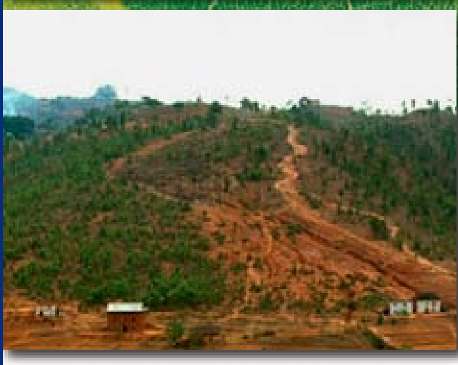






The International Biodiversity Project

Understanding Biodiversity, Ecosystem Services and Poverty in order to support policy makers

2002 - 2008

An international, collaborative project led by the Netherlands Environmental Assessment Agency

Netherlands Environmental Assessment Agency

The International Biodiversity Project

The problem

Biodiversity is in decline worldwide and this is affecting the goods and services that depend on vital ecosystems, which in turn influences human well-being and poverty. Policy makers take decisions on these issues every day. However, information on economic and social impacts of policy decisions is usually more readily available than information on biodiversity and ecosystem services. This hampers balanced decision making and is thus an obstacle to sustainable development.

Strong support for biodiversity-related policies

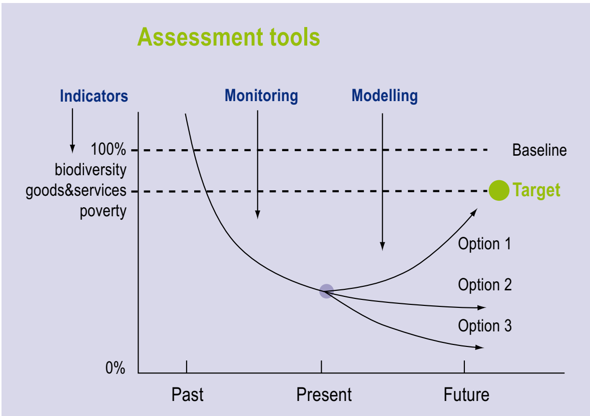
Our vision is that policy makers around the world will have available reliable information on biodiversity, ecosystem services and their linkages with poverty, which they can use in their decision making. This will help them get a better understanding of the possible consequences of their decisions. With this vision in mind, the ultimate aim of the International Biodiversity (IB) project is to build tools and institutional capacity for continuous support of biodiversity-related policies such as the Convention for Biological Diversity (CBD), the Millennium Development Goals, Poverty Reduction Strategy Papers, Socio-Economic Development Plans and National Biodiversity Action Plans.

A toolkit of indicators, monitoring and models

To achieve our goal, we are working to establish globally accepted assessment tools, including indicators, monitoring and models. These tools provide information on the historical and possible future status of and trends in biodiversity, ecosystem goods and services and poverty. Coherence between these tools and their applicability at national, regional and global levels is essential for consistent assessments.

The tools can help to answer four key policy questions:

1. Indicators and monitoring
   ➔ what is changing?
2. Modelling
   ➔ why is it changing?
3. Biodiversity-poverty linkages
   ➔ why is it important?
4. Assessments
   ➔ what can we do about it?



Collaboration: a franchise approach

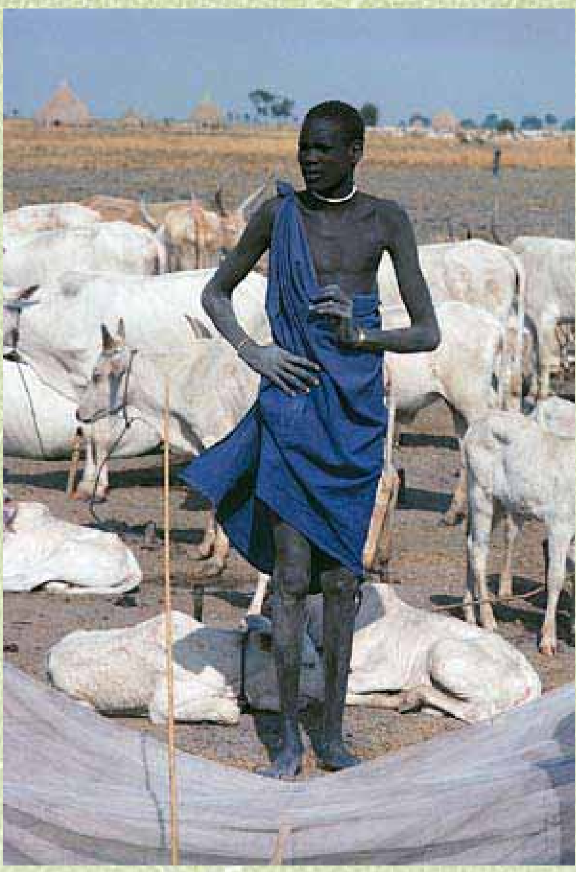
We take a franchise approach in which we offer a universal framework of indicators, monitoring and models which can be refined and localized nationally. The International Biodiversity project collaborates with partners from around the globe to carry out projects to build and implement these tools. This network consists of governmental organizations, NGOs, national and international research institutes and universities, which are supporting policies on the national to regional scale. These partners in turn often work with other organizations, including those in neighbouring countries, to bring together all the available information and expertise and to disseminate the approach as well as the results gained through applying it.

