# CHAPTER 1

# Introduction

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## Summary

Biodiversity is both a factor in and an indicator of the health of all ecosystem processes. The majority of ecosystems across the globe have been greatly modified by humans. The evidence suggests that many wildlife populations are declining as a result of human activities. The result will be a more homogenized biosphere with lower diversity at regional and global scales. These changes in biodiversity have already important implications for the functioning of ecosystems and services to human society. The Costs of Policy Inaction (COPI) study aims *to highlight the need for action*, prior to the specific development and appraisal of policy instruments. A COPI assessment is therefore concerned with problem identification and with understanding the dynamics of ecosystem change and the associated damage costs in the absence of new or revised policy interventions. The main objective of the study is therefore to illustrate the impact of not meeting the 2010 biodiversity target globally in several different terms to ensure a full picture – which includes qualitative, quantitative and monetary impacts.

## 1.1. The urgency of addressing the loss of biodiversity

Biodiversity is the diversity of species, populations, genes but also communities, and ecosystems. It is both a factor in and an indicator of the health of all ecosystem processes. These processes form the environment on which organisms, including people, depend. Direct benefits of ecosystems to humans such as food, timber, clean water , protection against floods, and aesthetic pleasures all depend on biodiversity, as does the productivity and stability of natural systems.

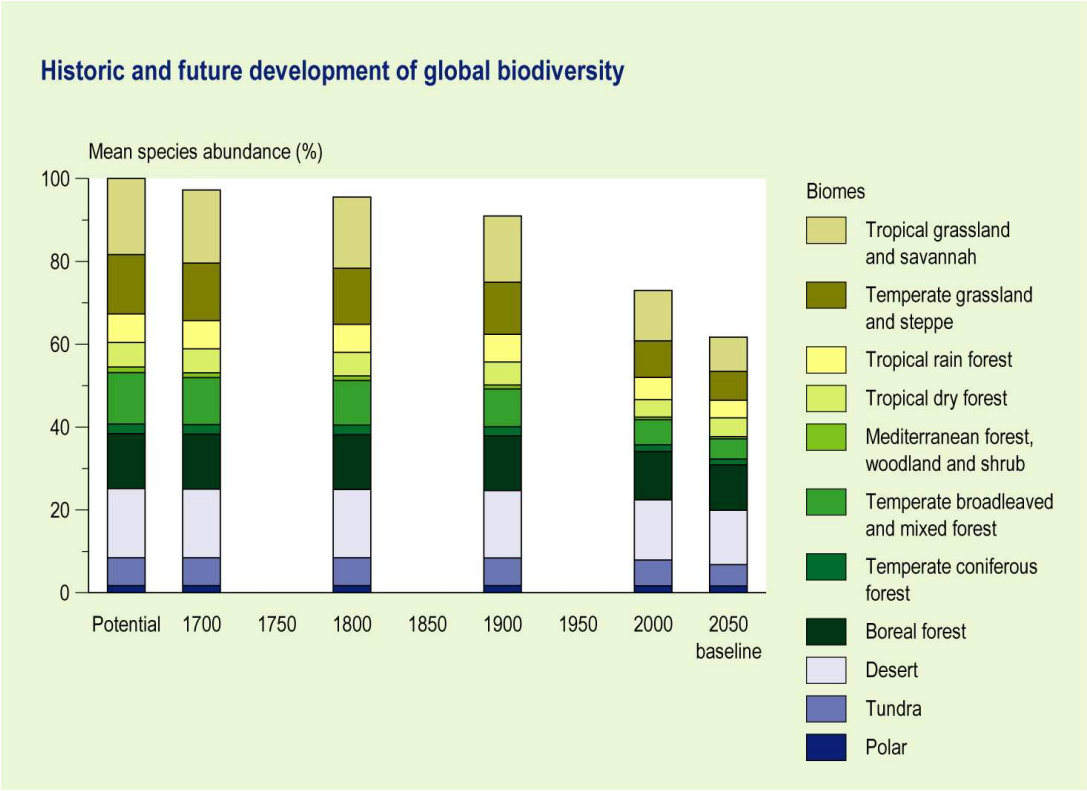


***Figure 1.1 Historical and future development of world biodiversity***

The decrease of biodiversity over the last few centuries is shown in *figure 1.1*. The measure of biodiversity used is Mean Species Abundance (MSA) which reflects the result of the total of pressures, of human origin and others (see Chapter 4 for details). Measuring change in the abundance of species populations is important for understanding the link between biodiversity and ecosystem function, as changes in populations can have important implications for the functioning of ecosystems long before any species actually goes extinct.

The majority of biomes have been seriously modified by humans. By 2000, between 20% and 50% of 9 of the 14 terrestrial biomes had been transformed to croplands. Tropical dry forests have been reduced most by cultivation, with almost half of the biome's native habitats replaced with cultivated lands. Temperate grasslands, temperate broadleaf forests, and Mediterranean forests have experienced 35% or more conversion. Biomes that have so far been least reduced by cultivation include deserts, boreal forests, and tundra. While cultivated lands provide many provisioning services, such as grains, fruits, and meat, habitat conversion to agriculture typically leads to reductions in native biodiversity.

