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Economic instruments for biodiversity

Setting up a Biodiversity Trading System in Europe

Report

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Content

Preface

Sir Nicholas Stern defined climate change as the greatest and widest-ranging market failure ever seen. It might be claimed that the pace and risks of world wide loss of biodiversity involve an equal fundamental failure of markets: those who damage others by harming biodiversity and natural areas seldom pay. This observation illustrates the urgent need to correct this market failure on a international scale. The European application of an economic framework to correct for these market can be a first step to halt world wide decline of biodiversity.

This report, written for the Dutch Ministry of Housing, Spatial Planning and the Environment (VROM), embodies an analysis of possibilities for using economic incentives for the protection of biodiversity worldwide. The aim is to address the impact that European consumption of products has on biodiversity by attaching economic value to biodiversity.

Martijn Blom, Marisa Korteland and Geert Bergsma
CE Delft
December, 2008

Summary

Aim

The aim of this study is to explore the practical design of an economic framework for protecting biodiversity connected to the European consumption of products that have a high impact on biodiversity worldwide. The analysis takes the Ecobalance concept as a starting point.

The Ecobalance concept divides the total usable land that is available worldwide into two parts: land used for economic activities and natural land. In order to reach a balance between both types of land uses, economically justified land use needs to be compensated by a comparable amount of land that is protected, whereby areas are classified in terms of vulnerability and biodiversity value. Under this approach, biodiversity protection would compete with exploitation of land and a new equilibrium will arise.

Fundamental causes of biodiversity loss

The loss of biodiversity is occurring worldwide at a rapid rate that has the potential to significantly undermine the prospects for sustainable development. Although the main proximate cause of biodiversity loss is land conversion, the fundamental causes are rooted in economic, institutional and social factors and include market failures and the lack of property rights. These fundamental causes include lack of sufficient price signals, absence of markets for biodiversity functions[1] and the implementation of misguided government policies. The absence of markets means that those in a position to preserve habitat lack sufficient incentives to do so. Economic instruments can be designed to address these economic forces and pay for the ecosystem services in order to combat these pressures.

Economic instruments

Without the introduction of new policies the current decline in biodiversity and the related loss of ecosystem services will continue and, in some cases, are even expected to accelerate. The European consumption pattern is an important contributor to biodiversity loss as it shows a rising ecological footprint in terms of worldwide land use (and declining own biocapacity in Europe). Europe accounts for 17%, of humanity's footprint and Europe uses over twice the amount of its own land and seas space that is required to support resource demands. In order to be able to reduce this European footprint, incentive mechanisms must operate at the global level. Rewarding conservation activities through incentive-based instruments increase the profitability of conservation as a land use activity. Thus, land management for conservation can be brought in closer competition with more destructive management activities such as mining and agriculture. This competition will most likely engender the beneficial side effect of increased land

[1] Biodiversity services are systematically being underestimated through a lack of information and as a consequence the demand for services can be considered too low.

prices in those areas where conservation is an economically viable alternative. Facing higher land prices, developers will opt for more area-intensive production that minimises harm to biodiversity.

In order to successfully change land use patterns incentive mechanisms should incorporate two price components:
- Cost of protection measures.
- Opportunity cost of alternative land use.

Role of offsets and habitat banking
Offsets and habitat banking have the potential to create incentives for conservation at two levels. First, offset requirements discourage activities that reduce biodiversity by increasing the cost of development. Developers must pay an additional fee for their activities in the form of compensation for residual biodiversity loss. Second, offsets create a demand for conservation land. By increasing the demand for conservation, offsets provide an additional incentive to 'manage' land for conservation as opposed to more biodiversity-destructive economic activities. Initiatives for biodiversity offsetting have been developed in a number of regions around the world, e.g. in the US, Australia, South Africa.
Offsets and habitat banking do have some major drawbacks. Most important are the acclaimed lack of additionality of protection projects, valuation difficulties and transaction costs. Part of these drawbacks can be dealt with through a careful design of a framework and mitigation hierarchy.

Voluntary or compulsory?
Voluntary offsetting schemes will prove unable to undermine the ongoing loss of biodiversity. Voluntary schemes will not provide the scale necessary to create a global demand and change land prices fundamentally. Only through an offset requirement on the European level demand for conservation can be substantially increased so as to provide the necessary scale for protected areas. This scale also means the offset market can be standardised and improved by requirements proposed by the EU.

European framework for offsetting European footprint
Under a European system of biodiversity offsets, high-impact land use change activities are 'taxed' for their development activities through a requirement to compensate for all unavoidable impacts to biodiversity. Revenues are collected to finance biodiversity credits provided by the European habitat bank. These credits are supplied by (developing) countries that undertake *additional* efforts to preserve their valuable and threatened ecosystems.

This ecological footprint can be determined on the basis of the quantity of land use (hectares) and quality of land utilization. Three classes of land use management are distinguished: no conversion/undisturbed state, partial conversion and full exploitation. A market for biodiversity credits is created and, through the compensation requirement, a global demand for conservation land is formed.

Demand for credits

The obligation to compensate can be placed at European Member States or at the level of European producers and importers.

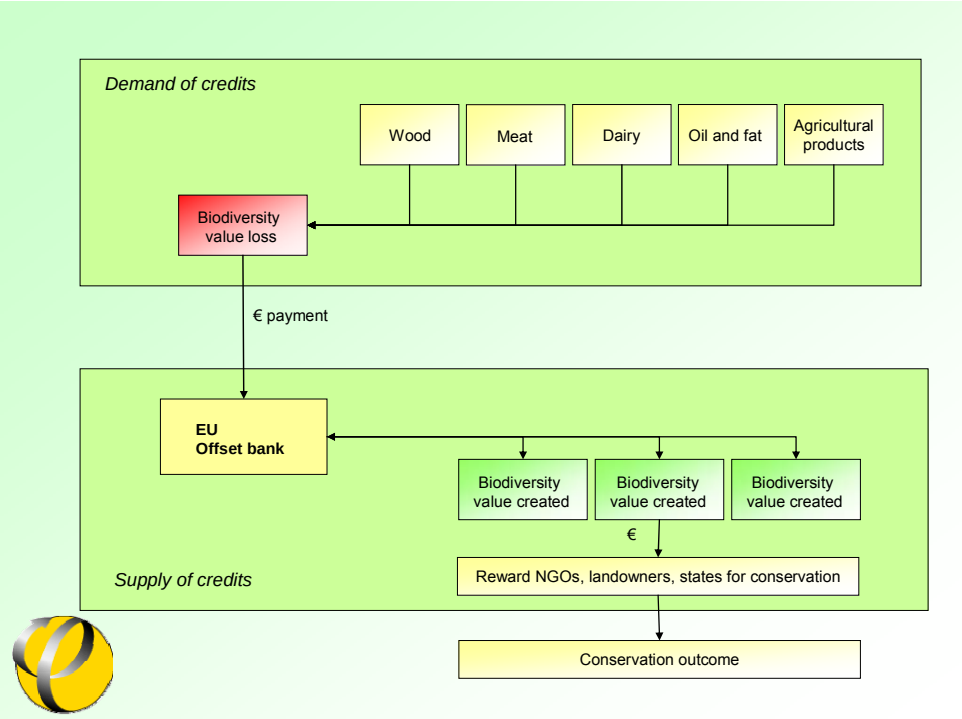
An advantage of placing European States under an obligation is that it gives more flexibility in developing alternative financial mechanism for collecting the necessary financial means for compensation. Secondly it will reduce transactions costs, but at the same time remove the incentive to reduce the own ecological footprint, which would reduce the BTS exclusively to a framework for compensation.