Figure left: Ongoing projects worldwide by May 2006.

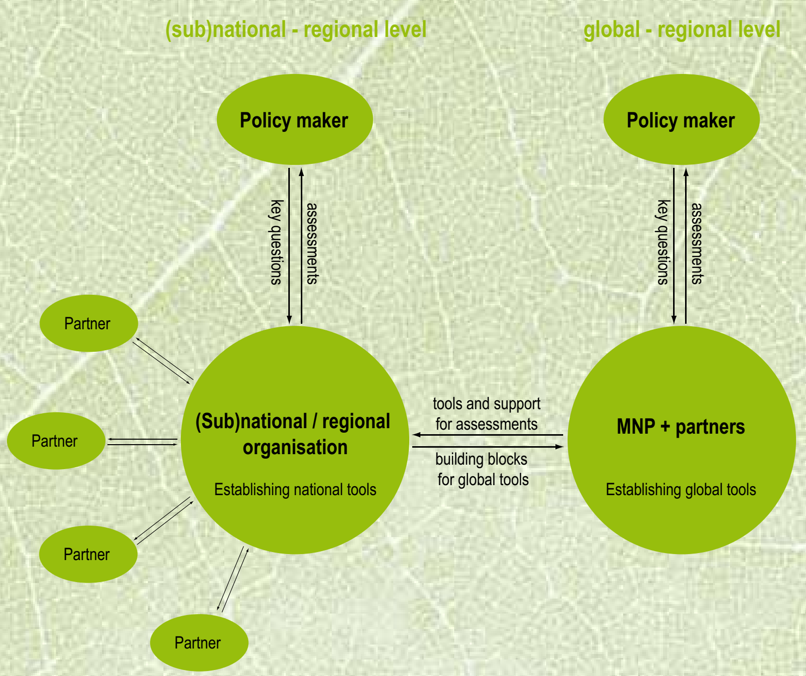
Photo left: Clearcut in tropical forest, Brazil.

Photo below: Nuer herdsman with cattle, North Sudan. More than 800 million people directly depend on natural resources surrounding them.

Figure below: Collaboration between partners, serving different scales.



Partners in the IB Project



TOOL 1 What is changing: Indicators and monitoring

Indicators keep track of changes in biodiversity, ecosystem goods and services and poverty, in the context of policy goals. The challenge is to create powerful, tangible indicators that accurately describe trends in biodiversity loss and ecosystem goods and services. Indicators should be quantitative, sensitive, affordable in use, linkable to socio-economic scenarios and universally applicable. Once indicators have been designed, cost-effective monitoring programmes are needed to collect data for frequent and reliable updates.

Biodiversity indicators for the 2010 target

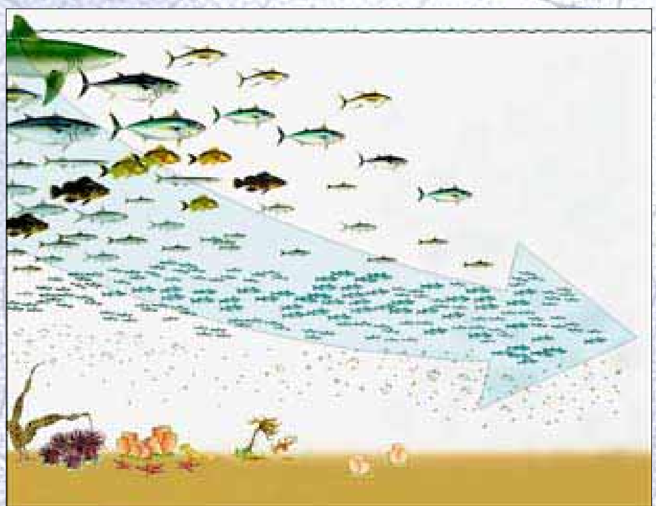
To evaluate progress towards its 2010 target, the CBD has selected a set of headline indicators (Kuala Lumpur 2004). This set covers a broad range of issues, including ecosystem extent, species abundance, the status of threatened species, coverage of protected areas, sustainable use, pressures (e.g. nitrogen deposition and alien invasions), the marine trophic index and freshwater quality. Coherence between the indicators is of the utmost importance, as it is ultimately the set of indicators that will tell the story of biodiversity loss. The IB project team actively contributed to the design of this set of indicators, as well as to the design of other sets of indicators such as those used by the EU and OECD.