A similar picture has unfolded across the marine and coastal systems on the globe. With the onset of industrial fisheries, stocks of commercially interesting fish and other marine species and the area and structure of coastal systems such as mangroves and estuaries have declined. Overall, the emerging evidence suggests that, for larger organisms, especially those with small areas of distribution, most populations are declining as a result of human activities and are being replaced by individuals from a much smaller number of expanding species that thrive in human-altered environments. The result will be a more homogenized biosphere with lower diversity at regional and global scales.

The 2010 Biodiversity policy target, as agreed at WSSD (World Summit on Sustainable Development) in 2002 and adopted by the parties to the Convention on Biological Diversity, is an important goal for biodiversity management. The global target is to "*significantly reduce the rate of loss of biodiversity by 2010*". However, now, in April 2008, we consider it already too late to reverse the near-term trends in biodiversity loss, and achieve this goal by 2010, given the lag times in ecosystem responses. Until a measure of control is achieved on the critical drivers, most declines seem likely to continue at the same or increased rates, although there is evidence that biodiversity loss is slowing or even recovering for some habitats (such as temperate woodlands) and species (birds in the temperate biomes, for example). Some of this positive news can be attributed to the effect of conservation policies.

A large proportion of the world's terrestrial species richness is concentrated in a small area of the world, mostly in the tropics. Regions of high species richness broadly correspond with centres of evolutionary diversity, and tropical moist forests are especially important for both overall variability and unique evolutionary history. Homogenization, the process whereby species assemblages become increasingly dominated by a small number of widespread, human-adapted species, represents further losses in biodiversity that are often missed when only considering changes in absolute numbers of species. The many species that are declining as a result of human activities tend to be replaced by a much smaller number of expanding species that thrive in human altered environments.

Over the past few centuries humans may have increased the species extinction rate by as much as three orders of magnitude. The available information, based on recorded extinctions of known species over the past 100 years, indicates extinction rates are at least 100 times if not 1000 times (MA, 2005) greater than rates characteristic of species in the fossil record. Up to about 50% of species within well-studied higher taxa, such as birds and mammals, are threatened with extinction. This is particularly relevant to humans as for many ecosystem services, local population extinctions are more significant than global extinctions, as many human communities still depend for their wellbeing on populations of species that are accessible to them.

