREAM SWAMPS					
Hardwood + Cypress	206	60	5,863	0	6,129
Pine	204	184	1,228	0	1,617
Not classified = 124 acres					
STREAM AND RIVER TERRACES & DRAINAGE SLOPES					
Hardwoods	0	0	1,730	0	1,730
Pines	111	479	1,214	0	1,804
Not classified = 158 acres					
TIDAL STREAMS AND ESTUARIES					
Current Condition	0	71	731	0	802
Not classified = 502 acres					
MARITIME RIDGES AND DUNES					
Current Condition	26	0	23	0	49

** Seral Stages: early = 0-10 years, mid = 11-50, late = 50+, old growth = 110+ for longleaf pine, 70+ for pond pine, 200+ for hardwoods. *NOTE* CISC age adjusted to reflect time since wildfire, e.g., raised peatlands have early seral habitat due to the Fish Day Fire.*

Management Activities and Habitat

Next, landtypes were categorized by most or least affected considering the degree of management activity anticipated in planning alternatives. Five of the landtypes would be most

affected by possible management activities. Appropriate MIS for those affected landtypes are displayed in Table G.2.

*Table G.2 Probable management practices and MIS**Error! Bookmark not defined.** by landtype.*

Most Affected Landtypes		
	Probable Management Practices	MIS
Longleaf Pine Savannas Drainage Headlands & Interstream Flats	RCW HMA, Pine Savanna Prescriptions, Longleaf restoration, prescribed fire, stand improvements, thinning, road maintenance, OHV trail construction, and maintenance	Red Cockaded Woodpecker Longleaf Pine/Wiregrass Community
Raised Peatlands	Wilderness or Bear Prescriptions,Prescribed Fire,mowing for soft mast, access restrictions,	Black Bear
Peat Mantled Forest Wetlands	Bear or Mixed Pine prescriptions, Mixed pine and pond pine regeneration, stand improvements, thinning, prescribed fire, road maintenance roadside mowing	
Stream and River Terraces	Upland Hardwood Management Prescription, Hardwood Restoration, road maintenance, grass/forb planting and maintenance	Wild Turkey
Least Affected Landtypes		
Lake and Stream Swamps	Hardwood Wetlands prescription: maintenance of openings, trails, construct canoe access points, Pocosin Lakes Prescription: maintain boat launches, construct parking areas or similar facilities	Monitor Habitat
Tidal Streams and Estuaries	Prescribed fire	Monitor Habitat
Maritime Ridges and Dunes	None	Monitor Habitat

Most Affected Landtypes. Habitat changes are focused in 5 landtypes as shown in Table G.2. Active management strategies vary by planning alternative to change vegetation composition and structure through time within these landtypes. Longleaf restoration goals, regeneration of mixed pine forests, and hardwood restoration goals in the alternatives comprise the greatest amount of active management. To accomplish these goals, a wide spectrum of treatments may be applied including (but not limited to) 2-age shelterwood group selection and clearcut harvesting, site preparation, planting, prescribed burning, thinning, midstory control by drum chopping, and more. The extent of activity can range from 600 to 6000 acres in the first planning period (10 years), and more in subsequent planning periods. Therefore, MIS are useful for gauging effects of planning alternatives for forestwide vegetation management goals.

Forestwide access management (roads and trails) planning strategies also vary by alternative and affect populations of MIS. Disturbance caused by motorized access, including off highway vehicles, may limit habitat use by species. Alternatives vary by amount of vehicle access, and notably, there are differences in how unauthorized roads and trails are handled among alternatives.

Least Affected Landtypes. A few landtypes have no active management practices, or, the management practices are limited in amount and distribution so that effects would not cause forestwide population changes. These landtypes are also displayed in Table G.2. Low-impact practices, such as, maintenance of existing improvements, designating canoe access trails, constructing a roadside parking area would not cause forestwide population trends to change, and therefore, MIS are not useful planning tools for estimating effects of alternatives

The neotropical migratory birds were dropped as MIS between the Draft EIS and Final EIS because their habitat occurs within the least affected landtypes. Although their population numbers are a significant issue, management of habitat (hardwood wetlands) on the CNF have few, low impact and relatively infrequent activities which would not affect population levels. Management of those habitats do not vary by alternative. And, a larger area than the CNF would be needed to determine meaningful population levels and trends. Current monitoring would continue as part of the Landbird Management Strategy (USDA, Forest Service, 2000) and population estimates and trends may be established at a regional scale. For the CNF, periodic monitoring of the habitat condition will be conducted.

Monitoring habitat, instead of a single species population, would be useful for managers. Monitoring the condition of landtypes least affected by management activities would check that habitats are progressing toward desired conditions.

Selection of Management Indicator Species

Management Indicator species are listed below with narratives describing how criteria for selection were met.

Red-cockaded woodpecker: Federally listed Endangered species.

- Non game species of special interest.
- Significant issue-many comments about sustainable population levels during scoping.
- Special habitat requires live cavity trees in a matrix of late successional, open pine savannas, preferably longleaf.
- Populations are directly affected by distribution and amount of habitat, which is tied to longleaf restoration goals and objectives, which vary by alternative.
- Population trend is well established through 10 years of monitoring using 100 percent population counts at the forestwide scale.
- Trend estimates vary by alternative.

Longleaf/Wiregrass Community Longleaf pine and wiregrass are plant species directly affected by longleaf restoration and maintenance practices, the central theme of the forest plan and plan alternatives.

- Captures overstory (longleaf pine), midstory, and understory (wiregrass) conditions for a systematic evaluation of management activity effects.
- Baseline population data at the forestwide scale acquired in 2001 using randomly selected plots. Remeasurement establishes the trend.
- Trend estimates and quality vary by alternative.
- Along with RCW, this plant community should provide information about conditions for an assemblage of species, such as, Bachman sparrow and southern fox squirrel.

Eastern black bear: Game Species. Significant issue-many comments about sustainable population levels during scoping. Special habitat requires hard and soft mast, but most important is a matrix of large areas with low levels of motorized disturbance.

- Populations affected by condition of pocosin habitats managed through prescribed fire, large tracts with low disturbance, corridors for migration, and access travel management planning.
- Also affected by gamelands hunting regulations, which are not controlled by the CNF.
- Monitored by NC Wildlife Resources Commission.
- Trend estimates derived using population index.
- Trends vary by alternative.

Wild Turkey: Game Species. Special habitat requires grasses and forbs and hardmast in a matrix of late successional forests.

- Sensitive to disturbance.
- Relationships to habitat well known and should provide indicators of grass/forb, hardwood and access management.
- Long term monitoring would indicate hardwood restoration goal achievements.
- Affected by gameland hunting regulations and restocking programs, which are not controlled by the CNF.
- Monitored by NC Wildlife Resources Commission.
- Trend estimates derived using population index.
- Trends vary by alternative

Aquatic Habitat

The assessment of forest and land management effects on associated aquatic environments is best accomplished by examining the biotic integrity of communities inhabiting the waters of concern. A fish community index of biotic integrity, which incorporates information about species richness and composition, trophic conditions, fish abundance and fish condition, is one such measure. This approach is widely used by both regulatory and resource management agencies at State and Federal levels. All regionally adapted versions or approaches are based upon the use of the metrics developed by Karr (1981). The North Carolina index of biotic integrity (NCIBI) summarizes the effects of all classes of factors influencing aquatic faunal communities (water quality, energy source, habitat quality, flow regime, and biotic interactions).

Unfortunately, the existing IBI is for wadeable fresh waters only as the samples are collected by electrofishing, and it is difficult to capture fish with this method in deep or colored waters. In marine and estuarine waters, fish community health is measured by total catch, catch per unit

effort, and abundance of juvenile fish. The State of North Carolina has long term monitoring in place to assess the health of marine and estuarine systems and the information is available to the Forest Service. Because of the complexity of sampling methods that measure harvest and catch per unit effort, and because there is no reasonable possibility for Forest Service land management activities to have any measurable influence on those large, complex ecosystems, no MIS or habitat monitoring is proposed for those systems.

Redfin pickerel (lakes), largemouth bass (ponds), and yellow bullhead catfish (swamp drainage) were selected as MIS in the Draft EIS, but have been dropped in the Final EIS. Active management regimes were not formulated for ecological types they represent. Population trends would not vary by alternative. The NC Wildlife Resources Commission monitor those species, and Forest Service biologists assist with the monitoring. For the CNF, habitat data for those ecological types would be obtained and tracked over time.

Forest Service biologists cooperate with other agencies to monitor aquatic habitat. Measuring several water quality data would provide the important information needed to determine how those ecological types are changing. These variables include but are not limited to: ph, salinity, dissolved oxygen, and conductivity. Changes in these variables would trigger more investigation about the possible causes and likely outcomes. Table G.3 displays the aquatic ecological types and the cooperative agency efforts.

Table G.3 Aquatic Ecological Type and Agency Monitoring

AQUATIC ECOLOGICAL TYPES	HABITAT MILES	QUANTITY ACRES	Agency Monitoring Habitat
1. Salt Water Sound	40		NC Dept of Marine Fisheries.
2. Large Tidal Rivers	35		NCWRC and FS.
3. Tidally Influenced Reaches of Large Creeks	16		NCWRC and FS
4. Non-tidal Mid Reaches of Large Streams	16		NCWRC and FS
5. Acidic, Upper Reaches of Large Streams	32.5		NCWRC and FS
6. Non-acidic Upper Reaches of Large Streams	35.5		NCWRC and FS
7. Large Pocosin Lakes		2,800	NCWRC and FS
8. Acidic Ponds		4.0	NCWRC and FS
9. Non-Acidic Ponds		10.0	NCWRC and FS
10. Estuarine Branches	17.2		NCWRC
11. Estuarine Creeks	1.8		NCWRC
12. Acidic First or Second Order Tributaries of Sounds and Rivers	32.4		NCWRC
13. Non-acidic First or Second Order Tributaries of sounds and Rivers	30.2		NCWRC
14. Tributaries to Large, Saline Creeks	5.7		NCWRC

FEIS APPENDIX H: Species Viability Evaluation For EIS Alternatives

Introduction

This document describes the purpose, methods, and results of a species viability evaluation for EIS alternatives developed for the Croatan National Forest (CNF) Land and Resource Management Plan, National Forests in North Carolina. Species viability is assessed within the context of National Forest Management Act regulations to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives." The viability evaluation incorporates concepts included in the Final Supplement Environmental Impact Statement for '*Amendment to the Survey & Manage, Protection Buffer, and other Mitigation Measures, Standards and Guidelines*' *– Volume I – Chapter 3&4- National Forests in Regions 5 and 6* (USDA Forest Service 2000), procedures presented in '*Expert Panels for Species Viability Evaluation for Preliminary Draft EIS Alternatives – National Forests in Wisconsin and Minnesota'* (USDA Forest Service 2002), and recommendations from Richard Holthausen – Wildlife Ecologist (USDA Forest Service – Washington Office, personal communication).

H.1. Purpose

The purpose for conducting this species viability evaluation is to determine the degree to which ecological conditions on national forest system lands contribute to the long-term viability (for a 50-year planning horizon) of species at risk[1]. More specifically, this evaluation provides an estimate of the likelihood that these species will persist on the CNF for a given period of time.

Requirements in the National Forest Management Act (NFMA)

Regulations in NFMA require National Forests to manage habitat in order "to maintain viable populations of existing native and desired non-native vertebrate species in the planning area". United States Department of Agriculture regulation 9500-4 extends this mandate to include vascular plants and wildlife species. A viable population is defined as "one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed in the planning area" (36CFR219.19). The regulations direct that "habitat must be provided to support, at least, a minimum number of reproductive individuals and that habitat must be well distributed so that those individuals can interact with others in the planning area." The planning area is defined as the USFS lands included in the Forest Plan and, for this analysis, includes all lands within the CNF proclamation boundary.