Work has started at the global, regional and national level to implement the indicators for the 2010 target. The IB project team is closely involved in the project Streamlining European Biodiversity Indicators (SEBI), and applies the indicators in modelling and assessments. For poverty the project team uses socio-economic indicators related to the Millennium Development Goals, such as income, daily food intake and access to clean water.

Homogenization and the Mean Species Abundance index (MSA)

Biodiversity loss consists of loss of natural area and changes in species abundance in the remaining area. Changes in species are generally characterized by a decline in the abundance of many original species, combined with an increase in the abundance of a few other - opportunistic - species, as a result of human activities. Extinction is 'merely' the last step in a long process of degradation. As a result, many different ecosystem types are becoming more and more alike. This process is called homogenization.

The Mean Species Abundance (MSA) is an index which calculates the mean trend in population size of a representative cross section of the species, in line with the CBD 2010 indicator for species abundance. The MSA addresses homogenization by dealing only with the original species in a particular area. This avoids the increase in the opportunistic species masking the loss in the original species. The IB project team applies the MSA to express the results of monitoring and modelling.

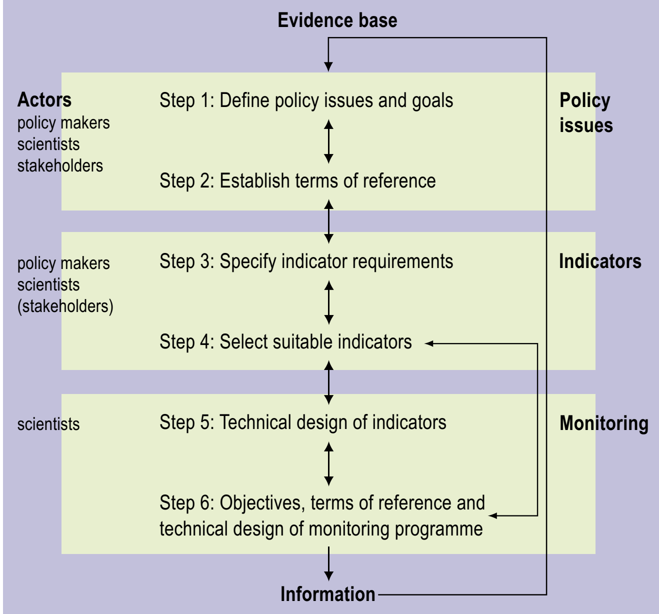


The homogenization process in the sea, caused by 'Fishing down the food chain'. *Source: Pauly et al. 1998*

Collaborating on indicators and monitoring

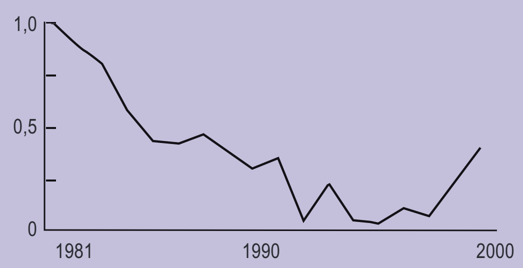
The IB project supports partners in establishing indicators and monitoring. In line with recommendations by the CBD, we use a step-by-step approach, which focuses on the key questions asked by policy makers. After the design phase, the indicators are fed back to the policy makers to see whether they sufficiently answer the key questions (in an iterative process). The final indicators are used to produce indicator-based assessments. The IB project team can also assist in finding cost-effective monitoring strategies for continuous data supply.
During the whole process, careful attention is paid to the roles of each of the actors involved.
A good example of collaboration in this area is the project 'Biodiversity Indicators for National Use' (BINU), in which the IB project team - together with the UNEP World Conservation Monitoring Centre - supported the Philippines, Kenya, Ukraine and Ecuador in producing indicator-based assessments. Among the successfully tested indicators were trends in mean species abundance and ecosystem extent. Reports on this work can be found at www.unep-wcmc.org.