The main causes of species extinction vary geographically and between species groups, and whilst introductions of new species to old habitats and overexploitation have always been major threats, habitat loss and degradation are currently the most significant. Climate change is becoming an important pressure. Recent empirical evidence, logical extrapolation of trends and scenario studies suggest that climate change will unavoidably lead to further population losses. Studies of amphibians globally, African mammals, birds in intensively managed agricultural lands, British butterflies, Caribbean corals, water birds, and fish species show the majority of species to be declining in range or number. Those species that are increasing have benefited from management interventions such as protection in reserves or elimination of threats such as overexploitation or are species that tend to thrive in human-dominated landscapes (*adapted from MA, 2005b*).

## 1.2. The economics of biodiversity loss

As a reference for the discussion in this report, the essential dynamics of a typical regional ecological-economic system are captured in *figure 1.2*. The "Natural Ecosystem" (with associated biodiversity "B") is shown to provide an array of ecosystem services, some to the "Agricultural ecological-economic system", some to the consumers in the "Urban/Industrial system" and some exported (incorporating human services as well). Payments (€) for these services do, of course, not go to the ecosystems but to the production, harvesting and trade sectors of the Agricultural and Urban systems, respectively. Since the industrial age, an increasing part of the economic dynamics has become determined by the "Imported goods and services, including fuels," and trade, and *consequently the direct dependency of the agricultural and urban prosperity on local and regional ecosystems decreased!*

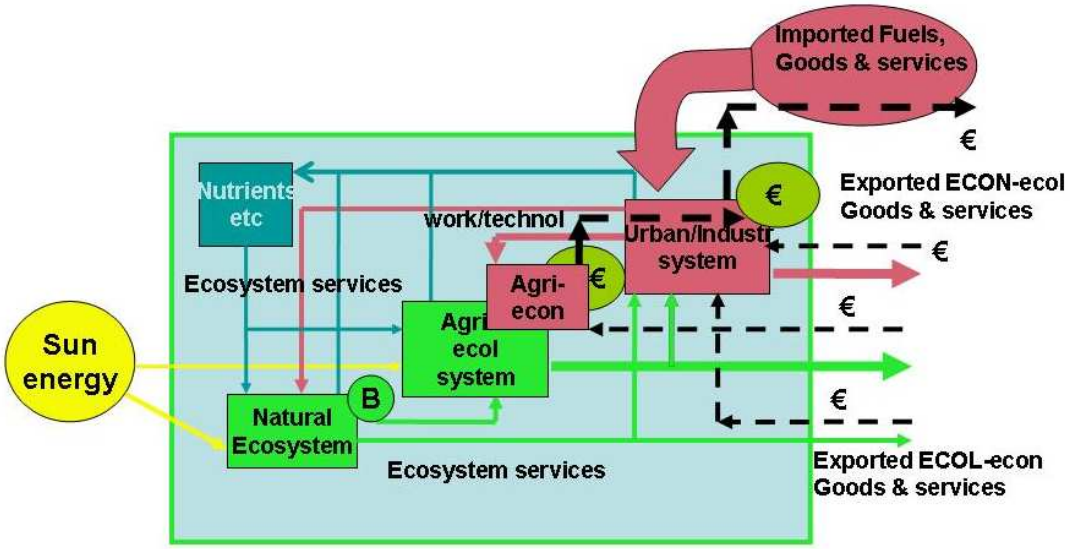


***Figure 1.2 The generalised ecological – economic system (Braat, in prep.).***

Psychologically, this has led to estrangement of the regional population from their local resource base, with decreasing care for management and for sustainability of use. However, in reality, the local systems still provide a real value to both the local and the global economy through various types of services. In the second half of the 20th century, globalization, world trade discussions and increasing worries about the quality of environmental conditions in developing countries, which export their raw materials, have led to re-evaluation of the role of ecosystem services in regional economies.

The diagram indicates the various types of ecosystem services, as distinguished by the Millennium Ecosystem Assessment (MA, 2005a). The green boxes and arrows represent the direct and indirect contributions by the bio-geo-chemical processes in ecological systems (both natural and man-influenced agricultural), called provisioning services when actual food, fiber or clean water is delivered to human systems and called supporting services when referring to the work done within the ecosystems which makes deliveries possible. The blue box and arrows represent the so called regulating services, where ecosystems by means of their structure and processes absorb, neutralise and recycle waste products of human systems, as well as locally excessive natural energy flows, such as floods and fires (see Chapter 5).