Supply of credits

Supply of credits to the European Offset Bank can be provided by individual project developers abroad to fulfil requirements and monitoring protocols of the EU Bank. As an alternative donations for compensation can be provided at the level of individual countries on the base of unilateral agreements. Under such a scenario the Habitat Bank is a financial intermediary which channels under strict conditions capital from European sources to nations protecting unique and vulnerable habitat.

Irrespective of the specific role of the bank (or bank or intermediary), a certain degree of standardisation of the offsetting procedure is necessary and desirable for scaling-up to the international level. An EU procedure institutionalised in a *EU Offset Bank* can be the forerunner for a global mechanism that discourages biodiversity loss resulting from internationally-driven land use change by requiring all residual biodiversity loss from development by international actors to be offset through commensurate conservation elsewhere. The EU scheme is summarised in Figure 1.

Figure 1 An EU offset scheme



European framework for mitigating and offsetting European footprint
However, under such an offset system, European firms can use as much land as they want as long as they compensate for biodiversity loss. This scheme offers no guarantee that the volume of biodiversity use decreases over time; there is a risk of 'green washing' business as usual. The results in terms of land destined for conservation (embodied in the *Ecobalance concept*) might not fulfil the initial expectations.

To reduce Europe's demand for ecological resources a *cap and trade system* can be considered in which the total amount of biodiversity use for the consumption of 'harmful' products can also be regulated (option 2). Companies or sectors under the trading system also need to buy *biodiversity debits,* but the number of debits in the market is limited since the cap on total biodiversity use cannot be exceeded. The initial allocation of debits can be based on auctioning, after which trading takes place.

Such a trading scheme allows a reduction in the total impact on biodiversity on a year-to-year basis (by lowering the cap) and compensates the residual biodiversity footprint through using the auctioning revenues. The money will be spend on biodiversity credits. Two markets are thus created here: a biodiversity debit and credit (offset) market.

Sectors included
Relevant sectors to be included in both systems are:
- Wood (demand for timber) and paper.
- Meat (or feed for cattle like soy beans).
- Dairy products.
- Oil and fat.
- Agricultural products (including wheat, sugar beet, coffee and cotton).

Together these 'high impacts' products constitute more than 95% of the land use claim of Dutch consumption.

Institutional blueprint
Independent of the above mentioned design issues two new European institutions are pivotal to ensure an effective and cost effective approach to offsetting and trading;
- *EU biodiversity authority*. It which will guarantee the enforcement of the offset market and, in case of a *cap and trade* system, the debit market. Every European producer and importer is required to have sufficient biodiversity credits to cover their footprint or needs to surrender enough debits for their footprint. The biodiversity authority seeks to the process of transferring sufficient credits or debits by European companies according to their individual production.

- *EU offset bank*. This organization will be responsible for establishing an effective and cost effective market for offsetting. It is an independent organization that implements and maintains the offsets on behalf of the developer in exchange for financial compensation. An independent European institution will add credibility to the offsets and creates a mechanism for standardizing the practice ensuring a large scale and cost effective market for offsetting. This can be institutionalized through establishing an EU offset bank.

Recommendations

This study shows that *international incentives* are urgently called for in order to correct for market failures and halt biodiversity destruction effectively. Europe can make an important start as Europe accounts for 17% of humanity's footprint. Trade is the mechanism that makes it possible for Europe to maintain its current way of life.

The BTS approach looks promising against the background of Europe's rising ecological footprint, but there are still important remaining questions left to be answered. The most important question is if such a scheme can be established against acceptable transaction costs. One of the major arguments against project-based offsetting emphasises the institutional capacity required for monitoring offset requirements and contrasts this sharply with the lack of capacity in many developing countries.

Insight on the following aspects is essential in order to asses the desirability and feasibility of a BTS system:

- Measurement and allocation of land use and assessment of available statistical and trade information to assess the loss biodiversity adequately.
- Indirect effects of EU-BTS on land use (leakage).
- Indirect effects on food prices.
- Implementation costs and transaction costs of BTS in Europe as well as the costs of monitoring and verification of projects in developing countries.
- Additionality of conservation project in developing countries.

1 Introduction

1.1 Background

Throughout history, concerns about the environmental impact of human behaviour have been widespread. Several approaches have been developed that would help to alleviate the pressure on nature and the environment caused by production and consumption activities. They range from private partnerships and voluntary certification schemes to command-and-control policies and economic instruments implemented by governments.

The use of economic instruments has frequently been advocated as a means of attaining environmental objectives in the most efficient manner. It was the Brundtland report of 1987 which first put economic instruments seriously on the policy agenda. Before that time, the predominantly social democratic dominated governments and policy makers regarded taxation of pollution as a way in which industries could continue to pollute if only they paid the price. Since the late 1980's, government reports in many OECD countries have announced an increased use of economic instruments (Pearce, 1989; Ministry of Housing, Spatial Planning and Environment, 1989, Lalonde, 1990). In 1991 the OECD, in accordance with its 1975 *polluter pays principle*, recommended its member countries to consider the possibilities of introducing more environmental taxes - again.