Steps to implement indicators



Source: UNEP/CBD/SBSTTA/9/10

Bird trends on lake Naivasha, Kenya



In Kenya, BINU indicators such as 'Bird trends on Lake Naivasha' have supported national policies in a number of ways, for example:

- **Fishery in Lake Naivasha was stopped for one year, because of overfishing**
- **The indicators were used to underpin the new Kenyan wetlands policy**
- **BINU results were used as input for the 2005 State of the Environment report. Indicators are now seen as a standard tool for reporting on the environment.**

Source: Kenya Wildlife Services

Fisheries in the Philippines

In the Philippines fishing is the main livelihood and source of protein of a large part of the population. However, the BINU report shows that fish stocks are in decline (indicated by a fall in the catch per unit of effort - CPUE), because of overfishing. In the Philippines the findings of BINU were included in the draft medium term industry development plan, with protection and rehabilitation of degraded fishery habitats as a top priority.
Once approved, the Philippines Congress will provide funds for projects to support new policy on biodiversity.

Source: Bureau of Fisheries and Aquatic Resources, Philippines

TOOL 2 Why is it changing: Biodiversity modelling

Models help us frame knowledge on the relationship between human activities, the environment and biodiversity. They can thus help answer questions on the impacts of policies on biodiversity, ecosystem goods and services and poverty. A model may also help us find the major reasons for change and identify the areas where the impact is greatest. Furthermore, models are used to explore whether, how and when targets can be met.

The GLOBIO 3 model

The Netherlands Environmental Assessment Agency, the UNEP World Conservation Monitoring Centre and UNEP-GRID Arendal have developed the GLOBIO 3 model. GLOBIO 3 uses quantitative relationships between environmental pressure factors and biodiversity, based on state-of-the-art knowledge from literature. Pressure factors comprise changes in land use (agriculture, forestry and settlements), climate change, infrastructure, fragmentation and nitrogen deposition. By combining results related to individual pressures, the overall change in biodiversity is calculated in terms of mean species abundance (MSA) and the extent of ecosystems. The model is linked to several other global models, including the global fisheries model EcoOcean of the University of British Colombia. Relationships with poverty will be added to the model.

In 2004 a review panel of international scientists concluded that the GLOBIO 3 approach is scientifically sound and fit for purpose (Leemans et al. 2005, available on request). Following the recommendations, the GLOBIO 3 team - together with national partners - is now focusing on further developing a poverty module and species-based modelling.

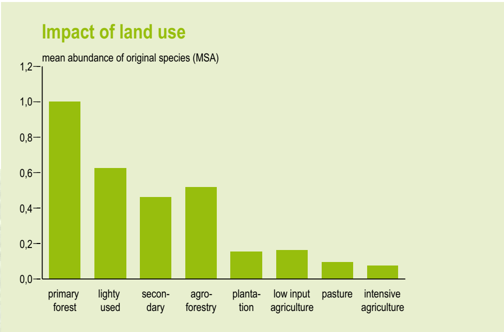
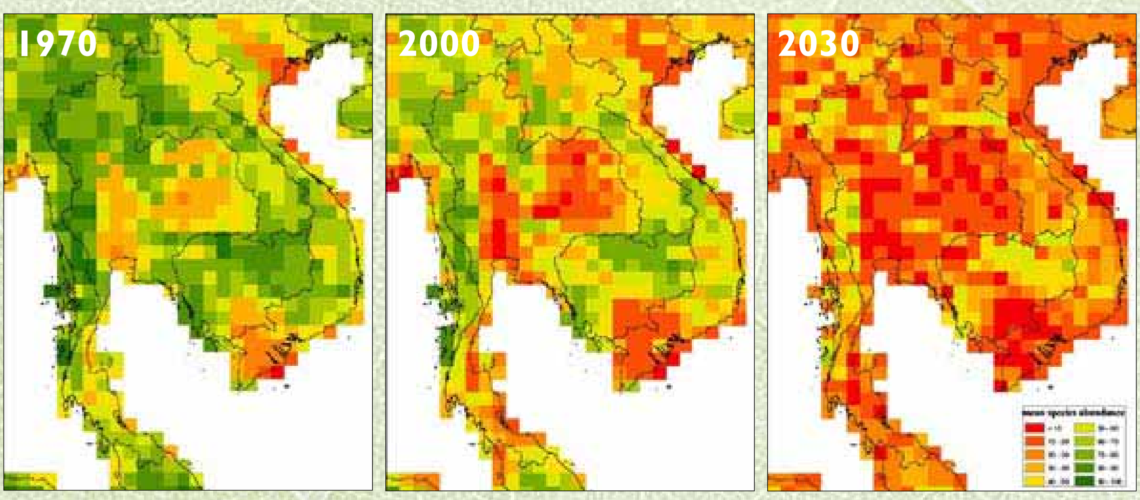


Figure right: An example of a pressure-biodiversity relationship in the GLOBIO 3 model: the impacts of changes in land use on biodiversity, in terms of the mean species abundance (MSA). Similar relationships are available for the other pressures.