## 1.3 The position of the COPI project in the policy life-cycle

The position of COPI in the so-called policy life-cycle is shown in *figure 1.3* (Bakkes et al., 2006)

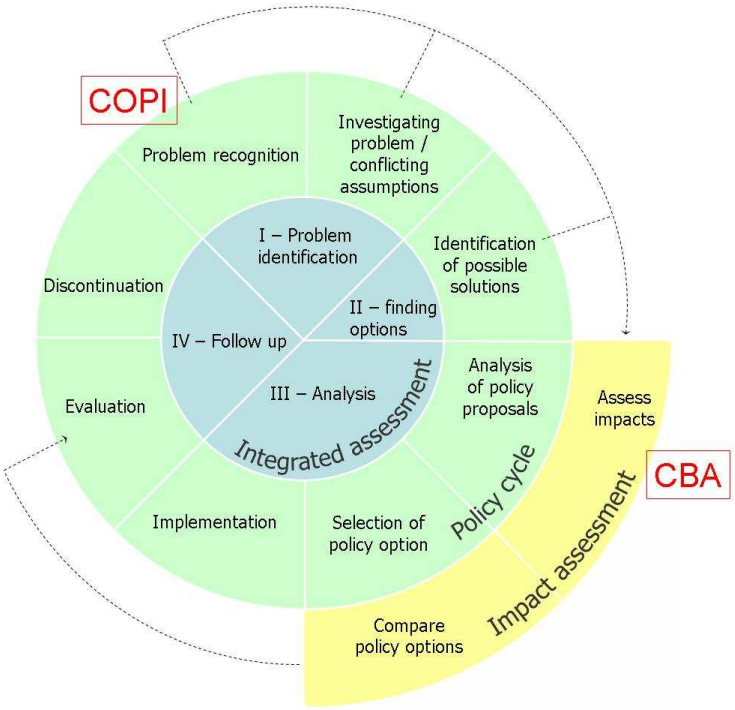


***Figure 1.3: Place of COPI in the policy life cycle***

The purpose of estimating the costs of policy inaction is *to highlight the need for action*, prior to the specific development and appraisal of policy instruments. COPI is therefore concerned with problem identification, and with understanding the dynamics of ecosystem change and the associated damage costs in the absence of new or revised policy interventions. A COPI-analysis differs from a Cost-Benefit analysis - in that:

- COPI is undertaken prior to the identification of policy choices, while Cost-Benefit analysis relates to a defined policy option and choice;
- COPI addresses the total costs of not changing, while Cost-Benefit analysis is concerned with the marginal net benefits of change or the marginal net costs of not changing;
- COPI is concerned either with a range of pressures on an environmental domain, or with the effect of a given pressure on a range of environmental domains, or some combination; Cost Benefit analysis relates to the specific policy options and the related defined pressure and a particular aspect of the environment

The most important guiding principle for a COPI analysis is to say what can be said, in terms that are clear, understandable, with results that are useful and can be traced and explained. In practice, it is valuable to present the costs of policy action in all three manners – in qualitative terms, in quantitative terms and monetary terms – all the while understanding what each of these covers, and therefore presenting the results in context.