Yet, the main area in which economic instruments were implemented was environmental protection (the *grey environment*) rather than nature protection (the *green environment*). Nature and biodiversity conservation was traditionally the domain of ecologist instead of economists. Conservational policy was largely carried out through direct regulation (command and control). The importance of economic instruments and other financial incentives is recognized in the late 90's and early 2000. Economic instruments have been advocated in the texts of numerous agreements and decisions of the Conference of the Parties (COP) and the Organization for Economic Cooperation and Development (OECD). There has, for example, been an increasing recognition that economic incentives could make an important contribution to achieving the goals of the Convention of Biological Diversity.

These announcements have, however, only been followed by a restricted range of action. The record of actual use of economic instruments for the protection of nature is limited. Although the use of economic instruments in this field has increased over the years, it is still a rather modest increase. This is predominantly confined to national policy making. Measures adopted so far have been mainly focused regulations (command and control) aimed at controlling international

trade in listed species, despite the fact that the economic and ecological consequences of the biodiversity decline have become more and more visible.

The international scale of the market failure demands an equal international effort of western and non-western countries to correct it. For this reason the Ministry of Environment of the Netherlands requested CE Delft to conduct an analysis of a practical design of a useful economic framework for addressing the value of international (impact on) biodiversity from the consumption of products.

1.2 Objective and scope

The aim of this study is to explore the practical design of a useful economic framework for protecting biodiversity connected to the European consumption of products that have a high impact on biodiversity worldwide.

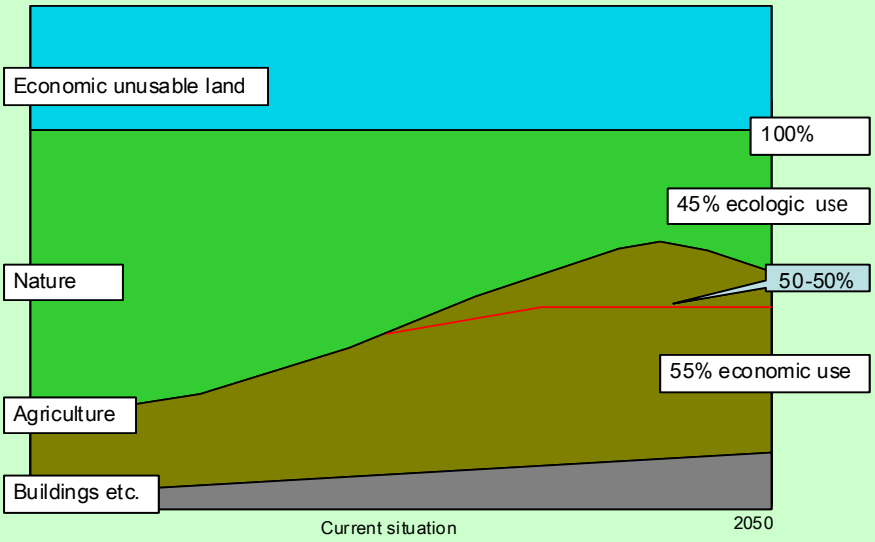
Ecobalance concept
This concept focuses on the most important pressure factor of land use (aim: high effect with low complexity) and on international compensation (avoid making use of natural resources without compensating for it). Of the important pressure factors (land use change, invasive species, overexploitation, pollution, climate change) causing a decline in biodiversity, land use change is regarded to be of the most influence: most notably the transformation of primary natural areas into agricultural land.

To this extent, a relative simple idea has been developed: compensate what you consume, or 'balancing biodiversity'. It just puts that you compensate e.g. your annual consumption of wood by an equal amount of forested territory (i.e. land use) needed for its production. Preliminary research for the Netherlands indicates that the largest pressures derive from meat and wood consumption (app. 65%, source: RIVM, 2004).
Compensation is to be translated into biodiversity conservation, organized by independent NGO's.

Ecobalance

The Ecobalance concept divides the total usable land that is available worldwide into two parts: (1) land used for economic activities and (2) natural land. It is expected that worldwide land use will develop according to the figure below. According to preliminary MNP estimates, the division between economy and ecology is currently 45-55%, but the economic share in total land use is expected to reach 55% in 2050.

Expected development in global land use and socially optimal division of land use



The question is what the socially optimal development in land use is. It is currently assumed that an roughly equal division of land between economy and ecology (50-50%) would be desirable. This is depicted by the red line in the figure above. Such a target means that all economically justified land use needs to be compensated by a comparable amount of natural land.

Subsequently, it would be worthwhile for societies to avoid massive land exploitation nowadays as they would otherwise need to restore the land in the longer run[2]. Rebuilding nature and ecosystems is more expensive and time consuming than protect existing biodiversity areas. Besides, it is highly uncertain whether specific biodiversity values can actually be re-established once they are destructed.

Source: VROM, 2007.

[2] This line of argument does not hold if societal preferences are highly biased towards economic land use, assigning for example 70% of total land surface to these activities. In such a case, hardly any nature compensation would be needed.

1.2.1 Scope of application

We focus on a European design of such an instrument (i.e. compensation of European consumption), eventually extended by a wider group of developed countries. The scope of the biodiversity impacts for this study is worldwide, in order to take all use of natural resources into account.

Efficient design of economic instruments is based on the economic value of (the loss of) biodiversity by using complex valuation techniques. As a result of the complexity of measuring the economic value of biodiversity and the lack of relevant information of economic value in international product chains we consider this option as infeasible and certainly not free from discussion. Land use is a more simple indicator and reliable statistics on land use from different agricultural products are available. For these reasons we focus on land use as the key point of application of the envisaged economic framework.
Biodiversity depletion has two main causes (UNEP/CBD, 1997; OECD, 2001):

- **Loss of habitats** (size of ecosystem surface). The main anthropogenic cause of biodiversity loss at the landscape level is the loss of habitat that follows land use change. The main consequence of biodiversity loss is a change in the flow and nature of ecosystem services.
- **Loss of ecosystem quality** (decreasing abundance of many characteristic species). Decreasing ecosystem quality is generally caused by factors as climate change, pollution, habitat fragmentation and overexploitation in natural ecosystems, the use of external synthetic inputs (pesticides and fertilisers), etc.

We therefore chose to concentrate on both *quantity* and *quality* of land use patterns.

An important condition in the development of a framework is further that it should not only generate funds for protecting unique and biodiversity-rich areas worldwide, the instruments should have preferably a significant contribution to a sustainable use of biodiversity stemming from European consumption.