Mean species abundance (as % of original)



An example of GLOBIO 3 output: modelled mean species abundance (MSA) for 1970, 2000 and 2030 in South-east Asia. For 1970 and 2000 historical pressure data were used as input for the model; for 2030 a business-as-usual scenario was applied.

Collaborating on models

Using regional data and expert knowledge of species, the generic GLOBIO 3 model can be refined into a region-specific, species-based biodiversity model. These models can predict the volume of species stocks on which people directly depend, such as commercial fish, tree and game species. For this modelling we use species knowledge in a simple and pragmatic way.

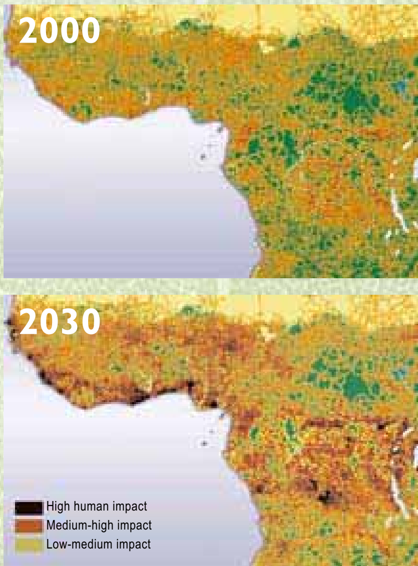
As the core of the model, partners develop so-called ecoprofiles, which contain basic information on suitable land use, the habitat, and other ecological 'preferences' of the species. Using this information the model predicts changes in species distribution and abundance due to changes in land use, climate change, fragmentation and other pressures. Based on results for individual species, composite indices such as MSA can be calculated across species.

Regional biodiversity models have already been used in Africa and are currently being developed in Latin America, the Northern Andes region and Ukraine. Together with eight other European institutes, the Netherlands Environmental Assessment Agency is participating in the EU BioScore project to develop a European species-based biodiversity model.

Ecoprofile Example

Species name	: Gorilla *(Gorilla Gorilla)*
Habitat	: African tropical moist forest African tropical mountain forest African tropical lowland forest African tropical swamp forest
Suitable land use	: Primary forest Secondary forest
Distance to roads	: > 1 km
Distance to water	: Not relevant
Altitude	: 0-4000 m
Min. Area Requirement	: 100 km²
Dispersal	: 1 km² (daily average)

Sources: African Mammals Databank, Animal Diversity Web, IUCN, UNEP-WCMC

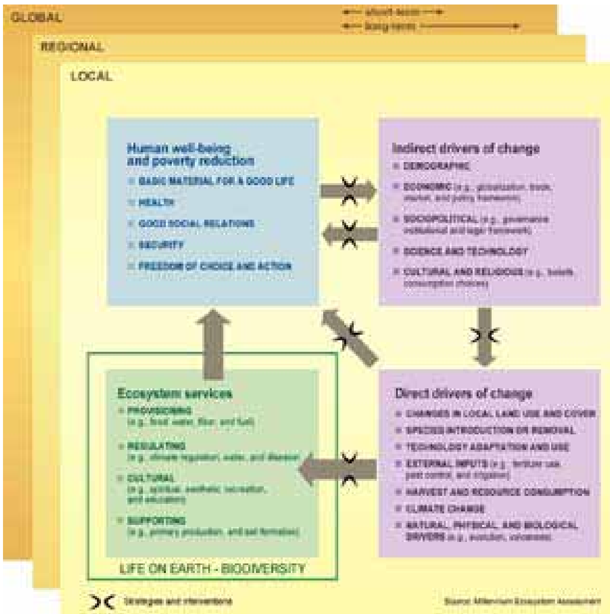


Modelling primate habitat for the current and future impact of infrastructure with the GLOBIO 2 model.

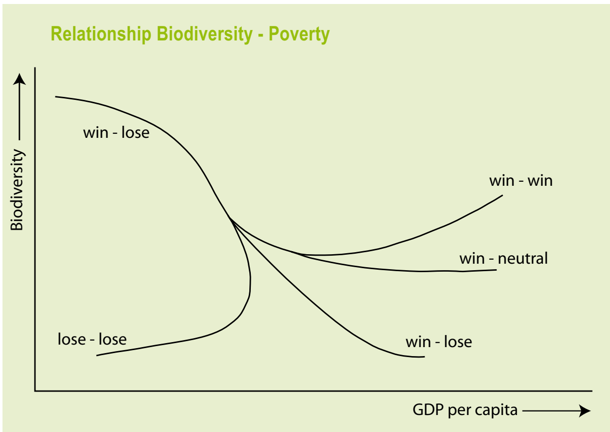
Source: Great Apes Survival Project (GRASP)

TOOL 3 Why is it important: Poverty alleviation

Poor people in rural areas are highly dependent on natural resources in their immediate surroundings. They extract timber, fish, crops and water, and benefit from ecosystem services such as protection against erosion and soil fertility. If more ecosystem goods are extracted than generated, livelihoods will eventually be at stake. The conceptual framework of the Millennium Ecosystem Assessment shows how human well-being is linked to biodiversity.