Relationship of USFS Viability Evaluations to Population Viability Analysis

[1] *federally threatened, endangered, proposed, & candidate species; USFS sensitive & locally rare species*

Definitions of population viability in the scientific literature have focused on the probability of a populations' persistence for a biologically meaningful period of time. For example, Soulé (1990) defines viability in terms of the capacity of the population to maintain itself without significant demographic or genetic manipulation for the foreseeable ecological future – centuries – with a degree of certainty and adaptation. Adaptation requires that the population "maintains a normal level of immediate fitness (individual vigor, fertility, fecundity) and has sufficient genetic variation to adapt by natural selection to changing environmental conditions within the predicted range of frequency and amplitude of disturbance and change of a species or population" Soulé (1990). Population vulnerability analyses (PVA) are used to estimate minimum viable populations (MVPs). These analyses consider the effects of demographic stochasticity, genetic stochasticity, environmental stochasticity, and catastrophes. They evaluate life history of the species (population), the temporal and spatial distribution of its resources, its level of genetic variation, and the consequences of habitat fragmentation (Gilpin and Soulé 1986). Shaffer (1981) defined MVP as "the smallest isolated population having a 99% chance of remaining extant for 1000 years despite the foreseeable effects of demographic, environmental, and genetic stochasticity, and natural catastrophes".

The role of PVA is to provide an assessment of the likelihood of species persistence to some specified point in time. However, the Forest Service must evaluate not only this output of PVA, but also the area and distribution within which the species persists. Because of the NFMA regulations that require habitat be provided to support well-distributed populations, the distribution of species persistence should be recognized explicitly in the assessment.

H.2. Methods

The species viability evaluation presented here is not a quantitative population viability analysis; it does not employ explicit models of genetic or demographic risk to species. The information needed to complete such an assessment is lacking, especially for rare species, i.e., species at risk. This information would include demographic characteristics such as age-specific survival and fecundity, immigration, emigration and trends over time in these parameters (Lebreton et al. 1992) and genetic considerations such as the type of genetic variation most important to preserve (Boyce 1992). Long-term demographic data is available for only one species on the CNF, the red-cockaded woodpecker (*Picoides borealis*); an additional quantitative viability analysis for this species is included in Attachment H-10.

The species viability evaluation presented here is a reasoned series of judgments, reviewed by species experts[2], about projected amounts and distributions of habitat and the likelihood that such habitat would allow populations of selected species to remain well-distributed over the long run (USDA 2000, 2002). The evaluation, therefore, meets the essential criterion of a population viability analysis, to provide an estimate of the likelihood that a population will persist in a given geographic distribution for a given period of time.

The viability evaluation includes the following steps: 1) identifying species at risk, 2) data acquisition, synthesis, and summary, 3) comparing current, historic, and future patterns of

[2] List in Attachment H-1

species distribution, and 4) determining management "outcomes" and likelihood of species persistence.

H.3. Identifying Species at risk

Species vulnerability and conservation priorities identified by the U.S. Fish and Wildlife Service (USFWS), N.C. Natural Heritage Program (NCNHP), and USFS were used to identify 66 species at risk (Attachment H-2; H-9) that occur or have historically occurred on the CNF. The following categories were included in this list:

1. species at the greatest risk of extinction and listed by the USFWS as threatened, endangered, proposed, or federal candidates,
2. species at risk of extinction in a portion of their range as evidenced by downward trends in population numbers or density, or downward trends in habitat capability and listed by the USFS Regional Forester as sensitive (normally G1, G2, and G3 global ranking), and
3. species not at risk of extinction that do not show downward trends in population number over their range as a whole but are uncommon on the CNF and add to the biological diversity in the planning area (normally NCNHP S1, S2, and S3 State ranking).

H.4. Data Acquisition, Synthesis, and Summary

The following species habitat information was considered in this assessment: (*Source*: USFS Geographic System (GIS), (USDA 2002b): Ecological Classification of Onslow, Jones, Carteret, and Craven Counties, streams, roads, water bodies; Pre-settlement Vegetation and Natural Fire Regimes on the Croatan National Forest (Frost 1996); Flora of the Carolinas and Virginia (Weakley 2002); Pre-settlement Vegetation Community Types of Camp Lejeune Marine Corp Base (2002); North Carolina Natural Heritage Program element occurrence records (EOs) in GIS (2001); North Carolina Natural Heritage Program list of rare animal species of North Carolina (2001); North Carolina Natural Heritage Program list of rare plant species of North Carolina; NatureServe 2001: and NatureServe's 2001Biological Conservation Database (TNC 2001, 1982). These data are summarized in Attachments H-3, H-4, and H-9.

1. Species range-wide distribution and state rank;
2. Risk category;
3. Primary habitat association;
4. Habitat specificity;
5. Fragmentation of habitats within the CNF proclamation boundary in comparison; to pre-settlement condition;
6. Extent of potential primary habitat on the CNF;
7. Regional population (number of occurrences on all ownerships in a 4-county area, on the CNF, and on the CNF and the Camp Lejeune Marine Corp Base;
8. Local population (number of EOs with > 100 individuals and > 1000 individuals);
9. Distribution of populations on the CNF relative to ecological units at the Landtype Association level;

10. Number of populations within Natural Areas, Old Growth areas, the Red-Cockaded Woodpecker Habitat Management Area, Wilderness, and the Hardwood-Cypress wetlands management prescription (the "coarse filter") by EIS alternative.

H.5. Comparing Historic, Current and Future Patterns of Biological Distribution

The historic distribution of species in the planning area was considered the environmental baseline to evaluate current conditions and to compare the effect of USFS management alternatives on future conditions. In order to serve as a baseline for comparison of species viability, it was assumed that the natural history of the species resulted in historic distributions that followed many different patterns but that these reference distributions were "well distributed". For purposes of this analysis, well-distributed means "distributed sufficient to permit normal biological function and species interactions, considering life history characteristics of the species and the habitat for which it is specifically adapted" (USDA Forest Service 2000). Therefore, if the current or projected distribution of a species approximates its reference distribution, then the species could be considered "well-distributed". This would apply to species with reference distributions that range from isolated sites (very restricted range) to those that are relatively widespread and to all possible intermediate patterns having varying degrees of habitat connection.

Reference distribution is based on available information about habitat associations, occupancy of suitable habitats, the extent of potentially suitable habitats, and the inferred historic habitat distribution within the CNF proclamation boundary. Historic refers to the time period before European settlement but within the same general climatic conditions found today on the CNF. The CNF is a relatively young landscape; vegetation types stabilized less than 9,000 yrs BP (Ingram and Otte 1981; Otte 1981; Ash et al. 1983).

Each species at risk was evaluated separately and its historic, current, and future distribution under each Plan alternative was described as occurring in one of four distinct patterns (USDA Forest Service 2000 and 2002). We avoided a potential tendency to consider the best possible distribution that would facilitate population connectivity by paying close attention to the fact that all distribution patterns are not applicable to all species. Species were included in one of the following four distribution patterns:

1. **Isolated sites** – Relatively few, highly isolated sites or populations, with little to no potential for gene flow between them; may be known from a single site. There is a strong potential for extirpations within many of the patches, and little likelihood of re-colonization of such patches.

2. **Isolated site clusters** – Distributed as groups or clusters of occurrences or subpopulations, with some potential for dispersal and/or gene flow within the groups but little potential for dispersal or gene flow between the isolated clusters. While some of the subpopulations associated with these ecological conditions may be self-sustaining, there

is limited opportunity for population interactions among many of the suitable environmental patches.

3. **Limited connectivity among multiple sites and/or clusters** - Groups or clusters of occurrences or subpopulations with intra-cluster connectivity and some potential (based on species-specific spatial scale or configuration, over appropriate time periods) for connectivity among isolated sites or isolated site clusters. Connectivity may occur through intervening suitable habitat, refugia, or secondary dispersal habitats. There is opportunity for subpopulations in most of the species range to interact as a metapopulation, but some subpopulations are disjunct or of such low density that they are essentially isolated from other populations.

4. **Multiple avenues of connectivity among sites and clusters** – Multiple sites and/or clusters of sites within a web of potential inter-connections; includes multiple potential connectivity pathways occurring in diverse landscape and habitat conditions that may include natural gaps in distribution and suitable habitats. Disjunct areas of suitable ecological conditions are typically large enough and close enough to permit dispersal among subpopulations and potentially to allow the species to interact as a metapopulation across its range.

H.6. Evaluating Management Effects on Future Species Stability and Distribution

The distribution of suitable habitats to support species at risk and the likelihood that these species will persist on the CNF is dependent on a number of factors. These factors include the change in reference (historic) distribution patterns, the number and distribution of suitable habitats on the CNF and surrounding areas, the existing population size and distribution, and the minimum habitat and genetic interchange needed for species to persist for a biological meaningful period of time. For this analysis, the effects of management actions combined with these factors are termed "outcomes".

It was assumed that the difference between a species reference (historic) distribution and its current distribution is due primarily to habitat loss and fragmentation and that this could have a major effect on species persistence on the CNF. Deterministic events such as habitat loss can bring a population into a size range where rather frequent or probable stochastic events can easily terminate it (Gilpin, Soulé 1986). Loss of habitat has been a major factor in the extinction of a number of tropical plant species (Gentry 1986) and is likely the cause of species declines in the highly altered landscapes of the near-subtropical Southeastern Coastal Plain of which the CNF is a part. Species persistence, however, is also affected by alteration of habitat quality and suitability, which can reduce species fitness and subpopulation size and may aggravate fragmentation effects. Although habitat condition and therefore species fitness can be improved through management, habitat loss is permanent.

In evaluating the probable outcomes of changes in species reference condition, and the effect of future management options, population stability was also considered. A species with a stable population is defined as one that "over time, maintains population numbers, given inherent levels

of population fluctuation and variability of habitats to which they are adapted" (USDA 2000). Thus, a species may become stable at a "different population level than the current or (inferred) historical level" (USDA 2000).

For the four distribution patterns above, substantial alteration of the reference distribution may be indicated, in general, by the following.

1. For a species distributed in isolated sites, loss of any sites might be considered a dire condition and assessed as becoming not well distributed.

2. Loss of single sites, multiple sites, or clusters that serve a significant role for population persistence or in the species' biological diversity might result in a determination of not well distributed, depending on total number and distribution of sites and clusters across the species range.

3. A result of not well distributed normally results only from loss of sites or clusters that affect overall population persistence, such as source subpopulations, those within connectivity areas, or loss of genetic and biological diversity of the population. Loss of a cluster for species with few clusters, relative to species range, distribution, and effective population size, could result in a species becoming not well distributed.

4. It might be possible for species in this pattern to remain well distributed with numerous losses of non-significant sites and connections among sites and some gaps in distribution. However, fragmentation could be a serious risk to population stability and the projected distribution pattern need not completely change to the limited connectivity category for it to become not well distributed.

To provide for an objective comparison of the projected effects of the alternatives, a series of "outcomes" were described to synthesize available knowledge about species distribution and population stability into five categories. The following categories or "solutions" serve as the estimate of the likelihood that a species population will persist on the CNF for the planning horizon under the different alternatives:

- **Outcome A**: Habitat (including known sites) is of sufficient quality, abundance and distribution to allow species to stabilize in a pattern similar to reference distribution.

- **Outcome B:** Habitat (including known sites) is of sufficient quality, abundance, and distribution to allow species to stabilize in a pattern altered from reference distribution with some limitations on biological functions and species interactions.