1.2.2 Synergy with other instruments

A range of economic instruments (see for example OECD, 1996, 1999, 2004; UNEP, 2004) has been implemented at the countries where biodiversity depletion takes place or where the demand for consumer products origins. Market failures including unsustainable patterns of production or consumption, open/free access to unique natural areas and the ill-defined property rights are to be addressed by these instruments. These incentives are usually taken by national governments.

However, the market-failure leading to biodiversity depletion has a strong international dimension. Specifically, land-use change is driven globally by international developers selling products for export, as well as locally by actors altering land to meet subsistence needs. Both causes of land-use changes can only be addressed with economic instruments applied at the international level as has been done for the EU tradable emission rights scheme (EU ETS). The main focus of this report lies on the international application of economic instruments

from the perspective of the EU, eventually extended by a wider group of developed countries.

The focus on economic instruments does not mean, however, that all other policy approaches can be considered as abundant. They can support each other (synergy) in tackling the pressure that lead to biodiversity loss. For instance, command and control regulation is progressively more complemented with economic instruments, as well as educational and other measures (UNEP, 2004). Economic instruments can enhance the effect of existing policies. They can, if designed properly, give significant incentives to for example existing and new initiatives in the field of labelling and environmental certification. These initiatives have gained significant market importance particularly in the area of natural resource extraction and management. Schemes are often voluntary, and frequently created by private agents in the market. They seek to increase incentives for environmentally-sound production by enabling consumers to differentiate between production techniques, product qualities or producing organizations. Economic instruments can contribute to the further market penetration of these schemes.

1.3 Types of economic instruments

In general, economic instruments to encourage biodiversity protection can be grouped into four categories (OECD, 2004):

1 *Positive incentives*: monetary or non-monetary inducements which encourage or motivate governments, organisations and individuals to safeguard biological diversity.
2 *Disincentives*: mechanisms that internalise the costs of use of and/or damage to biological resources in order to discourage activities that deplete it.
3 *Indirect incentives*: trading mechanisms and other institutional arrangements that create or improve upon markets and price signals for biological resources, encouraging the conservation and sustainable use of biological diversity.
4 *Perverse incentives*: incentives which induce behaviour that reduce biodiversity; most of them are unanticipated side-effects of policies designed to attain other objectives.

There are two main types of economic instruments: either taxes or tradable permits. There are several variations of each; taxes may, in particular, take the form of either input taxes or product taxes. Tradable permits have mainly been used in the EU and the US, and they enjoy many of the same advantages as pollution taxes.
At the start of this study, we briefly evaluated available measures (see Annex A). Attention has been paid to taxation of 'biodiversity harmful' activities, tariff exemption for environmental products and the option that governments destine a certain percentage of the country's GDP for environmental protection. We found that there are practical limitations on the implementation of taxation schemes on biodiversity use. EU tax harmonization will be difficult, definition of the tax base could be problematic and, last but not least, earmarking revenues for specific

projects might not be allowed. For these reasons political support for a European tax or harmonised national taxes will be very difficult.

Given these limitations of practical design of a 'European tax on biodiversity' trading systems can be considered as a more feasible option. Such a system should embody a biodiversity offsetting requirement to create a structural demand for offsetting. Subsequently, we chose to focus in this report on the introduction of a European trading framework, which we called '*Biodiversity Trading System'* (EU BTS).

1.4 Structure

The set up of this report is as follows: chapter 2 provides the theoretical framework on the use of economic instruments for biodiversity. It starts by giving an analysis of the drivers of world wide decline of biodiversity.
Attention is paid to the rationale behind implementing economic instruments in the field of biodiversity protection, types of economic instruments, design issues and effects of economic measures. Chapter 3 covers the practical design of an European Biodiversity Trading Scheme (EU BTS), whereby two types of schemes are outlined. The institutional framework and other practical design issues are discussed here. Chapter 4 forms the conclusion.

2 Theory: biodiversity and economic instruments

2.1 Introduction

In this chapter we analyse the causes of worldwide loss of biodiversity and examine ways to combat these pressures from a theoretical point of view. The basic idea presented here is quite simple:

- Internalise part of the external cost of biodiversity caused by European consumption of biodiversity harmful products (European biodiversity footprint).
- Use part of the revenues to compensate this biodiversity footprint by setting up a tradable system for offsets.

First, we will analyse the importance of global supply of biodiversity (section 2.2) and causes of biodiversity loss (section 2.3). Second, we present the economic framework for designing an efficient economic European framework (section 2.4 and 2.5). Third, we will explore the concept of offsetting (section 2.6) and consider an appropriate point of application (section 2.7). Finally, we will review the possible effects of such a economic framework from a theoretical point of view in terms of price effects and collecting revenues (annex B.1).

2.2 The importance of global biodiversity to European citizens

What is biodiversity?

Biodiversity can be defined in a variety of ways. A very narrow definition is to focus on genetic diversity (which occurs within species, e.g. subspecies/forms) or species diversity, perhaps taking into account the functional role different species play. A broader definition is to focus not just on species but also habitat and ecosystem diversity. Here varied landscapes, uplands, lowlands, wetlands and coastal areas all contribute to the diversity of the natural environment. This broader version follows the standard Convention on Biological Diversity definition (see http://www.biodiv.org).

Why is biodiversity important?

Humanity receives countless benefits from the natural environment in the form of goods and services such as food, wood, clean water, energy, protection from floods and soil erosion (TEEB, 2008). Natural ecosystems are also the source of many life-saving drugs as well as providing sinks for our wastes, including carbon. Human development has also been shaped by the environment, and this interlinkage has strong social, cultural and aesthetic importance. The well-being of every human population in the world is fundamentally and directly dependent on ecosystem services.

Biodiversity decline

An important conclusion of the TEEB report (TEEB, 2008)[3] is that if we do not adopt the right policies, the current decline in biodiversity and the related loss of ecosystem services will continue and, in some cases, even accelerate. Some ecosystems are likely to be damaged beyond repair.

With a 'business as usual' scenario, by 2050 we will be faced with serious consequences:

- 11% of the natural areas remaining in 2000 could be lost, chiefly as a result of conversion for agriculture, the expansion of infrastructure, and climate change.
- Almost 40% of the land currently under low-impact forms of agriculture could be converted to intensive agricultural use, with further biodiversity losses.
- 60% of coral reefs could be lost - even by 2030 - through fishing, pollution, diseases, invasive alien species, and coral bleaching due to climate change.