The question now is how the relationship between biodiversity and poverty will work out. In general, one would expect an "environmental Kuznets curve", with income increasing at the expense of biodiversity (a win-lose situation). This loss might continue for some time but, once a certain level of well-being is reached, some biodiversity may be regained (win-win). In other cases, biodiversity loss stabilizes while economic activity continues to increase (win-neutral). However, there is also a risk of overexploiting the ecosystem, resulting in a continued loss of biodiversity (win-lose). Finally, this can cause a failure to deliver goods and services and a decline in human well-being (lose-lose).



Given these possible pathways, the key questions on the relationship between biodiversity and poverty are:

1. How to avoid poverty as a result of biodiversity loss (lose-lose path)?
2. How to alleviate poverty without biodiversity loss (win-neutral path)?
3. How can restoring biodiversity help alleviate poverty (win-win path, but also the lose-lose path reversed)?

How to link biodiversity and poverty?

There are many different drivers linking biodiversity and poverty, but lose-lose situations are probably determined by a few typical combinations of drivers. One example is the combination of high population growth, land erosion, problems with land access and failing rural development policies.

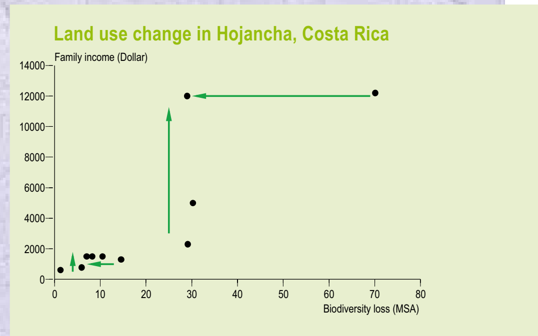
The IB project team and their partners carry out studies to explore these mechanisms, using two approaches:

1. ***A bottom-up approach*** based on case study research, identifying and correlating drivers that might cause both poverty and biodiversity loss. So far, the project has set up ten case studies in selected countries in Asia, Africa and Latin America.
2. ***A top-down approach*** designed to find globally applicable relationships by analyzing the literature as well as global maps and datasets. Output from both approaches is used to build a biodiversity-poverty module - as part of the GLOBIO 3 model - which can predict areas at great risk of poverty and explore options for avoiding so-called "poverty traps" in a timely manner.

Collaborating on biodiversity - poverty linkages

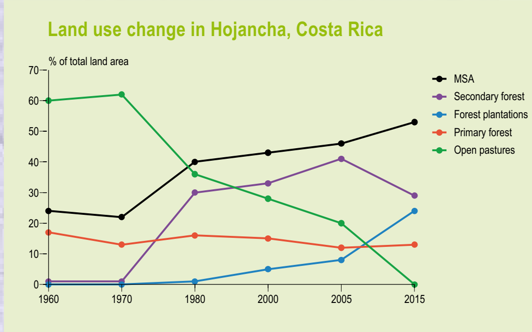
Our partners use a step-by-step approach when carrying out case studies. Key steps are:

Step 1: Categorize farms



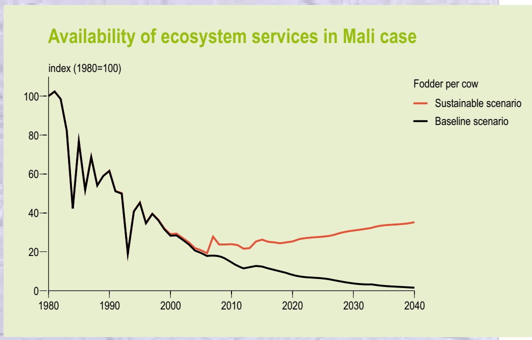
Different farms usually have different ratios between biodiversity loss and income. This example shows that biodiversity and farm income can be decoupled by intensifying production on a smaller area of land (horizontal arrows) or by diversifying production in the same area (vertical arrows). *Source: UCA-ADAA, Managua, Nicaragua*