- **Outcome C:** Habitat (including known sites) is the minimum quality, abundance, or distribution to allow species to stabilize but in a pattern highly altered from reference distribution with major limitations on biological functions and species interactions. Loss of any sites that provide linkage could result in habitat insufficient to support stable populations of the species.

- **Outcome D:** Habitat (including known sites) is insufficient to support stable populations of the species.

- **Outcome E:** Information is insufficient to determine an outcome.

H.7. Results and Discussion

Historic, Current, and Future Patterns of Biological Distribution

In general, there has been an alteration of the reference distribution for all species at risk found on the CNF. This is due primarily to habitat modification and fragmentation resulting from urban development, highway construction, and intensive agricultural practices on private land within the planning area and to a lesser extent from past forest management practices on USFS administered land within this area. Nearly ½ of the approximately 300,000 - acre landscape within the USFS proclamation boundary is currently in private ownership (Attachment H-5). Habitat alteration and fragmentation within this area has decreased the capability of sites to support many species at risk by reducing potential dispersal between once connected sites and between those historically more isolated sites and site clusters. Specifics results of this evaluation, for each species at risk, are summarized in Attachment H-6 and H-9.

There are no species at risk that are currently distributed in a quantity or pattern that would approximate their reference (historic) distribution. Although two species were placed in a distribution pattern category the same as their reference condition, these species historically occurred in isolated marl outcrops (distribution pattern 1) (*Asplenium heteroresiliens, Cystopteris tennesseensis*) and continue to occur in isolated sites. However, these sites have been further isolated by habitat loss and fragmentation. These species might approximate the reference distribution pattern but habitat in the proclamation boundary is so reduced that connectivity between habitats has been significantly altered.

Habitat fragmentation or alteration has also affected 21 other species that were historically distributed in isolated site clusters and are now distributed as more isolated sites having reduced potential for dispersal and/or gene flow within the groups. These species occur in rare habitats such as limesink ponds, forests underlain by marl, and other specialized habitats (Attachment H-6 and H-9).

Most of the other species at risk are currently distributed in a pattern that is very different from their reference distribution, i.e. their current distribution category is two levels "below" their reference distribution. Twenty-seven (nearly ½) of the CNF's species at risk were historically distributed in multiple sites and/or clusters, having limited connectivity because of the inherent ecosystem pattern typical of landscapes in the Southeastern Coastal Plain (distribution pattern 3). These sites historically had opportunities for subpopulations in most of the species range to interact as metapopulations but are now distributed as relatively few, highly isolated sites or populations, with little or no potential for gene flow between them (distribution pattern 1, -- 23 species), or as isolated site clusters (distribution pattern 2 -- four species).

Of greater concern are 11 species that historically had the best possible distribution that could facilitate population connectivity (distribution pattern 4) but now occur in isolated site clusters (distribution pattern 2 - 8 species) or, based on current information, occur in isolated sites (3 species). Only the Croatan Crawfish (*Procambarus plumimanus*), a narrow endemic, and the American alligator (*Alligator mississippiensis*) that were once distributed on sites with multiple avenues of connectivity (distribution pattern 4), occur among multiple sites and/or site clusters with an opportunity for subpopulations to interact as metapopulations. (distribution pattern 3).

Management Outcomes based on Species Distribution and Stability

Based on the available data, it was concluded that the major factors controlling species "outcomes" are: 1) the degree and type of alteration of historic distribution, 2) the abundance of suitable and potentially suitable habitat, 3) the current number and distribution of populations and subpopulations on the CNF, 4) the "contribution" from populations on adjacent private land and their potential interaction with CNF populations, and 5) the extent of habitat improvement and maintenance activities projected for different management alternatives. A key/decision tree was developed using these factors to guide the process for making decisions and to make these determinations more consistent. The results of this evaluation, for each alternative, are summarized in Attachments H-8 and H-9, and the key is presented in Attachment H-7.

In general, habitat loss, fragmentation, alteration of historic distribution patterns, and reduced population / subpopulation size has reduced the potential for management activities to provide future well-distributed habitats and stable populations on the CNF for most species at risk. However, it is anticipated that nearly three-quarters of these species will have enough improvement in habitat quality, abundance, and distribution to increase their likelihood of persistence in the planning area.

Under current conditions and management emphasis, only the red-cockaded woodpecker, American alligator and the Croatan crawfish (*Procambarus plumimanus*) have stable and well-distributed populations on the CNF. Although altered from reference distribution, habitat is of sufficient quality, abundance, and distribution to enable these species to persist on the CNF with some limitations on biological functions and species interactions. This would also be true for two other relatively wide-spread species: branched gerardia (*Agalinis fasciculata*), and spring-flowering goldenrod (*Solidago verna*) but current management practices may not provide sufficient linkages to source populations. These conditions are expected to improve during implementation of the Plan therefore changing the current condition - "outcome" C, to "outcome" B.

Similarly, the expected improvement in habitat quality, abundance, and distribution resulting from management actions (especially in pine savanna) should result in more stable future populations for 13 other species, i.e. movement from "outcome" C to "outcome" B. These species currently exist in conditions where loss of any sites that provide genetic linkage could result in unstable populations. Except for the gopher frog (*Rana capito*) they were historically distributed in multiple sites with multiple connectivity pathways (distribution Category 4) or among multiple sites and/or site clusters with opportunities for subpopulations in most of the species range to interact as metapopulations (Category 3). Currently they occur as isolated sites

or isolated site clusters separated by potential habitat of only moderate to poor quality that could be improved through habitat management.

Habitat for 32 species at risk is currently considered insufficient to support stable populations on the CNF but is expected to improve in quality, abundance, and distribution to at least minimum levels (current "outcome" D, to "outcome" C). Most of these species were historically distributed among multiple sites and/or site clusters with opportunity for subpopulations to interact as metapopulations but now occur as isolated sites with little potential for gene flow between them because of intervening unsuitable habitat. These species have a greater probability of persisting on the CNF because of planned future management activities that would improve the conditions of these habitats. This improvement depends, in part, on the condition and linkages to adjacent populations on private land or other public lands.

For 12 species, the expected improvement in habitat quality, abundance, and distribution resulting from any currently known management alternative is insufficient to change their likelihood of persistence on the CNF. Six species would remain at "outcome" C with habitat remaining at the minimum quality abundance, and distribution to allow these species to stabilize but with major limitations on biological functions and species interactions. Six species would remain at "outcome" D with habitat considered insufficient to support stable populations. This is not expected to change under any management alternative for several reasons. Three of these species are habitat specialists and are extirpated from the CNF; one of which, *Lejeunea bermudiana* – a liverwort is now considered only a historic element in North Carolina. The other two species, Leavenworth's goldenrod (*Solidago leavenworthii*) and Hairy smartweed (*Polygonum hirsutum*) have not been observed on the CNF since 1991 and 1976 respectively. The remaining species are also habitat specialists that occur in very rare habitats or rare microhabitats, such as limesink ponds, savanna ecotones with pine barrens reedgrass, or in the maritime zone (Attachment H-2). These habitats are equally rare on private lands and even if the few remaining undeveloped sites in the proclamation boundary were purchased by the USFS, they would not be sufficient to meaningfully improve the likelihood of species persistence on the CNF. Although we investigated all possible combinations of management actions, no alternatives can be developed to ensure the viability of these species due to lack of habitat and no means to increase the habitat through restoration.

Information is insufficient to determine an outcome for four species at risk, all insects: Berry's skipper (*Euphyes berryi*), the two-spotted skipper (*Euphyes bimacula*), a dagger moth (*Acronicta sinescripta*), and the Annoted sallow (*Pyreferra ceromatica*)

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Attachment H-1: Species Experts – Review and Input of Assessment Results

Species Group: Amphibians and Reptiles
Alan J. Ratzlaff: Biologist, USDI Fish and Wildlife Service, Region 4, Asheville, NC

Species Group: Birds
John O. Fussell: Consulting Biologist and Author of "A Birder's Guide to Coastal North Carolina", New Bern, North Carolina.

Species Group: Crustaceans
Robert Butler: Biologist, USDI Fish and Widlife Service, Region 4, Asheville, NC

Species Group: Insects
Stephen P. Hall: Invertebrate Zoologist, North Carolina Natural Heritage Program, Division of Parks and Recreation, N.C. Department of Environment and Natural Resources, Raleigh, NC

Species Group: Vascular and Non-Vascular Plants
Alan S. Weakley: Curator of Herbarium at University of North Carolina at Chapel Hill, North Carolina.

Allison E. Weakley: Consulting Botanist, Chapel Hill, North Carolina

Attachment H-2: Species at Risk and Habitat Relationships

SCIENTIFIC NAME	COMMON NAME	HABITAT
BIRDS		
Aimophila aestivalis	Bachman's sparrow	open longleaf pine forests, old fields
Ammodramus henslowii	Henslow's sparrow	clearcut pocosins and other damp weedy fields
Anhinga anhinga	Anhinga	wooded lakes or ponds, or open swamps (for nesting)
Haliaeetus leucocephalus	bald eagle	mature forests near large bodies of water (nesting); lakes & sounds
Phalacrocorax auritus	Double-crested Cormorant	lakes with scattered trees for nesting
Picoides borealis	red-cockaded woodpecker	mature open pine forests, mainly in longleaf pine
CRUSTACEANS		
Procambarus plumimanus	Croatan crawfish	rivers, ponds, ditches, and borrow pits
HERPETOFAUNA		
Alligator mississippiensis	american alligator	fresh to slightly brackish lakes, ponds, rivers, and marshes
Crotalus adamanteus	E. diamondback rattlesnake	pine flatwoods, savannas, pine-oak sandhills
Ophisaurus mimicus	mimic glass lizard	pine flatwoods, savannas, pine/oak sandhills
Rana capito capito	Carolina gopher frog	breeds in temporary fish-free pools; forages in pine-oak sandhills
Seminatrix pygaea	Black swampsnake	lush vegetation of ponds, ditches, or sluggish streams
INSECTS		
Atrytone arogos arogos	arogos skipper	wet savannas with pinebarrens reedgrass
Euphyes berryi	Berry's skipper	wet areas near ponds, canals, or marshes
Euphyes bimacula	two-spotted skipper	marshes, wet savannas, sedgy areas near wet woods
PLANTS		
Agalinis aphylla	scale-leaf gerardia	wet savannas and sandhill/pocosin ecotones
Agalinis fasciculata	branched gerardia	savannas
Andropogon mohrii	bog bluestem	wet savannas
Asclepias pedicellata	stalked milkweed	dry savannas and moist flatwoodss
Asplenium heteroresiliens	Carolina spleenwort	shaded coquina limestone outcrops (marl)
Carex basiantha	S. Willdenow's Sedge	moist to wet forests over coquina limestone (marl)
Cystopteris tennesseensis	Tennessee bladder-fern	shaded calcareous rock outcrops (marl)
Dionaea muscipula	Venus flytrap	savannas, seepage bogs, pocosin edges
Eleocharis robbinsii	Robbins's Spikerush	limesink ponds, clay-based Carolina bays, peat-burn lakes, ponds
Lachnocaulon beyrichianum	Southern bogbutton	sandhills, sandhill/pocosin ecotones
Lejeunea bermudiana	a liverwort	marl outcrops, decaying logs or tree bases in blackwater swamps
Litsea aestivalis	Pondspice	limesink ponds and other depression wetlands
Ludwigia linifolia	flaxleaf seedbox	limesink ponds
Lysimachia asperulifolia	rough-leaved loosestrife	savanna/pocosin ecotones, pocosins
Malaxis spicata	Florida adder's mouth	maritime swamp forests, calcareous but mucky outer coastal swamps
Myriophyllum laxum	loose watermilfoil	limesink ponds, waters of natural lakes
Panicum tenerum	Southeastern panic grass	limesink ponds, wet savannas, sandhill seeps
Peltandra sagittifolia	Spoonflower	pocosins, other wet, peaty sites
Pinguicula pumila	small butterwort	savannas
Platanthera integra	yellow fringeless orchid	wet savannas
Platanthera nivea	snowy orchid	wet savannas
Polygala hookeri	Hooker's milkwort	savannas
Polygonum hirsutum	Hairy smartweed	limesink ponds, clay-based Carolina bays, drawdown zones of rivers
Ponthieva racemosa	shadow-witch	blackwater forests and swamps especially over marl
Rhexia cubensis	W. Indies meadow beauty	limesink ponds
Rhynchospora harperi	Harper's beakrush	limesink ponds and cypress savannas
Rhynchospora oligantha	feather-bristle beakrush	wet savannas, seepage bogs
Rhynchospora pleiantha	Coastal beaksedge	limesink ponds
Rhynchospora scirpoides	long-beak bald-sedge	limesink ponds, beaver ponds, wet savannas
Sagittaria graminea chapmanii	Chapman's arrowhead	limesink ponds
Scirpus lineatus	drooping bulrush	low rich woods over marl
Scleria baldwinii	Baldwin's nutrush	wet savannas
Scleria georgiana	Georgia nutrush	wet savannas
Solidago gracillima	Graceful goldenrod	savannas, boggy sites, peaty places
Solidago leavenworthii	Leavenworth's goldenrod	savannas, pocosin borders, clay-based Carolina bays, peaty seeps
Solidago pulchra	Carolina goldenrod	savannas
Solidago verna	spring-flowering goldenrod	mesic savannas, other mesic to moist pinelands, pocosin ecotones
Sphagnum fitzgeraldii	Fitzgerald's peatmoss	pocosins and wet savannas
Spiranthes longilabris	giant spiral orchid	wet savannas
Tofieldia glabra	Carolina asphodel	wet savannas, sandhill seeps, moist sandhill/pocosin ecotones
Urtricularia olivacea	Dwarf bladderwort	limesink ponds, beaver ponds
Xyris flabelliformis	Elliott's yellow-eyed grass	savannas
Xyris stricta	savanna yellow-eyed grass	wet savannas