European Footprint

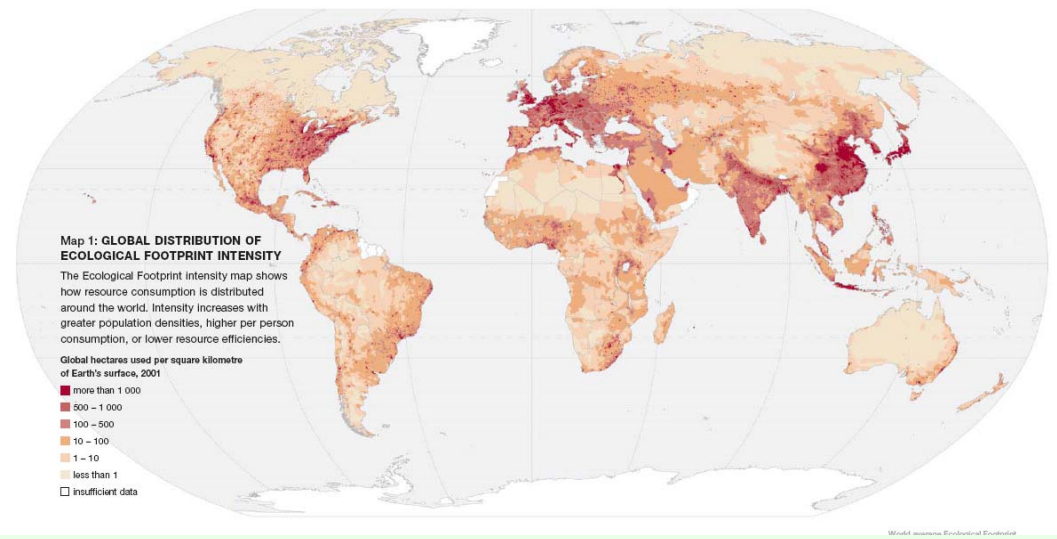
Most biodiversity and ecosystem benefits are public goods which have no price: no single world citizen can be excluded from most of its services. European citizens profit to a large extent of unvalued biodiversity services from ecological recourses world wide. Although Europe is the second smallest continent, its population density and high per person consumption make it a significant contributor to the global ecological footprint (see textbox).

[3] The TEEB report presents the results of a preliminary analysis of the costs of the loss of biodiversity and ecosystem services from forests. In the first years of the period 2000 to 2050, it is estimated that in the early years we are losing forest ecosystem services with a value equivalent to around 28 billion dollar each year, and this value increases over the period to 2050.

What is the ecological footprint?

The ecological footprint measures people's demand for nature. A country's footprint is the total area required to produce the food and fibre that it consumes, absorb its waste, and provide space for its infrastructure. People consume resources and ecological services from all over the world, so their footprint is the sum of these areas, wherever they are on the planet. The footprint can be compared with nature's ability to renew these resources.

The ecological footprint intensity map (below) shows how resource consumption is distributed around the world. Intensity increases with greater population densities, higher per person consumption, or lower resource efficiencies. The red areas, including important parts of Europe, depicts a footprint of 1,000 hectare use per square kilometre.



Source: WWF, 2005.

Home to 7% of the world population, Europe generates 17% of humanity's footprint (WWF, 2005). Today, the footprint of the EU-25 is 2.2 times as large as its own biological capacity. This means that at its current rate of consumption just over twice its own land and sea space would be required to support Europe's resource demands. Trade is the mechanism that makes it possible for Europe to maintain its current way of life. It is only by importing resources and using the ecological services of other countries and the global commons that Europe can continue to increase its consumption while avoiding further liquidation of its own natural capital.

Brazil, on the other hand, has one of the world's highest 'bio capacity', nearly five times as large as its ecological footprint, yet this is declining as a result of deforestation (Goldman Sachs, 2007).

Figure 2 Eu-25's ecological footprint and biocapacity per person, 1961-2001

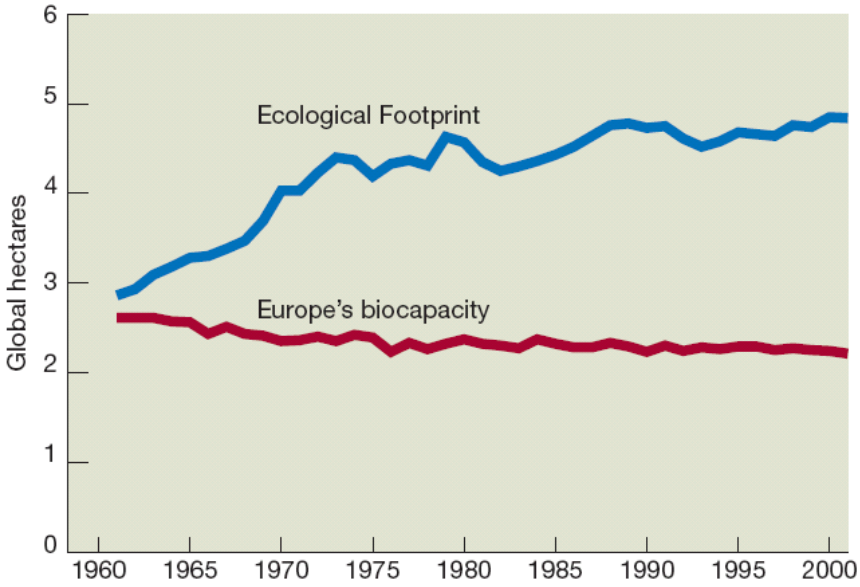


Figure 2: The ecological footprint of the EU-25 has risen by almost 70% since 1961. Europeans now require 4.9 globally average hectares per person to provide for their lifestyle. As the continent can only supply 2.2 global hectares per person, Europeans rely on the rest of the world to make up this increasing deficit - effectively more than another Europe.

In order to be able to reduce this European footprint, incentive mechanisms must operate at the global level if they are to successfully modify the behaviour of those actors driving these pressures. Globalization and trade can help developing countries prosper but excessive demand on resources may cause degradation of ecosystems in countries providing them. To achieve global sustainable development, the world and European community would need to decide how big the planet's ecological budget is, and how it will be shared.