Step 2: Analyze the historical land-use pattern



In this example, both the income of rural people and biodiversity values (MSA) were initially very low and many people migrated to urban areas. However, since 1970, the situation has changed: pasture has been converted into secondary forests and plantations. Biodiversity values improved, while incomes increased through subsidies for forest plantation and payments for ecosystem services. *Source: CATIE, Turrialba, Costa Rica*

Step 3: Analyze the future delivery of ecosystem goods, using local models



This example shows how a major ecosystem good (fodder) gets lost in a business-as-usual (baseline) scenario, but can be maintained with an alternative, sustainable policy package. Thus overgrazing can be avoided and biodiversity loss halted, while well-fed livestock generate income. *Source: T. Struif-Bontkes, Wageningen, the Netherlands & J.J. Kessler, AidEnvironment, Amsterdam, the Netherlands*

To identify generic mechanisms, results from a number of case studies are combined to identify sets of drivers that lead to a lose-lose situation for biodiversity and poverty. Poor to extremely poor communities have in common that they depend on natural resources, have no alternatives and are confronted with the increasing scarcity of these resources (i.e. they are caught in the poverty trap). Often, population growth is high to very high and there is a lack of rural development policies.

TOOL 4 What can we do about it: Assessments

Governments develop and implement Biodiversity Strategy and Action Plans, Socio-Economic Development Plans and Poverty Reduction Strategy Papers at national, regional and global level. Assessments are needed to answer the key questions that policy makers ask in a coherent manner:

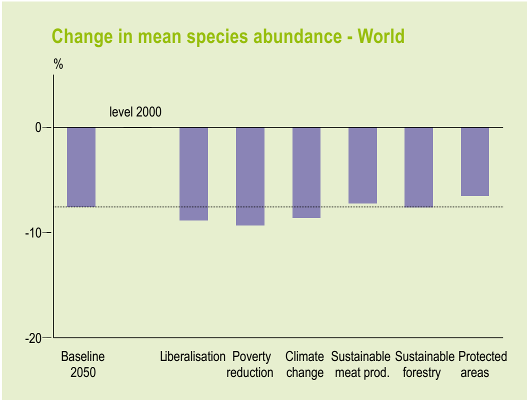
• *What is changing?* • *Why is it changing?* • *Why is it important?* • *What can we do about it?*

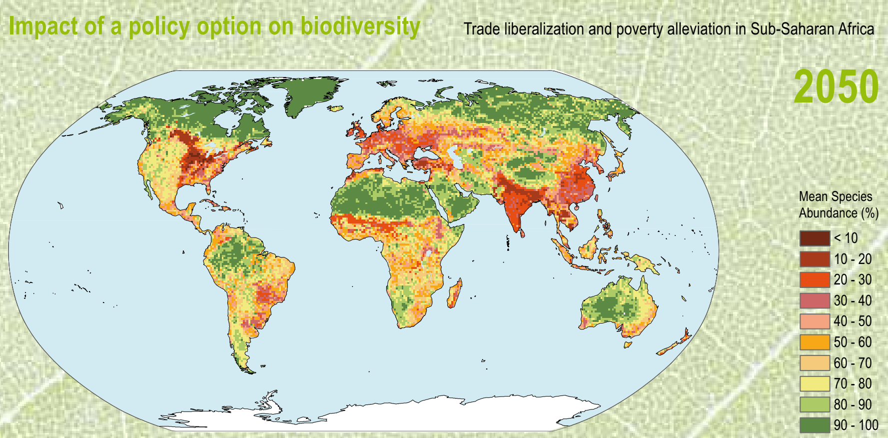
Global assessments

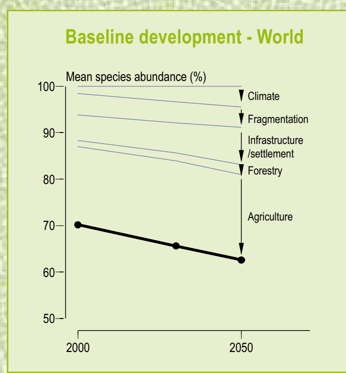
Models and indicators developed by the IB project team are used in evaluating socio-economic and environmental policies that may have an effect on land use, climate and biodiversity. Using these tools, the IB project team has contributed to e.g. UNEP's Global Environmental Outlooks, OECD assessments, the Millennium Ecosystem Assessment and the 2nd Global Biodiversity Outlook.