Attachment H-3: Species Range-wide Distribution and State Rarity

SCIENTIFIC NAME	Rangewide Distribution and state rank[1]													
	NC	SC	GA	FL	AL	MS	LA	TX	VA	TN	KY	AR	OK	OTHER STATES
BIRDS														
Aimophila aestivalis	S3	S3	S3	S3	S3	S3	S3	S3	S1	S2	SX	S3	S2	DC-SX,IL-SX,IN-SX,MD-SH,MO-S1,OH-
Ammodramus henslowii	S2	S?	S3	S?	S2	SZ	S3	S2	S1	S1	S3	S1	S2	CT-SH,DE-SH,DC-S2,IL-S2,IN-S3,IA-S, 14
Anhinga anhinga	S2	S?	S5	S?	S3	S4	S5	S1	SN	S1	SX	S3	S1	MO-SX
Haliaeetus leucocephalus	S3	S2	S2	S3	S3	S1	S2	S3	S2	S3	S1			all other states
Phalacrocorax auritus	S1	S?	S5	S?	SA	S4	S2	S3	S1	S2	SH			all other states
Picoides borealis	S2	S2	S2	S2	S2	S1	S2	S2	S1	SX	S1	S2	S1	MY-SH, MO-SX
CRUSTACEANS														
Procambarus plumimanus	S3													
HERPETOFAUNA														
Alligator mississippiensis	S3	S5	S4	S4	S4	S4	S5	S4				SH	S4	
Crotalus adamanteus	S1	S3	S4	S3	S3	S3								
Ophisaurus mimicus	S2	S?	S2	S?	S2	S2								
Rana capito capito	S2	S2	S?											
Seminatrix pygaea	S2	S?	S3	S?	S2									
INSECTS														
Atrytone arogos arogos	S1	S1	SX	S1	S1	S1	S1		S1					NJ-S1
Euphyes berryi	S1	S?	SU	S4										dist. poorly known
Euphyes bimacula	S1	S1	S1		S?				S2					CT-SH,DC-S?,IL-S2,IN-S2,KS-S?, + 11 NE
PLANTS														
Agalinis aphylla	S3	S?	S3	SR	S2	S2	S1							
Agalinis fasciculata	S2	SR	S5	SR	SR	SR	SR	SR	SU	SR	S4	SR	SR	DE-SH,ILS?,IN-S3,KS-S2,MD-S1, 3 others
Andropogon mohrii	S1	S?	S2	S?	SR	S4	S?		SH					
Asclepias pedicellata	S2	S1	S2	S?										
Asplenium heteroresiliens	SR	SR	SR	S1										
Carex basiantha	S1	SR	SR	SR	SR	SR	SR			SR		S2	SR	
Cystopteris tennesseensis	S1		S1		S2				S1	SR	S?	S?	SR	DE-S1,IL-SR,IN-SR,KS-SR,MD-S1, 2 others
Dionaea muscipula	S3	S1												
Eleocharis robbinsii	S2	S?	S3	SR	S1	S2			S1					CT-SR,DE-S3,IN-S2,ME-SR,MD-S1,MA-SR, 9
Lachnocaulon beyrichianum	S2	S?	S1	S2	SR									
Lejeunea bermudiana	SH		S?	S?	S?	S?				S?				Bermuda N?
Litsea aestivalis	S2	S3	S2	S2			SR		S1					MD-S1
Ludwigia linifolia	S2	S?	SR	SR	S?	SR								
Lysimachia asperulifolia	S3	S1												
Malaxis spicata	S1	S?	S1	S?					S3					
Myriophyllum laxum	S1	S2	S2	S3	S2	S1								
Panicum tenerum	S3	SR	S1	SR	SR	SR	S1	SR						West Indies
Peltandra sagittifolia	S2	S?	S2	S3	S2	S2	SR		SU					
Pinguicula pumila	S2	SR	S4	S?	S1	SR	SR	SR					S1	
Platanthera integra	S1	S2	S2	S3	S2	S3	S2	S1	SP	S1				MD-SR,NJ-S1
Platanthera nivea	S1	SR	S3	S3	S2	SR	SR	SR	SR	S1		SR		DE-SH,MD-SR,NJ-SH
Polygala hookeri	S2	S1		S1	S1	S1		S2						
Polygonum hirsutum	S1	SR	SR	SR	SR	SR								
Ponthieva racemosa	S2	S?	S2	S?	S2	S2	S2	SR	S3	S1				
Rhexia cubensis	S1	SR	SR	SR	SR	SR	SR							West Indies
Rhynchospora harperi	S1	S?	S1	S4	S1	S1								MD-S1,DE-S1
Rhynchospora oligantha	S2	S?	S1	SR	SR	SR	SR	SR	S1					DE-SH,NJ-S2
Rhynchospora pleiantha	S1	S?	SH	SR	S1		SR							
Rhynchospora scirpoides	S2	SR	S2	SR	SR	S3	S1	SR	S1			S1		IN-S2,MI-S2,WI-S1,MD-S2, + 6 NE states
Sagittaria gram. chapmanii	S1		S3	SR	SR	SR	SR							
Scirpus lineatus	S2	SR	SR	SR	SR	SR	SR	SR	S3					CO-SE, MA-SR,MN-SR,WVA-S?
Scleria baldwinii	S1	S1	SR	S?	SR	S4	SR	S1						

Attachment H-3: Species Range-wide Distribution and State Rarity (continued)

SCIENTIFIC NAME	Rangewide Distribution and state rank[1]												
	NC	SC	GA	FL	AL	MS	LA	TX	VA	TN	KY	AR	OK	OTHER STATES
Scleria georgiana	S2	SR	SR	SR	SR	SR	SR	SR						
Solidago gracillima	S1	SR	SR	SR	SR				S2	SR	S2			WVA-SR
Solidago leavenworthii	S1	SR	SR	SR										
Solidago pulchra	S3	S?												
Solidago verna	S3	S1												
Sphagnum fitzgeraldii	S2	S1		S1										
Spiranthes longilabris	S1	S?	S1	S3	S1	S2	SR	S1	SR					
Tofieldia glabra	S3	S?	SR											
Urtricularia olivacea	S2	S1	S1	SR	S1	S1			S1					NJ-S1
Xyris flabelliformis	S1	SR	S3	SR	SR	SU	SR							
Xyris stricta	S1	SR	S4	SR	S?	S?	S1	S1						

S1= Critically imperiled in State because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state (1-5 extant populations)
S2= Imperiled in State because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state (6-20 extant populations).
S3 = Rare or uncommon in State (21-100 extant populations)
S4 = Apparently secure in State (100-1000 extant populations)
S5 = Demonstrably secure in State (1000+ extant populations)
S? = unranked, or rank uncertain
SH = Of historical occurrence in State, perhaps not having been verified in the past 20 years, and suspected to be still extant.
SN = Rank of non-breeding population in the State
SRs = Significantly Rare in State (1-20 populations)
SU = Possibly in peril in State but status uncertain; need more information
SX = apparently extirpated from State
SZ = Population is not of significant conservation concern

Attachment H-4: Habitat Factors, Regional and Local Population, and Habitat Protection