2.3 Fundamental causes biodiversity loss

Opposed to the increasing European ecological footprint, the global available bio capacity[4] steadily decreases. Over the years, ecosystems worldwide have been heavily affected by human activities (Pimm, 1995). Land conversion, climate change, pollution, unsustainable harvesting of natural resources and the introduction of exotic species have been the main drivers of a change in the quantity and quality of natural capital (Sala, 2000). The main anthropogenic cause of biodiversity loss at the landscape level is the loss of habitat that follows land use change. The main consequence of biodiversity loss is a change in the flow and nature of ecosystem services. It is undermining sustainable development opportunities, eroding genes, species and ecosystems that constitute important resources and support systems to human well-being.

[4] Biocapacity tracks the planet's biologically productive capacity. The productive area of the biosphere translates into an average of 1.8 global hectares per person in 2001 (WWF, 2005).

The pressure on the environment is increasing from growing population. The world's population has more than tripled in the 20th century and projections show that continued growth is expected over the next 50 years. At the present pace, the Earth's renewable resources are rapidly being depleted. According to the Ecological Footprint and many other studies, human consumption of renewable resources has surpassed the Earth's ability to regenerate them. The expected doubling of the world's population over the next 50 years will exacerbate these pressures.

The combination of a growing population coupled with unsustainable resource use patterns is the dire problem facing humanity. The average resident of an industrialized nation uses 15 times as much paper, 10 times as much steel, and 12 times as much fuel as a person in a developing country (World Watch Institute, 1991).

There is a fundamental distinction between proximate causes of biodiversity loss and underlying economic forces that result in these causes. OECD (1996) identifies absent markets, insufficient price signals and misguided government policies (perverse subsidies and developments policies) as the most prevalent underlying causes of biodiversity loss and concentrates on correcting these through the assignment of property rights and the correction of price signals. Also information failures exist which lead to non-reflection of the value of biological diversity in market prices. This leads to an underestimation of the demand for ecological services. Market-based instrument can enhance the demand for ecological services. This underline the need to apply economic instruments in a mix of measures to combat the pressures on biodiversity loss.

2.4 Theory of economic instruments

Economic instruments can be broadly defined as those measures that make use of the price system and market forces to achieve their objectives (OECD, 1996). The essential element of a market is that prices are determined by the collective supply of and demand for a particular good or service of individual actors. However, markets not always work perfectly well. There are several causes for market failure, one of them being the existence of public goods. The free rider problem arises here (see textbox).

Free-rider problem: tragedy of the commons

Free-rider behaviour means that an individual may decline to share in the costs of a certain good or service knowing that he or she cannot be precluded from sharing the benefits (Kahn, 2005). Since it is assumed that each individual acts out of self-interest, every individual will consume as long as the benefits outweigh the costs. This might eventually lead to serious over-use of the particular public good, a situation which is often referred to as the 'tragedy of the commons'.

In a famous essay, Hardin (1968) illustrated the mechanism by showing how the sharing of a pasture by local herders may lead to overgrazing. Adding an additional animal to the land will provide the individual herd extra income (= an individual benefit), while it degrades the pasture (= a commonly born cost). Since all herds are interested in their own utility, they continue to add animal to the field, so that in the end the pasture is totally degraded. Other examples are fishing behaviour causing over fishing and human population growth that may outweigh the Earths carrying capacity.

Biodiversity is a public good, meaning that most of its benefits are available to society in general. They do not exhibit complete rivalry and excludability in the market place. Subsequently, a wedge is driven between the value of biodiversity to individuals and to society as a whole. While there are ways of using market mechanisms to pay for the conservation of biodiversity, most aspects of biodiversity will always be difficult to 'market'.

Working through the price system, the various economic instruments that governments have at their disposal can improve private decision-making on biological resources by reducing the gap between the private and social value of biodiversity. They increase returns to activities that conserve or restore valuable biological ecosystems and increase the cost or lower the return to activities that damage ecosystems. They work to level the playing field between the observable returns to destructive activities and the non-observable returns to conservation. For example, farmers who receive a return in the form of a government payment for maintaining biological diversity on their land will be more willing to use farm practices that sustain biodiversity values than they otherwise would.

2.5 Design of economic instrument

We have seen that many of ecological and forest functions are not marketed. They do not generate financial flows since their prices are zero. For example, in the absence of markets in carbon dioxide sequestration carbon stored in forest has a zero price. This creates the illusion that their value is zero, which is not the case. The timber production has a clear price (causing commercial timber at a non-sustainable level). Increasingly CO_2 capture in forests gets a price by carbon deals and the flexible Kyoto mechanism. However, most services as water protection and regulation, prevention of soil erosion are not paid in the absence of relevant markets

The design of appropriate markets for capturing these economic values implies two steps:

1 Estimation of the economic value of forest functions in a non-market context.
2 Internalise the resulting values in market systems so that they affect land use decisions.

The use of economic instruments for biodiversity protection is based on the idea that the social costs of biodiversity loss can be imputed into the price of the activities that cause this loss. This requires the monetary measurement of the preferences for the public good aspects of biodiversity. Once the correct value has been derived, economic instruments can achieve ecological and economic efficiency. However, whereas the determination of exact monetary values for biodiversity is feasible in principal on the bases of techniques developed by economic theory, the intrinsic complexity of biodiversity makes this difficult to accomplish in practice (OECD, 1999).

2.5.1 Valuation of biodiversity

Not all values of biodiversity can be measured in economic terms. To many people nature has an intrinsic value that is unrelated to its usefulness to humans. Besides, only part of the full range of benefits provided by biodiversity and ecosystems can be assessed due to current limitations in the understanding of ecological functions. Value estimates from case studies usually take into account only some of the benefits. Also data and valuation studies are not yet available for all types of ecosystems - for example marine ecosystems are less well covered than terrestrial ecosystems. Therefore, it should be kept in mind that estimates of the economic value of biodiversity and ecosystem services are surrounded by many uncertainties.

TEEB study
The TEEB report presents the results of a preliminary analysis of the costs of the loss of biodiversity and ecosystem services from forests. In the first years of the period 2000 to 2050, it is estimated that in the early years we are losing forest ecosystem services with a value equivalent to around 28 billion dollar each year, and this value increases over the period to 2050 (it has to be noted that a large part of these benefits is currently not included in GDP). Losses of our natural capital stock are felt not only in the year of the loss, as the reduction in the service flow continues over time.