## 1.4 Objectives and outcomes of the study

The objectives of this COPI study are:

### 1. To develop an exhaustive inventory of the economic evaluations of biodiversity so far.

For a COPI assessment there needs to be as good a coverage as possible of the different ecosystem service values for the different biome types. The inventory of the economic evaluations of biodiversity therefore needs to as 'exhaustive' as possible, in the sense that the combinations of "biome-land use" units, as distinguished in this report, with "sets of the ecosystem services", derived from the Millennium Ecosystem Assessment, are representative for the full range of existing and potential combinations. It will be 'exhaustive' also in the sense of presenting the most relevant parts of the information that are available. Note that experience suggests that for some biome types and ecosystem services quite good information is available, and in other areas there will be gaps. It is considered important to both present ranges of values for where there are several estimates, and also important to be clear on the gaps – some can be addressed by estimation, others will have to be left blank if insufficient information is there for an estimate. The insights on both where the gaps are, and methods on how to address the gaps, will be helpful to clarify task and challenges for evaluation work building on the findings of this work. *Details of the inventory are presented in Annex I*

### 2. To analyse and to present the economic evaluations in a coherent framework

The case studies from the inventory have been put in a spatially explicit, ecological – economic database to allow for an analysis of the case study data and a synthesis of results into economically, politically and geographically relevant systems. The choice as to which biome-habitat types the analysis builds on reflects those in the OECD scenario work to ensure compatibility. *Details are presented in Chapter 2 and Annex I.*

### 3. To illustrate the impact of not meeting the 2010 biodiversity target globally

The illustrations of the impact are specified in several different terms to ensure a full picture – which includes qualitative, quantitative and monetary impacts:

- Qualitative: most important losses of biomes and of ecosystem services
- Quantitative: aggregated physical indicators
- Loss of services: percentage loss of appropriate indicators
- Monetary: An aggregate monetary value of the COPI

*Details are presented in Chapters 3 to 6 and Annexes II and III.*

### 4. To help setting priorities within the field of biodiversity conservation in the EU.

With a set of conclusions and a discussion of the merits and uncertainties of the analyses, the basis is to be formed for recommendations as to potential improvements in policy and management. *Details on the policy perspective are presented in Chapters 3 to 7.*

### The wider objectives: COPI in context

The COPI study is one of a series of studies being carried out in parallel, all of which contribute to the wider study on The Economics of Ecosystems and Biodiversity (TEEB). The results of COPI will feed into the Phase 1 report of the TEEB that is being presented at the CBD COP9 in Bonn in May 2009. Furthermore, the methodological insights will help form a basis from which the TEEB phase 2 will build. The results of the COPI work therefore have a dual purpose – both as a study on the costs of policy inaction in its own right, but also as a contributor to a wider and bigger process of understanding and assessing the economics of ecosystems and biodiversity and thereby contributing to the much wider efforts to halt biodiversity loss.

## 1.5 Structure of the report

The overall COPI methodology applied in this study is presented in Chapter 2. Chapter 3 summarises the developments of the demographic and economic drivers of biodiversity change as calculated in the Baseline OECD scenario, and resulting changes in land use and other pressures for the period 2000-2050. Chapter 3 also presents the policies which are considered part of the baseline. Chapter 4 presents the changes in biodiversity, an extension of work done in the course of the OECD Environmental Outlook to 2030. Biodiversity changes in marine and coastal systems are added. In Chapter 5 the available knowledge with respect to the changes in ecosystem services is summarised and linked to the Baseline scenario. This is to form the basis for an assessment of losses of ecosystem services benefits. Chapter 6 introduces the monetary assessment work. Valuation results are linked to different biomes and land use types, and also take into account the geographic location, and the demographic and economic contexts of the case studies. Chapter 7 presents the conclusions and recommendations, both with respect to policy as to necessary research. The COPI valuation database is presented in Annex I, a detailed case study of economic valuation of forests around the world in Annex II and of invasive alien species in Annex III.

## References

Bakkes, J.A., Braeuer, I., ten Brink, P., Görlach, B., Kuik, O. & Medhurst, J. (2006) *Cost of Policy Inaction – A scoping study. Final report for the European Commission*, Brussels.

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MA (2005b) *Millennium Ecosystem Assessment: Ecosystems and human well-being, Volume 1: Current state and trends.* Washington.