SCIENTIFIC NAME	USFS Status[1]	# of States[2]	Habitat Factors				Regional Population (EOs)[6]			Local Population			Habitat Protection					
			Primary Habitat	Specificity[3]	Fragmtation[4]	Area 1000s ac[5]	4-County[7]	Public land[8]	Croatan NF	> 100 individuals[8]	> 1000 individuals	Distribution[10]	# of EOs in coarse filter[11] by -------Alternative --------					
													A	B	C	Cm	D	E
BIRDS																		
Aimophila aestivalis	S	19	savannas	R	56%	27	39	37	12	0	0	w1p2	2	12	12	12	2	12
Ammodramus henslowii	LR	31	costl.prairie	B	17%	74	3	2	1	0	0	i	0	1	1	1	0	1
Anhinga anhinga	LR	14	water	B	46%	6+	3	1	1	0	0	i	1	1	1	1	1	1
Haliaeetus leucocephalus	T	all	water	B	46%	6+	6	1	1	0	0	i	1	1	1	1	1	1
Phalacrocorax auritus	LR	all	lakes	B	27%	5.1	2	1	1	0	0	i	1	1	1	1	1	1
Picoides borealis	E	14	savannas	R	56%	27	144	108	62	0	0	w4p2	62	62	62	62	62	62
CRUSTACEANS																		
Procambarus plumimanus	LR	1	water	B	46%	6+	?	?	6	0	0	w4	0	0	0	0	0	0
HERPETOFAUNA																		
Alligator mississippiensis	T/A	10	water	B	46%	6+	44	21	10	0	0	w3	2	10	10	10	2	10
Crotalus adamanteus	LR	6	savannas	R	56%	27	9	8	2	0	0	p2	0	1	1	1	0	2
Ophisarus mimicus	S	6	savannas	R	56%	27	7	6	6	0	0	w1p1	1	4	4	4	1	6
Rana capito capito	S	3	sandhills	R	70%	16	13	12	5	0	0	w1p2	1	4	4	4	1	5
Seminatrix pygaea	LR	5	water	B	46%	6+	6	2	2	0	0	p2	1	2	2	2	1	2
INSECTS																		
Atrytone arogos arogos	S	9	savannas	R	56%	27	1	1	1	0	0	i	1	1	1	1	1	1
Euphyes berryi	LR	4	ponds	R	70%	0.1	2	2	2	0	0	p2	2	2	2	2	2	2
Euphyes bimacula	LR	23	marshes	R	66%	1.2	2	2	2	0	0	p2	2	2	2	2	2	2
PLANTS																		
Agalinis aphylla	LR	**7**	savannas[12]	R	56%	27	20	14	4	1	0	p2	1	4	4	4	1	4
Agalinis virgata	LR	10	savannas	R	56%	27	18	16	13	3	0	w3p1	4	12	12	12	4	12
Andropogon mohrii	LR	8	savannas	R	56%	27	2	1	1	0	0	i	0	1	1	1	0	1
Asclepias pedicellata	LR	4	savannas	R	56%	27	20	19	7	0	0	w1	2	6	6	6	2	7
Asplenium heteroresiliens	S	4	marl	R	60%	0.1	9	1	1	1	1	i	1	1	1	1	1	1
Carex basiantha	LR	4	marl	R	60%	0.1	1	1	1	0	0	i	1	1	1	1	1	1
Cystopteris tennesseensis	LR	19	marl	R	60%	0.1	3	1	1	1	1	i	1	1	1	1	1	1
Dionaea muscipula	S	2	savannas	R	56%	27	63	53	22	6	1	w1p3	3	18	17	17	3	21
Eleocharis robbinsii	LR	22	ponds	R	70%	0.1	4	3	1	1	0	i	0	1	1	1	0	1
Lachnocaulon beyrichianum	S	5	sandhills	R	70%	1.1	4	4	3	0	0	mw1	0	3	3	3	0	3
Lejeunea bermudiana	LR	6	marl	R	60%	0.1	1	1	1	H	-	i	0	1	1	1	1	1
Litsea aestivalis	S	7	ponds	R	70%	0.1	12	11	6	2	0	w1	1	6	6	6	1	6
Ludwigia linifolia	LR	6	ponds	R	70%	0.1	6	6	1	0	0	i	1	1	1	1	1	1
Lysimachia asperulifolia	E	2	savannas	R	56%	27	16	14	6	3	0	w1p1	0	5	4	4	0	6
Malaxis spicata	LR	5	maritime	R	99%	0.1	3	1	1	0	0	i	0	1	1	1	1	1
Myriophyllum laxum	S	6	ponds	R	70%	0.1	3	2	1	0	0	i	1	1	1	1	1	1
Panicum tenerum	LR	8	savannas	R	56%	27	14	14	2	1	1	i	1	2	2	2	1	2
Peltandra sagittifolia	LR	8	pocosins	B	17%	74	11	6	3	0	0	p2	2	3	3	3	2	3
Pinguicula pumila	LR	9	savannas	R	56%	27	6	6	6	3	1	mw1	0	6	6	6	0	6
Platanthera integra	LR	12	savannas	R	56%	27	5	4	3	0	0	p3	1	3	3	3	1	3
Platanthera nivea	LR	15	savannas	R	56%	27	1	1	1	0	0	i	0	1	0	0	0	1
Polygala hookeri	S	6	savannas	R	56%	27	8	5	2	0	0	p1	0	2	2	2	0	2
Polygonum hirsutum	LR	6	ponds	R	70%	0.1	2	1	1	H	-	i	0	1	1	1	0	1
Ponthieva racemosa	LR	10	swamps	B	47%	30	12	8	7	2	1	w1p3	1	7	7	7	1	7
Rhexia cubensis	LR	7	ponds	R	70%	0.1	17	14	5	2	1	mw1	1	4	4	4	4	5
Rhynchospora harperi	LR	8	ponds	R	70%	0.1	9	9	1	0	0	i	1	1	1	1	1	1
Rhynchospora oligantha	LR	11	savannas	R	56%	27	10	9	5	0	0	p3	1	5	5	5	1	5
Rhynchospora pleiantha	S	6	ponds	R	70%	0.1	4	4	1	1	1	i	1	2	2	2	1	2
Rhynchospora scirpoides	LR	20	ponds	R	70%	0.1	5	4	1	0	0	i	1	1	1	1	1	1

Attachment H-4: Habitat Factors, Regional and Local Population, and Habitat Protection (continued)

SCIENTIFIC NAME	USFS Status[1]	# of States[2]	Habitat Factors				Regional Population (EOs)[6]			Local Population			Habitat Protection					
			Primary Habitat	Specificity[3]	Fragmtation[4]	Area 1000s ac.[5]	4-County[7]	Public land[8]	Croatan NF	> 100 individuals[8]	> 1000 individuals	Distribution[10]	# of EOs in coarse filter[11] by -------Alternative -------					
													A	B	C	Cm	D	E
Sagittaria graminea chap.	S	6	marshes	R	66%	0.1	2	2	1	0	0	i	0	1	1	1	1	1
Scirpus lineatus	LR	13	marl	R	60%	0.1	8	6	3	2	0	p2	1	3	3	3	1	3
Scleria baldwinii	LR	8	savannas	R	56%	27	1	1	1	0	0	i	0	1	1	1	1	1
Scleria georgiana	LR	8	savannas	R	56%	27	13	10	2	1	0	p3	0	2	2	2	0	2
Solidago gracillima	LR	9	savannas	R	56%	27	8	5	2	0	0	p1	2	2	2	2	2	2
Solidago leavenworthii	LR	4	savannas	R	56%	27	1	1	1	H	-	i	1	1	1	1	1	1
Solidago pulchra	S	2	savannas	R	56%	27	63	49	19	9	2	w1p3	1	17	14	14	1	18
Solidago verna	S	2	savannas	R	56%	27	37	27	27	16	4	w4p2	1	16	16	16	1	21
Sphagnum fitzgeraldii	S	3	pocosins	R	17%	74	12	1	1	0	0	i	1	1	1	1	1	1
Spiranthes longilabris	S	9	savannas	R	56%	27	2	1	1	0	0	i	0	1	1	1	1	1
Tofieldia glabra	S	3	savannas	R	56%	27	44	9	9	4	0	w1	0	9	9	9	0	9
Utricularia olivacea	LR	8	ponds	R	70%	0.1	5	3	3	0	0	p1	2	3	3	3	2	3
Xyris flabelliformis	LR	7	savannas	R	56%	27	16	10	1	H	-	i	2	2	2	2	2	2
Xyris stricta	LR	8	savannas	R	56%	27	1	1	1	0	0	i	0	1	1	1	0	1

[1/] USFS status: LR = locally rare, S = Sensitive (on Regional Forester's list), T = Threatened (listed by US Fish and Wildlife Service), E = Endangered (listed by US Fish and Wildlife Service), TSA = Threatened due to Similarity of Appearance.

[2/] Total number of states where the species occurs

[3/] Habitat specificity: R = Restricted: restricted to one or a few specialized habitats, B = Broad: occurs in variety of habitats

*[4/] Habitat fragmentation: the proportion of the potential primary habitat within the CNF proclamation boundary that is **not** administered by the CNF. Total area within the proclamation boundary is approximately 307,000 acres; the total area administered by the CNF is approximately 161,000 acres. **Note:** ponds (limesink ponds) occur primarily in sandhills (xeric pine savannas in the ecological classification) and therefore fragmentation for ponds is estimated from sandhills habitat fragmentation. However, ponds are highly clustered and not distributed throughout all sandhills. Therefore, this method may overestimate fragmentation effects. Marl outcrops are found primarily in stream-side habitats and therefore fragmentation for marl is estimated from swamp (wetlands) habitat fragmentation. Again, this is a rough estimate and may not accurately reflect fragmentation effects on marl outcrops because most swamp do not occur on marl.*

[5/] Habitat area = extent of habitat on the Croatan National Forest (in 1000s of acres)

[6/] EOs = Element occurrence record: the documented number of existing habitats that sustain or otherwise contribute to the survival of a population or self-sustaining example of a particular species. From the N.C. Natural Heritage Program (2001).

[7/] The number of EOs in a four County Area = all of Onslow county and that portion of Carteret, Jones, and Craven counties adjacent to the Croatan National Forest

[8/] The number of EOs on public land (Croatan National Forest and Camp Lejeune only)

[9/] The number of EOs having more than 100 individuals of the species observed. H indicates historic EOs

[10/] Distribution of EOs on the Croatan: A letter followed by a number; the letter describes the distribution of subpopulations (w = well distributed, mw = moderately well, p = poorly distributed populations and subpopulations – found in no more than 2 locations within the Landtype Association,, I = isolated population), the number indicates how many of the seven Landtype Associations the species occurs in, e.g., w1 = species well distributed but found in only one Landtype Association; w4p2 = species found in 6 Landtype Association, well-distributed in 4 and poorly distributed in 2.

[11/] The "Coarse Filter" on the CNF which includes Special Interest Areas (NC Natural Areas), old growth management areas, Wilderness Areas, the red-cockaded woodpecker Habitat Management Area, and the Hardwood-Cypress Wetlands Management Prescription.

[12/] Flatwoods are included in this habitat – for all species

Attachment H-5: Habitat Fragmentation on the CNF: Pine Savannas and Flatwoods

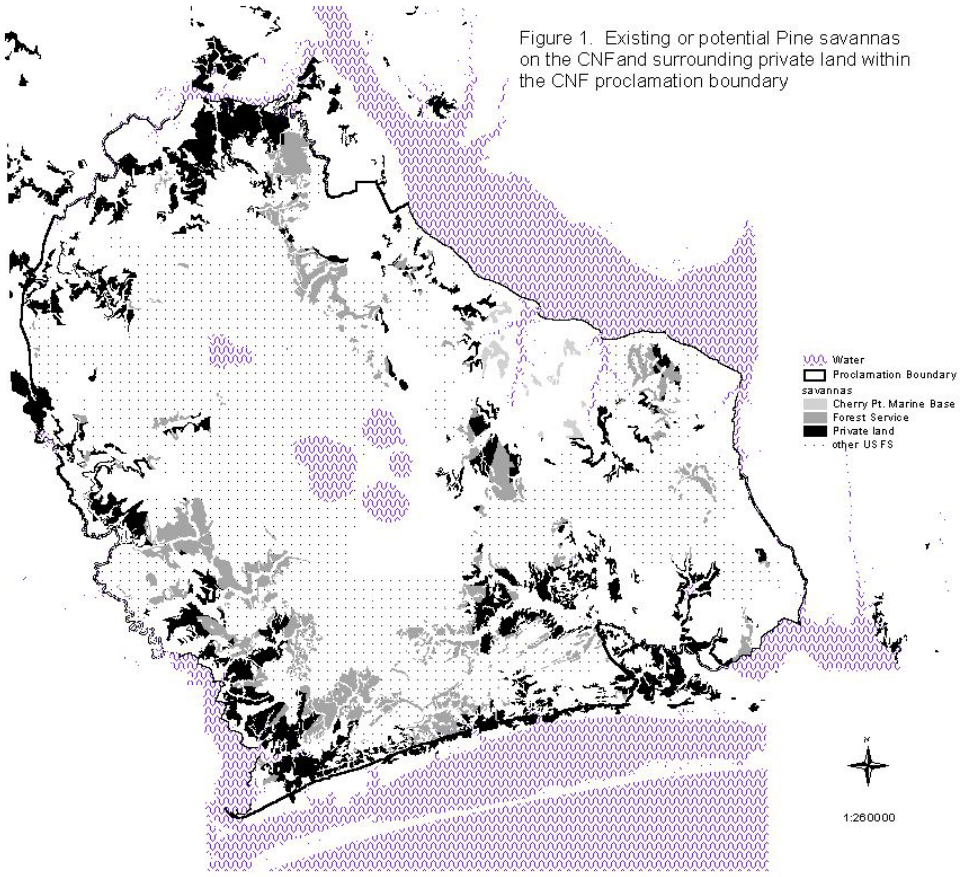

Figure 1. Existing or potential Pine savannas on the CNF and surrounding private land within the CNF proclamation boundary