The economic value of biodiversity is measured in a number of ways. A useful abstraction for policy purposes is to view biological resources as assets that provide a series of flows that benefit people. Even intangible values such as the existence value of species or ecosystems can be thought of as a flow of services. A concept that is often used in this regard is the concept of Total Economic Value (TEV) of a biological asset. The preference for a particular biological asset over another provides the indicator of its economic value.

There are two approaches to assess the economic value of nature:

1 *Revealed and stated preferences:* the valuation of ecosystems relies on welfare measures (consumer and producer surpluses). Methods to asses these values are stated and revealed preference techniques.
2 *Compensation/prevention costs:* deduct shadow prices on the base of environmental pricing techniques. This set of pricing techniques relies on data from *actual or potential* maintaining or preventing environmental degradation as a proxy for the environmental value.

The Ecobalance concept (Ministry of Housing, Spatial Planning and Environment, 2007) is in line with the second type of assigning values to biodiversity assets, namely the compensational cost to provide a alternative hectare of natural area with minimal an equal ecological value in terms of species. This approach should not be seen as a way to fully value the services of ecosystems. It is more a practical useful and implementable concept for internalizing a part of the costs of loss of species with the above mentioned limitations.

In order to give land owner effective incentives to protect biodiversity values of their land the price should reflect two components:
1 Cost of conservation measures.
2 Opportunity costs.

Cost of conservation[5]

The annual costs of effective field-based conservation vary enormously. A study of Balmford (2002), using data for 139 terrestrial programs worldwide, found a variation across seven orders of magnitude, from < $ 0.1 to > $ 1,000,000 per km^2 per year, with a typical cost estimate of 1,000 $/$km^2$/year. This variation can be closely predicted from positive associations between costs per unit area and an array of indices of local development. Corresponding measures of conservation benefit are limited but show opposing global trends, being higher in less developed parts of the world. The benefit-to-cost ratio of conservation is thus far greater in less developed regions, yet these are where the shortfall in current conservation spending is most marked. Substantially increased investment in tropical conservation is therefore urgently required if opportunities for cost-effective action are not to be missed.
The gross mismatch between the costs of effective nature conservation and current global spending means that prioritization of conservation effort is essential and should be based on economic as well as biological information (Balmford, 2002).

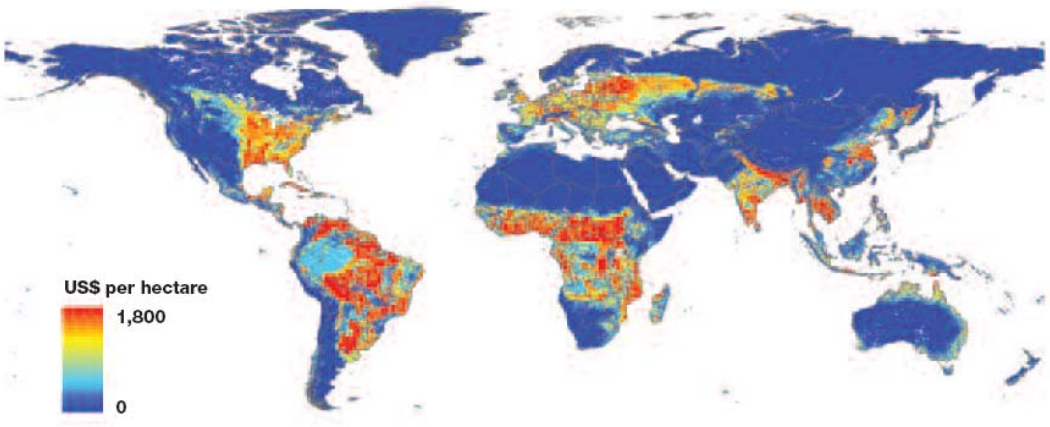
Opportunity costs

The second part of total costs of conservation consists of opportunity costs. Conservation has costs for local people in terms of the opportunity costs such as the loss in potential agriculture returns of not converting such habitats. Transferring some of the rich world benefits back to local people could be one approach to improving incentives to conserve those natural habitats and species locally that clearly have wider benefits globally. Possible alternative land uses might be timber harvesting, conversion to agriculture or conversion to urban development, etc. A measure of the opportunity costs are the agricultural returns of a regions. Depending on location and alternative land use opportunity cost vary $ 2 to $ 6,000/hectare/year (Mullan, 2008). For developing countries opportunity costs amount to maximum of $ 100/hectare/year, with typical values of < $ 5 /hectare/year. Figure 1 from the TEEB report presents an overview of agricultural returns as a proxy of the opportunity costs.

[5] These costs should include implementation costs - administration, monitoring and enforcement, creation of appropriate institutions, transactions costs.

Opportunity cost can be zero (see Figure 3) for those areas that are not economically productive. However it can be questioned whether conserving these areas will be additional compared to business as usual. If developers do not gain from converting forests (opp. cost zero), they would have restrained from land conversion anyway. The value of protected area thus depend on the biodiversity values of the area and the degree of threat from economic productive land use.

Figure 3 Illustration agricultural returns per hectare



From: TEEB, 2008.
Note: Opportunity costs are zero when there is no alternative economic productive land use.

Total costs

Incorporating both price components (cost of protection measures and alternative land use) is essential in developing an effective incentive framework for protecting biodiversity. Rewarding conservation activities through incentive-based instruments increase the profitability of conservation as a land use activity (Peterson, 2008). Thus, land management for conservation can be brought in closer competition with more destructive management activities such as mining and agriculture. This competition will most likely engender the beneficial side effect of increased land prices in those areas where conservation is an economically viable alternative. Facing higher land prices, developers will opt for more area-intensive production that minimises harm to biodiversity.
Total costs are summarised in Table 1.

Table 1 Conservation and opportunity costs in Euros/hectare/year

	Lower limit	Upper limit	Typical costs
Conservation Costs	0,0	7,300	7
Opportunity Costs	0,1	73	4
Total Costs	0	7,373	11

2.5.2 Targeting land use

Targeting land use change in order to slow biodiversity loss, however, is extremely difficult. Habitats are altered by international, national and local actors for a number of diverse motivations (Stedman-Edwards, 1997; Angelsen and Kaimowitz, 1999; Lambin, 2001; Geist and Lambin, 2002; Hardner and Rice, 2002). In order to effectively address biodiversity loss, we need to examine the 'broader context' in which these processes function (Wood et al., 2000, p. 79).