In the latter project six global policy options were explored for their effects (right graph) on meeting the 2010 biodiversity target:

1. trade liberalization
2. trade liberalization combined with poverty alleviation in Sub-Saharan Africa
3. sustainable meat production
4. bio-fuels for mitigating climate change
5. large-scale plantations of trees
6. protection of 20% of all ecoregions







The map shows the projected mean species abundance (MSA) of the original species in 2050, for the policy option 'trade liberalization combined with poverty alleviation in Sub-Saharan Africa'. Poverty alleviation measures in Sub-Saharan Africa result in a 25% increase in income per capita, but at the same time cause a further loss of biodiversity (graph above). The right graph presents the share of each pressure in the overall biodiversity loss in the baseline scenario (business-as-usual). The pictures on the front page of this brochure illustrate the change from highly natural ecosystems (MSA is 90-100%, green) to highly cultivated (MSA 10-20%, red) or degradaded ecosystems (MSA<10%, dark red).

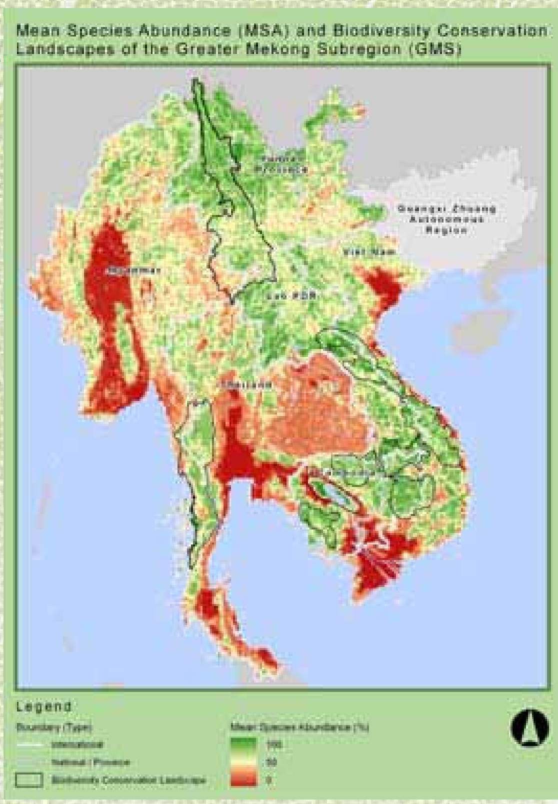
Collaborating on assessments

In national and regional assessments, the specific physical characteristics and policy issues of the area can be taken into account. To this end the global input in the generic indicators and models is replaced by national data to analyze the causes of biodiversity change and explore policy options. In collaborative projects the IB team can help partners produce such assessments. For national assessments the following national data can be used:

- land-use data
- data on pressures
- socio-economic scenarios
- policy options
- poverty incidence

One example of a regional assessment is a study of the Greater Mekong Sub-region in Southeast Asia, with project partner UNEP RRC.AP. This region is undergoing rapid economic development, which is expected to have a major impact on biodiversity and poverty. The Biodiversity Corridor Initiative (BCI) was designed to counterbalance these negative effects by safeguarding a significant area for nature.

The current state of biodiversity in the region was analyzed with the GLOBIO 3 model, using high resolution national data on land use and infrastructure. The map shows the remaining abundance of original species in the year 2000 (MSA, previously also called the Natural Capital Index) compared to the original, pristine situation, overlaid with a planned Biodiversity Corridor. The average MSA is 50% for the region as a whole, and 67% within the Corridor. The contribution of different pressures to the loss of biodiversity are calculated as well. Agriculture, followed by infrastructure, appears to have had the greatest impact. This collaborative project resulted in a significant improvement of the model outputs for the Mekong region (compare to maps under Tool 2).



Small-scale farm along the Mekong river, Laos.

MNP

The Netherlands Environmental Assessment Agency (MNP) is one of four independent assessment agencies in the Netherlands, which together give substance to the World Bank's 'People-Planet-Profit' concept. The MNP's primary task is to provide the Dutch government with information on a wide variety of environmental issues that is based on its extensive scientific knowledge and expertise. Policy-makers use MNP research findings to develop, implement and enforce environmental policy. MNP underpins government policy with its modelling, risk and impact assessment results. Operating within the remit of the Environmental Management Act and the Nature Conservation Act, the MNP charts the current status of the environment and nature in collaboration with a range of scientific institutes and other national assessment agencies. MNP contributes to broad, ecologically based political and social debate. It also supports the international assessment activities of various bodies within the European Union and the United Nations. The MNP teams share their knowledge and expertise with national and regional governments as well as with supranational bodies around the world.

Contact

Ben ten Brink, project leader
The Netherlands Environmental Assessment Agency (MNP)
PO Box 303
3720 AH Bilthoven
The Netherlands
telephone: 00 31 30 274 2210
e-mail: ben.ten.brink@mnp.nl

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