SCIENTIFIC NAME	HISTORIC CONDITION	CURRENT CONDITION ALT. A	ALT. B	ALT. C	ALT. Cmod	ALT. D	ALT. E
BIRDS							
Aimophila aestivalis	4	2	2	2	2	2	3
Ammodramus henslowii	3 winter	1	2	2	2	1	2
Anhinga anhinga	2	1	1	1	1	1	1
Haliaeetus leucocephalus	3	2	2	2	2	2	2
Phalacrocorax auritus	1	1	1	1	1	1	1
Picoides borealis	4	2	2	3	3	2	3
CRUSTACEANS							
Procambarus plumimanus	4	3	3	3	3	3	3
HERPETOFAUNA							
Alligator mississippiensis	4	3	3	3	3	3	3
Crotalus adamanteus	4	1	1	2	2	1	2
Ophisarus mimicus	3	1	1	2	2	1	2
Rana capito capito	2	1	1	1	1	1	1
Seminatrix pygaea	3	1	1	2	2	1	2
INSECTS							
Atrytone arogos arogos	3	1	1	2	2	1	2
Euphyes berryi	3?	1?	1?	1?	1?	1?	1?
Euphyes bimacula	4	1	1	1	1	1	1
PLANTS							
Agalinis aphylla	3	1	1	2	2	1	2
Agalinis virgata	4	2	2	3	3	2	3
Andropogon mohrii	3	1	1	2	2	1	2
Asclepias pedicellata	4	1	2	3	3	1	3
Asplenium heteroresiliens	1	1	1	1	1	1	1
Carex basiantha	2	1	1	1	1	1	1
Cystopteris tennesseensis	1	1	1	1	1	1	1
Dionaea muscipula	4	2	2	3	3	2	3
Eleocharis robbinsii	2	1	1	1	1	1	1
Lachnocaulon beyrichianum	3	1	1	2	2	1	2
Lejeunea bermudiana	2	1	1	1	1	1	1
Litsea aestivalis	2	1	1	1	1	1	1
Ludwigia linifolia	2	1	1	2	2	1	2
Lysimachia asperulifolia	3	1	1	2	2	1	2
Malaxis spicata	3	1	1	1	1	1	1
Myriophyllum laxum	2	1	1	2	2	1	2
Panicum tenerum	3	1	1	2	2	1	2
Peltandra sagittifolia	3	1	1	1	1	1	2
Pinguicula pumila	4	2	2	3	3	2	3
Platanthera integra	4	2	2	3	3	2	3
Platanthera nivea	3	1	1	2	2	1	2
Polygala hookeri	3	1	1	2	2	1	2
Polygonum hirsutum	2	1	1	2	2	1	2
Ponthieva racemosa	3	2	2	2	2	2	2
Rhexia cubensis	2	1	1	2	2	1	2
Rhynchospora harperi	2	1	1	2	2	1	2
Rhynchospora oligantha	3	1	1	2	2	1	2
Rhynchospora pleiantha	2	1	1	2	2	1	2
Rhynchospora scirpoides	2	1	1	2	2	1	2
Sagittaria graminea chap.	2	1	1	2	2	1	2
Scirpus lineatus	2	1	1	1	1	1	1
Scleria baldwinii	3	1	1	2	2	1	2
Scleria georgiana	3	1	1	2	2	1	2
Solidago gracillima	3	1	1	2	2	1	2
Solidago leavenworthii	2	1	1	1	1	1	1
Solidago pulchra	4	2	2	3	3	2	3
Solidago verna	4	2	2	3	3	2	3
Sphagnum fitzgeraldii	2	1	1	1	1	1	1
Spiranthes longilabris	2	1	1	1	1	1	1
Tofieldia glabra	3	1	1	2	2	1	2
Urtricularia olivacea	2	1	1	2	2	1	2
Xyris flabelliformis	3	1	1	1	1	1	1
Xyris stricta	3	1	1	1	1	1	1

Attachment H-7: Guidelines (KEY) for Determining Species Outcomes

1a. Species with < 5 documented occurrences on the CNF (chose 2a, or 2b)

2a. Potential suitable habitat is of sufficient abundance (mostly > 2,000 acres) on the CNF (pocosins, savannas, lakes, streams – Attachment H-4); historic distribution pattern included sites with limited connectivity among multiple sites or multiple avenues of connectivity among sites- Attachment H-6. (choose 3a or 3b)

3a. Alternative includes objectives to maintain/improve habitat quality for potential habitat and for at least 75% of occupied habitats – Attachment H-4. (choose 4a or 4b)

4a. Species is known from at least 3 sites within the surrounding 4-counties or species inventories are incomplete and species is likely more common than indicated by documented occurrence records -------- OUTCOME C

4b. Species is known from less than 3 sites within the surrounding 4-counties – --- OUTCOME D

3b. Alternative does not include objectives to maintain/improve habitat quality for potential habitat and/or 75% of occupied habitat – OUTCOME D

2b. Potential suitable habitat is not of sufficient abundance (mostly < 100 acres) on the CNF (maritime, marl, ponds, marshes – Attachment H-4); historic distribution pattern included isolated sites and isolated site clusters – Attachment H-6. (choose 3a or 3b below)

3a. Species is known from at least 4 sites within the surrounding 4-counties and these sites are protected by environmental law, i.e. they are jurisdictional wetlands or open water counties or species inventories are incomplete and species is likely more common than indicated by documented occurrence records. (choose 4a or 4b below)

4a. Alternative includes objectives to maintain/improve habitat quality for potential habitat and 75% of occupied habitat – Attachment H-4. (choose 5a or 5b)

5a. Historic distribution included only highly isolated sites ---------- OUTCOME D

5b. Historic distribution includes isolated sites and site clusters ---------- OUTCOME C

4b. Alternative does not include objectives to maintain/improve habitat quality for potential habitat and 75% of occupied habitat – OUTCOME D

3b. Species is known from less than 4 sites within the surrounding 4-counties or on sites not protected by environmental law.

4a. Species biology, distribution, and habitat relationships are well known – OUTCOME D

4b. Species biology, distribution, and habitat relationships are not well known – OUTCOME E

1b. Species with at least 5 documented occurrences on the CNF - (choose 2a, 2b, 2c below)

2a. Potential suitable habitat is of sufficient abundance on the CNF (pocosins, savannas, lakes, streams) and alternative includes objectives to maintain/improve habitat quality for potential habitat and for at least 75% of occupied habitat; historic distribution pattern included sites with limited connectivity among multiple sites or multiple avenues of connectivity among sites. (choose 3a or 3b below).

3a. Species is currently well-distributed (Attachment H-4) within at least one Landtype Association – or occurs in at least 3 Landtype Associations - OUTCOME B

3b. Species is not well-distributed on the CNF – OUTCOME C

2b. Potential suitable habitat is not of sufficient abundance on the CNF (maritime, marl, ponds, marshes) or the alternative does not include objectives to maintain/improve habitat quality for potential habitat and/or 75% of occupied habitat; historic distribution pattern included isolated sites and site clusters. (choose 3a or 3b below)

3a. Species is known from at least 3 sites within the surrounding 4-counties and these sites are protected by environmental law, i.e. jurisdictional wetlands and open water, -OUTCOME C

3b. Species is known from less than 3 sites within the surrounding 4-counties or on sites not protected by environmental law – OUTCOME D

2c. Potential suitable habitat is of sufficient quality, abundance and distribution to allow species to stabilize in a pattern similar to reference distribution, i.e., potential distribution = historic distribution –OUTCOME A

SCIENTIFIC NAME	OUTCOMES (A thru D)						
	ALT. A	**ALT. B**	**ALT. C**	**ALT. Cmod**	**ALT. D**	**ALT. E**	**COMMENTS**
BIRDS							
Aimophila aestivalis	C	C	C	C	C	B	
Ammodramus henslowii	D	D	C	C	C	C	
Anhinga anhinga	D	C	C	C	C	C	
Haliaeetus leucocephalus	D	D	D	D	D	C	
Phalacrocorax auritus	D	C	C	C	C	C	
Picoides borealis	B	B	B	B	C	B	
CRUSTACEANS							
Procambarus plumimanus	B	B	B	B	B	B	
HERPETOFAUNA							
Alligator mississippiensis	B	B	B	B	B	B	
Crotalus adamanteus	D	D	D	D	D	C	
Ophisarus mimicus	C	C	C	C	C	B	
Rana capito capito	C	B	B	B	C	B	
Seminatrix pygaea	D	C	C	C	D	C	And no restoration possible
INSECTS							
Atrytone arogos arogos	D	D	D	D	D	D	no habitat available to ensure viability
Euphyes berryi	E	E	E	E	E	E	insufficient inventory, habitat relationships
Euphyes bimacula	E	E	E	E	E	E	insufficient inventory, habitat relationships
PLANTS							
Agalinis aphylla	D	C	C	C	D	C	
Agalinis virgata	C	B	B	B	C	B	
Andropogon mohrii	D	C	C	C	D	C	more locations likely, insufficient inventory
Asclepias pedicellata	C	B	B	B	C	B	
Asplenium heteroresiliens	C	C	C	C	C	C	one site, 1000's plants, stable population
Carex basiantha	C	C	C	C	C	C	
Cystopteris tennesseensis	C	C	C	C	C	C	one site, 1000's plants, stable population
Dionaea muscipula	C	B	B	B	C	B	
Eleocharis robbinsii	D	C	C	C	D	C	
Lachnocaulon beyrichianum	D	C	C	C	D	C	
Lejeunea bermudiana	D	D	D	D	D	D	extirpated, last observed in 1953 @ 1 site
Litsea aestivalis	D	C	C	C	D	C	
Ludwigia linifolia	D	C	C	C	D	C	And no restoration possible
Lysimachia asperulifolia	C	B	C	C	C	B	
Malaxis spicata	D	D	D	D	D	D	No habitat available to ensure viability maritime habitat 99% in private ownership
Myriophyllum laxum	D	C	C	C	D	C	more locations likely, insufficient inventory
Panicum tenerum	D	C	C	C	D	C	
Peltandra sagittifolia	D	C	C	C	D	C	
Pinguicula pumila	C	B	B	B	C	B	
Platanthera integra	D	C	C	C	D	C	
Platanthera nivea	D	C	C	C	D	C	more locations likely, insufficient inventory
Polygala hookeri	D	C	C	C	D	C	
Polygonum hirsutum	D	D	D	D	D	D	extirpated, last observed in 1976 @ 1 site
Ponthieva racemosa	C	B	B	B	C	B	
Rhexia cubensis	D	C	C	C	D	C	
Rhynchospora harperi	D	C	C	C	D	C	
Rhynchospora oligantha	C	B	B	B	C	B	
Rhynchospora pleiantha	D	C	C	C	D	C	And no restoration possible
Rhynchospora scirpoides	D	C	C	C	D	C	
Sagittaria graminea chap.	D	D	D	D	D	D	No habitat available to ensure viability
Scirpus lineatus	D	C	C	C	D	C	
Scleria baldwinii	D	C	C	C	D	C	more locations likely, insufficient inventory
Scleria georgiana	D	C	C	C	D	C	
Solidago gracillima	D	C	C	C	D	C	
Solidago leavenworthii	D	D	D	D	D	D	extirpated, last observed in 1991 @ 1 site
Solidago pulchra	C	B	B	B	C	B	
Solidago verna	C	C	C	C	C	B	
Sphagnum fitzgeraldii	C	C	C	C	C	C	
Spiranthes longilabris	D	C	C	C	D	C	more locations likely, insufficient inventory
Tofieldia glabra	C	B	B	B	C	B	
Urtricularia olivacea	D	C	C	C	D	C	
Xyris flabelliformis	C	C	C	C	C	C	
Xyris stricta	D	C	C	C	D	C	more locations likely, insufficient inventory

Attachment H-9: Additional Species at Risk Identified by Species Experts & Results of Analysis

Table H-9a: Habitat Relationships

SCIENTIFIC NAME	COMMON NAME	HABITAT
BIRDS		
Passerina ciris	Painted bunting	shrub thickets near tidal water
INSECTS		
Acronicta sinescripta	(a dagger moth)	savannas and flatwoods
Agrotis n. sp. 1	(a dart moth)	savannas and flatwoods
Calephelis virginiensis	Little Metalmark	savannas and flatwoods
Hemipachnobia subporphyrea	Venus flytrap cutworm moth	savannas with venus flytraps
Pyreferra ceromatica	Annoted Sallow	mesic hardwood forests
Spartiniphaga cartera	Carter's Noctuid	savannas and flatwoods with pinebarrens reedgrass
PLANTS		
Rhynchospora macra	Large beakrush	wet savannas (peaty seepage slope areas)

Table H-9b: Range-wide Distribution and State Rarity

SCIENTIFIC NAME	Rangewide Distribution and state rank[1]													
	NC	SC	GA	FL	AL	MS	LA	TX	VA	TN	KY	AR	OK	OTHER STATES
BIRDS														
Passerina ciris	S3	S?	S3	S3	S2	S4	S5	S4		S2		S4	S5	AZ-SN,IL-SR,KS-S3,MT-SR,NE-SR,NY-SR,NM-S4
INSECTS														
Acronicta sinescripta	S2	S?		S?										
Agrotis n. sp. 1	S2													
Calephelis virginiensis	S3	S?	SU	S4	SU	S4?	S4?	S?	S1				S?	
Hemipachnobia	S1													
Pyreferra ceromatica	S1	S?		S?	SH		SU							CT-SH,IN-S2,ME-SX,MI-SH,NH-SX,NJ-SX,NY-SX,PA-SX
Spartiniphaga cartera	S2													NJ-S2
PLANTS														
Rhynchospora macra	S1	S1	S1?	S2	S1	S3	S2	S1						

Table H-9c. Habitat Factors, Regional and Local Population, and Habitat Protection

SCIENTIFIC NAME	USFS Status[1]	# of States[2]	Habitat Factors				Regional Population (EOs)[6]			Local Population			Habitat Protection					
			Primary Habitat	Specificity[3]	Fragmtation[4]	Area 1000s ac.[5]	4-County[7]	Public land[8]	Croatan NF	> 100 individuals[8]	> 1000 individuals	Distribution[10]	# of EOs in coarse filter[11] by -------Alternative --------					
													A	B	C	Cm	D	E
BIRDS																		
Passerina ciris	LR	18	tidal land	R	66%	1.2	10	2	2	0	0	p1	1	1	1	1	1	1
INSECTS																		
Acronicta sinescripta	LR	3	savannas	R	56%	27	1	1	1	0	0	i	1	1	1	1	1	1
Agrotis n. sp. 1	LR	1	savannas	R	56%	27	5	5	3	0	0	mw1	1	1	1	1	1	1
Calephelis virginiensis	LR	10	savannas	R	56%	27	10	10	4	0	0	mw1	1	1	1	1	1	1
Hemipachnobia subporphyrea	S	1	savannas	R	56%	27	2	1	1	0	0	i	1	1	1	1	1	1
Pyreferra ceromatica	LR	14	hardwoods	R	?	2.3	2	1	1	0	0	i	0	0	0	0	0	0
Spartiniphaga cartera	S	2	savannas	R	56%	27	2	1	1	0	0	i	1	1	1	1	1	1
PLANTS																		
Rhynchospora macra	LR	8	savannas	R	56%	27	1	1	1	0	0	i	1	1	1	1	1	1

Table H-9d. Current, Historic, Future Distribution of Species at risk

SCIENTIFIC NAME	HISTORIC CONDITION	CURRENT CONDITION ALT. A	ALT. B	ALT. C	ALT. Cmod	ALT. D	ALT. E
BIRDS							
Passerina ciris	2	1	1	1	1	1	1
INSECTS							
Acronicta sinescripta	?	1	?	?	?	?	?
Agrotis n. sp. 1	3	2	2	2	2	1	2
Calephelis virginiensis	3	2	2	2	2	1	2
Hemipachnobia subporphyrea	3	1	2	2	2	1	2
Pyreferra ceromatica	?	1	?	?	?	?	?
Spartiniphaga cartera	3	1	2	2	2	1	2
PLANTS							
Rhynchospora macra	2	1	1	1	1	1	1

Table H-9e. Outcomes of Management Alternatives

SCIENTIFIC NAME	OUTCOMES (A thru D)						COMMENTS
	ALT. A	ALT. B	ALT. C	ALT. Cmod	ALT. D	ALT. E	
BIRDS							
Passerina ciris	C	C	C	C	C	C	
INSECTS							
Acronicta sinescripta	D	E	E	E	E	E	insufficient inventory, habitat relationships
Agrotis n. sp. 1	C	B	B	B	C	B	more locations likely, insufficient inventory
Calephelis virginiensis	C	B	B	B	C	B	
Hemipachnobia subporphyrea	D	C	C	C	D	C	
Pyreferra ceromatica	E	E	E	E	E	E	insufficient inventory, habitat relationships
Spartiniphaga cartera	D	C	C	C	D	C	
PLANTS							
Rhynchospora macra	D	C	C	C	D	C	more locations likely, insufficient inventory

Attachment H-10: Population Monitoring and Viability Analysis for the RCW

Prepared by Jenna L. Begier

Monitoring Program

The RCW monitoring program on CNF exceeds the requirements set forth in the USDA Forest Service's Final Environmental Impact Statement (1995, FEIS) for RCW on national forest lands in the Southern Region but is consistent with U.S. Fish and Wildlife Service's Revised Recovery Plan for RCW (2000, Draft). The Recovery Plan suggests Level IV monitoring for populations deemed essential to recovery and occurring on public lands. Level IV monitoring consists of color-banding nestling and adult birds, conducting nest checks at 7-11 day intervals, and conducting fledgling and adult checks to determine number and sex of birds. Level IV monitoring may be conducted on a sample of active clusters (IVa) or on all active clusters (IVb) as has been done on CNF for the past 10 years.

The FEIS requires that all clusters be surveyed annually for activity status and that only a sample of clusters be monitored annually for nesting success and group composition. However, the Recovery Plan states that monitoring methods should not be mixed from year to year and that color-banding birds will be necessary when and if translocations are used as a management tool. Furthermore, the Recovery Plan states that due to sampling error, "…intensive monitoring of a sample of groups (Level IVa) can provide reliable estimates of productivity within a short period, but cannot estimate population trend until used for a longer period of time (e.g., 5 years)" and that "Accuracy of population trend assessment is also dependent on sample size…Thus, small samples cannot detect anything but large-scale changes in populations trends." Therefore, continued use of Level IVb monitoring on CNF will provide consistency and the most accurate population information. Identification of individuals will also be beneficial when and if within-population translocations are used to promote population growth. However, should the CNF population become too large for Forest Service staff to conduct 100% population monitoring, then statistically sound sampling methods can be implemented to monitor a subset of the population.

Population Dynamics

The data in this report are presented only for RCW clusters that are currently on national forest land. Therefore, some discrepancies exist between Dr. Walters's 1997 final report and the current report regarding the population and reproductive parameters.

Several variables are important for monitoring population dynamics including number of active clusters, number of potential breeding pairs, proportion of solitary males, and average group size. An active cluster is defined as one that has evidence of RCW activity including presence of active sap wells, fresh wood chips in one or more cavities, and birds observed in the vicinity of the cavity trees. A potential breeding pair is defined as a male and female pair of adult RCWs residing in an active cluster. Both are measures of population size, indicating number of potential RCW groups and size of the breeding population, respectively.

In general, the number of both active clusters and potential breeding pairs began to increase in 1991 following implementation of Walters management plan (Table 1). These numbers continued to increase each year from 2 % to 8 % peaking in 1996. The population subsequently suffered a net loss of activity at two clusters per year (3 %) from 1997 through 1999. However, the population experienced a 6.5 % increase from 1999 to 2000 that included the formation of two entirely new clusters. One of the new clusters was artificially created and the other was a result of territorial budding. The number of active clusters remained the same from 2000 to 2001, however, one recruitment cluster was occupied by a solitary bird post-breeding season. This cluster will not be considered active unless it remains active through the 2002 breeding season. The CNF breeding population experienced a net increase of one breeding pair in 2001.

Table H-10-a. Population parameters, 1989-2001

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Active Clusters	45	44	50	53	54	57	59	64	62	60	58	62	62
Potential Breeding Pairs	40	36	43	47	49	52	53	55	50	48	45	52	53
% Solitary Males	11.0	9.1	8.0	9.4	3.7	5.3	8.5	9.4	12.9	10.0	6.9	9.7	9.8
Avg. Group Size	2.45	2.69	2.44	2.53	2.55	2.58	2.64	2.47	2.42	2.31	2.36	2.54	2.62
# Adults	111	111	125	133	135	151	165	158	139	137	121	142	144

Proportion of solitary males and average group size are both good indicators of population health (USFWS 2000, Walters 1991). A solitary male is an unpaired male residing in an active cluster. This definition includes a breeding male that lost his mate but shares the cluster with other nonbreeding males such as previous helpers. A small proportion (10% or less) of solitary males are always present in a healthy population due to mate loss. However, a primary factor in declining populations is low quality territories leading to an increase in the proportion of solitary males and gradual abandonment of territories. Breeding males show great site tenacity upon loss of a mate and despite declining territory quality, remain on their territory until they die.

A group of RCWs includes a breeding pair and helpers. Nonbreeding adults, such as solitary males, intruders, and floaters, are not included in a calculation of average group size. An average size of 2.5 adults is considered desirable and indicates that approximately one half of the groups have helpers. Helpers provide the population with a pool of breeder replacements and can act as a buffer against fluctuations in productivity and mortality. The presence of helpers has also been found to increase group productivity because the group is more likely to attempt nesting and less likely to fail.

The proportion of solitary males on CNF has remained at or below 10% during each of the past eleven years except during 1997. Average group size has followed a trend similar to the other population measures. Even though the proportion of solitary males returned to acceptable levels in 1998, average group size continued to decrease through 1999 indicative of declining population health. However, group size rebounded in 2000 to an acceptable level of 2.54 birds per group and further increased to 2.62 birds per group in 2001.

Some possible reasons for the initial population decline are discussed by Walters in his 1997 final project report to the Forest Service and include hurricane-related mortality and declining habitat quality. Two hurricanes affected the area between the 1996 and 1997 breeding seasons and could account for the population numbers observed in 1997. However, population parameters should have rebounded to some extent in subsequent years. Instead, all population parameters, except proportion of solitary males, continued to decline through three breeding seasons before exhibiting signs of rebound in 2000. Furthermore, average group size began to show declines in 1996, prior to the hurricanes. Walters (1997) believes that although the population no doubt experienced some hurricane-related mortality, the prolonged population declines observed on CNF are more likely due to changes in habitat quality related to a lack of growing season burning.

Records show that growing season burns were conducted in 1989 and1991 at a total of 12 clusters in addition to dormant season burning. Growing season burns were not conducted again until 1997 and 1998. A total of nine clusters were burned late in the growing season (August) in addition to dormant season burning. In 2000, a total of three clusters were burned in the summer and in 2001, nine clusters in four separate burn units were burned in the summer. Undoubtedly, the Forest Service needs to incorporate more growing season burning into it's fire regime (see Habitat Management Section below), however, the burn history shows that growing season burning has never really been a major component of the prescribed burning program on CNF. Frequency of burning, even in the dormant season, has also been shown to be an important factor in controlling midstory vegetation in addition to season of burn (Hermann and others 1998, Brockway and Lewis 1997). Approximately one third of the available clusters have been burned on a regular basis with the majority of clusters having been burned irregularly over the past eleven years. In contrast, a small number of clusters (10.7%) have not been burned in eleven years, primarily due to problems with the urban interface. Five out of seven of those clusters were burned in fiscal year 2001 and the remaining two clusters are scheduled for burning in 2002. Despite the inconsistencies in the prescribed burning program, the number of active clusters increased consistently through 1996. Furthermore, the population rebounded in 2000 with the addition of two new clusters and renewed activity at some clusters despite the fact that growing season burning has overall been lacking. Without habitat data available to analyze change over time, it is difficult to specifically say that habitat quality is the reason for the declines.

Of notable interest is the decline in total number of adults and average group size beginning in 1996. Possible reasons for a loss of adults are natural disaster or inclement weather, lack of suitable cavities for roosting, disease, or human-induced death. The initial decline predates the hurricanes by a year, but the hurricanes certainly contributed to continued decline in 1997. Inclement winter weather or severe drought could conceivably cause a noticeable loss of birds if it continued for a long period of time, particularly if the population lacks a suitable number of cavities for roosting. A cavity tree assessment was completed by Walter's team in April of 1996 and only three clusters were deemed in need of cavities, so a lack of cavities does not seem a likely explanation. An outbreak of disease could conceivably cause a population decline, but without evidence, the prevalence of disease in a population would likely go unnoticed. As for human-induced death, occasional incidences of people shooting directly at RCWs has been

reported, however, these incidents have been isolated and few. The likelihood that human beings would kill enough birds to cause a noticeable decline in population numbers is minimal.

An examination of the specific clusters where a loss of activity occurred may provide some additional insight. All losses of activity were in clusters having unstable breeding histories or no breeding history, except for cluster #22. None of these clusters have serious midstory problems that would be undesirable to RCWs. However, several of them (908, 22, 907, 50, 42) have fairly shrubby understories and would benefit from a growing season burn. Two of these clusters, 68 and 907, are currently active.

Records show that cluster #22 was burned in the dormant season in 1990, the dormant season in 1997, and in late winter of 2000. Birds bred successfully at this cluster through 1998. This cluster does not have many cavity trees, and two of the trees have had problems with flying squirrels and cavity enlargement. Therefore, this cluster may have a cavity management problem. Two artificial cavities have been added, but additional ones may be necessary if suitable trees can be located. One of these cavities was active post-breeding season 2000 by a solitary male. Unfortunately, this bird either dispersed or died post-breeding season in 2001.

Three losses were in artificially created clusters (902, 908, and 907). At the time of their establishment, cavities were drilled at a height of 10 feet. Current management guidelines specify that cavities should be within the range of natural cavity height (USFWS 2000, Draft), and RCW cavities are typically 20 to 40 feet high on CNF (pers. obs.). Artificial cavities are currently drilled at heights around 20 feet and have so far been successfully occupied by RCWs.

Three losses were in clusters that are in close proximity to active clusters and have been occupied primarily by intruders (908, 68, and 50). Some of these areas may not have enough acreage of high quality foraging habitat to support multiple clusters and therefore, may not ever be consistently distinct clusters. The Recovery Plan (2000, draft) states that clusters within 0.25 mile of an active cluster are likely to be captured. Cluster 908 is not likely to be distinct cluster because it is too close to an active cluster, whereas, clusters 68 and 50 have greater chances of success. Finally, cluster #42 has not had a breeding pair in the past decade and may suffer from being somewhat isolated.

Reproduction

The Recovery Plan (2000, draft) provides a summary of current data on RCW reproduction and gives some average values for various reproductive parameters that can be compared with reproductive values on CNF. Nesting effort in a particular year is represented by three variables including the proportion of breeding pairs that do not attempt a nest (% no nest), the average number of eggs laid per nest (clutch size), and the proportion of breeding pairs that renest after a nest failure (% renest). On average, approximately 10% of breeding pairs do not attempt a nest and generally renesting attempt follows 30% of nest failures. Typical clutches range from 2 to 4 eggs.

Nesting success is measured as the proportion of nests that fail (% fail), the proportion of a clutch that is lost (% partial brood loss), and mean number of nestlings that reach fledgling age

(brood size). Whereas, a population's overall productivity is measured as the total number of fledglings produced in the population (fledglings) and the mean number of fledglings produced per group (young/group). Average values for nesting success are 20% nest failure and 40% partial brood reduction. A typical RCW brood contains from 1 to 4 nestlings, and on average, a population will produce 1.5 young per group.

Overall, reproduction on CNF has been within the normal range of reproductive values (Table 2). The proportion of groups that did not attempt a nest has, for the most part, remained below 10%. Annual mean clutch size has been around 3 eggs per nest (range 2.98 – 3.48), and the mean number of young produced has been around 1.5 per group (range 1.31 – 1.83). Furthermore, partial brood reduction has primarily remained at or below the average of 40% loss.

Table H-10-b. Reproductive parameters, 1989-2001

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Potential Breeding Pairs	39	36	43	47	49	52	53	55	50	48	45	52	53
% no nest	12	8	7	9	16	12	9	9	8	8	2	4	15
Clutch size	3.25	3.43	3.47	2.96	3.14	3.20	3.07	3.16	3.11	3.16	3.20	3.27	3.20
% fail	23	21	12.5	21	29	26	21	20	32.6	13.6	13.6	14	6.6
% renest	0	29	60	22	25	41.6	60	60	67	16.6	16.6	28.6	0
% Partial Brood loss	49	40	41	37	33	28	40	38	35	44	38	36	41
Brood size	1.63	2.06	1.98	1.78	1.82	1.96	1.81	1.86	1.73	1.73	1.98	2.06	1.85
Fledglings	44	52	72	62	64	84	76	85	74	63	78	95	79
Young/group	1.10	1.49	1.67	1.38	1.45	1.65	1.41	1.52	1.32	1.40	1.73	1.83	1.72

Walters (1997) notes that in 1997 an unusually high percentage of nests failed (32.6%). However, many of those were followed by a second nesting attempt (67%) and annual productivity was not unusually low. Productivity was somewhat low in 1998 but the population rebounded in subsequent years. Reproductive effort in both 1999 and 2000 was unusually high (only 2% did not attempt nesting in 1999 and 4% in 2000), nest failure was below average, and the mean number of young produced per group was above average (1.73 in 1999 and 1.83 in 2000). Furthermore, the total number of fledglings produced in 2000 is the highest of the decade. In contrast, the 2001 breeding season was unusual with a high proportion of pairs that did not attempt a nest. Approximately half of those pairs had at least one new bird and all new birds were inexperienced first-year birds. Of the pairs that attempted nesting, only 6.6% failed to fledge young, an unusually low number. Otherwise, 2001 reproductive values were typical and overall productivity (young per group) continues to be above average.

Despite the recent gains in productivity, the CNF population falls within the normal range of reproductive parameters for the region, and these parameters have remained relatively stable over the past decade. Generally, productivity and survival are not important for implementing a

successful management program, rather providing high quality territories and a suitable number of usable cavities will ultimately determine success or failure (USFWS 2000).

Population Viability Analysis

The Nature Conservancy (TNC) recently published a document titled "A Practical Handbook of Population Viability Analysis" (Morris and others, 1999) that presents quantitative methods for determining the viability of rare species populations. Population viability analysis (PVA) allows us to quantitatively assess the probability of a population's continued existence in a given area.

Utilizing the long-term population count data for RCW, we can predict future population trends based on past history, determine the probability of a population ever reaching an extinction threshold, and determine the probability of reaching an extinction threshold at some period of time(Morris and others 1999, Dennis and others 1991). Counts of total number of adults residing in an active cluster were used for the PVA (Table 1). The data were log transformed and a linear regression was used to estimate a population mean and variance. Measures of viability were calculated using the estimated mean and variance. Refer to Morris and others (1999) for a complete explanation of the theory and calculations of this PVA.

Linear regression estimates a mean of 0.02463 and a variance of 0.0103 for the CNF population. A positive mean and a variance that is less than the mean indicates an increasing population trend with minimal annual variation. Using the mean and variance, we can estimate the average population growth rate in the future given that current management practices continue and environmental stochasticity remains within normal parameters. The CNF population can expect an average growth rate of 1.03 with a 95% confidence of 0.967 to 1.097. These estimates indicate that on average the population will remain stable or increase over time (growth rate ≥ 1). However, we cannot rule out the possibility of a population decline because our lower confidence limit is less than one.

We can further estimate the probability that the population reaches a given extinction threshold in a scenario of population decline given the current population size, mean, and variance. The probability of the CNF population reaching an extinction threshold of 10 individuals is highly unlikely (0.000001 or 1 chance in 100,000). An extinction threshold of ten individuals was used for the calculation assuming that this population level would represent the brink of extinction.

A mean time to extinction can be estimated for a population, however, it is not useful for a population having a positive population mean and low probability of reaching an extinction threshold like that of the CNF population. On CNF, only 1 out of 100,000 possible population trajectories is expected to go extinct. Instead, we can estimate the probability that the population will have gone extinct at some specified time in the future. For instance, the probability that the Croatan population will be extinct in 100 years is only 1 in 5,000,000 (0.0000005) or in 525 years, the probability of extinction is still only 1 in 100,000.

Overall, population viability analysis indicates that CNF currently supports a viable population of RCWs. The viability of this population is dependent upon the continued use of prescribed burning within RCW territories to control hardwoods and promote an understory of native

grasses and forbs. It is also dependent upon maintaining an adequate number of suitable cavities for roosting and nesting.

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Attachment H-11: Comparison of Management Alternatives

The following is a comparison of the major differences in land allocation and management objectives among alternatives A (current condition) and alternatives B, C, C modified, D, and E (preferred alternative) that could affect the quality, abundance, distribution, and stability of species at risk on the CNF.

Table H-11.a: Management objectives by alternative.

	ALT. A	ALT. B	ALT. C& C-mod	ALT. D	ALT. E
Growing season burning in the RCW Habitat Mgmt. Area. (HMA) (acres per year)	200	1,000	2,000	1,000	2,000
Average annual burning in CNF (acres)	15,000	12,000	25,000	24,000	25,000
Longleaf pine restoration (acres)	600	0	4,000	230	2,650-3,600
Size of the HMA (acres)	37,845	46,656	46,656	43,424	69,000
New recruitment stands in 10 years	15-20	15-20	25-30	15-20	20-26
# of RCW clusters in 10 year	68-75	68-75	85-93	70-78	83-89
Long-term population objective	126-139	151-169	151-169	136-151	137-169

Table H-11-b: Rare communities and rare species management objectives by alternative.

	ALT. A	ALT. B	ALT. C & C-mod	ALT. D	ALT.E
# of Registered Natural Areas	11	28	18	11	18
Total acres in Natural Areas	42,452	63,924	47,730	42,452	47,730
% CNFs spp. of concern protected in Natural Areas	37%	72%	70%	37%	70%
#of CNFs spp. of concern EOs within "coarse"[1] filter	114	265	259	122	281
Rare community restoration (acres)	600	50	4,570	230	3,220 to 4,170
Average annual burning on CNF (acres)	15,000	12,000	25,000	24,000	25,000
# of new rare species populations (objective)	0	2	11	0	11
# of old growth mgmt areas	0	0	21-54	21-54	21-54
Old growth suitable for timber	yes	yes	no	yes	no

[1] *Natural Areas, Old growth management areas, RCW Habitat Management Area, Wilderness, and Hardwood-Cypress Wetland Management Prescription*