Kiss (2002) elaborates on this argument insightfully. Acknowledging that attributing biodiversity loss to only (or even primarily) over-population and poverty is 'overly simplistic', Kiss (2002) maintains that 'the fundamental cause of biodiversity loss worldwide is that those in a position to preserve it lack sufficient incentives to do so' (Kiss, 2002, p. 2). Thus, according to Kiss and a number of other conservationists, an effective approach to halting biodiversity loss requires an incentive-based approach that operates at the global level in order to address the multiple factors driving this phenomenon.

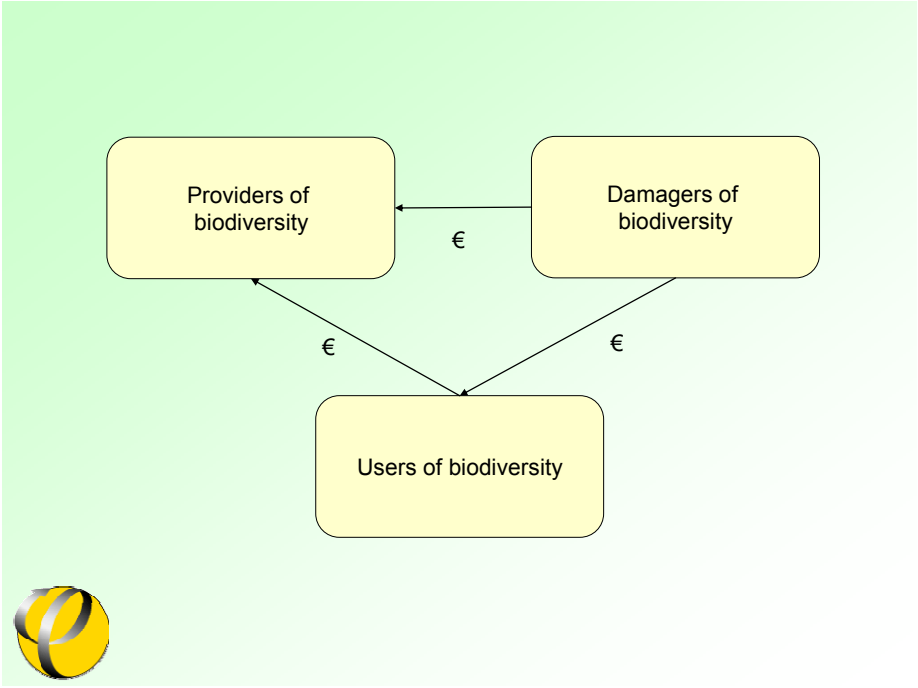
2.5.3 Who pays?

A difficult aspect in the development of biodiversity policy is how to decide when to make payments direct to people, when to pay them indirectly and when to require resource users to pay the full costs of biodiversity conservation (OECD, 1996). It is important to understand the distribution of costs and benefits among three target groups (see Figure 4):

1 Those whose behaviour actually enhances biodiversity-related goods, since these people tend to bear conservation costs.
2 Those who actually benefit from biodiversity-related goods and services, as they attach value to biodiversity.
3 Those whose behaviour actually diminish or harms biodiversity-related goods and services, as this groups affect both 1) and 2).

A properly designed economic incentive can encourage behaviour that promotes conservation (i.e. compensate landowners for forgone revenues/opportunity costs) and discourages behaviour that does not, thus transferring the amount of currency among these target groups in question.

Figure 4 Target groups affected by economic instruments



Source: Filion, 2004.

Those who use or damage biodiversity should pay at least a part of the cost of resource use, in line with the generally accepted *polluter pays principle*. In contrast, it is often the case that those who benefit from biodiversity use pay nothing. Young (1992) has suggested that this concept could be called the *beneficiary compensates principle*, meaning the reimbursement of incremental cost above normal costs of conservation measures. Offsetting and habitat banking can provide the (international) financial flow from *damager* to *provider* of biodiversity. Offsetting and habitat banking thus cover the above two blocks, but exclude the block below[6]. They can be considered as a form of International Payment for Environmental Services (IPES) (see textbox).

[6] Charging users for ecosystem services and products is a way of promoting users to pay for natural resource conservation. In protected areas, charge schemes can include entrance fees, concession payments for tourism, and hunting and fishing fees. These types of measures should be implemented by national states, not multilateral organizations. One can imagine, however, that Western countries propose a flight tax motivated on the ground of making use of unique natural areas worldwide (see Annex A).

IPES

International Payment for Environmental Services (IPES) is a concept that follows on Payment for Environmental Services (PES) initiatives. The core idea of PES is that the environmental provides several services to society. Beneficiaries of these services make direct, contractual and conditional payments to local landholders and users in return for adopting practices that secure ecosystem conservation and restoration. As such it offers an economic incentive to preserve biodiversity.

According to a strict definition a PES is: (1) a *voluntary* transaction where (2) a *well-defined* environmental service (or a land use likely to secure that service) (3) is being 'bought' by a (minimum one) environmental service *buyer* (4) from a (minimum one) environmental service *provider* (5) if and only if the environmental service provider secures the environmental service provision (*conditionality*). In practice there are, however, many PES-like initiatives. Barely any initiative complies with all 5 criteria. Especially the conditionality criterion is hard to meet (CIFOR, 2005).

The big four

Four ES types currently stand out (CIFOR, 2005):

- Carbon sequestration and storage (e.g. a Northern electricity company paying farmers in the tropics for planting and maintaining additional trees).
- Biodiversity protection (e.g. conservation donors paying local people for setting aside or naturally restoring areas to create a biological corridor).
- Watershed protection (e.g. downstream water users paying upstream farmers for adopting land uses that limit deforestation, soil erosion, flooding risks, etc.).
- Landscape beauty (e.g. a tourism operator paying a local community not to hunt in a forest being used for tourists wildlife viewing).

Since the parties that attach great value to the preservation of biodiversity are geographically apart from the ecosystems' location, international PES are introduced. It means that payments for environmental services take place through markets, like the carbon market.

The need for global scale

There is a large gap between the development of the global carbon market and other markets for ecosystem services. Despite the existence of many PES schemes around the world, there is still insufficient institutional support for these efforts at an international level. Biodiversity-related ecosystem services are in particular need of attention, as their global importance implies the need for international cooperation.

The development of IPES should therefore have a central focus on biodiversity, a global public good which, unlike carbon, does not currently benefit from market-based incentives at an international scale. At the same time, a focus on biodiversity conservation in the development of IPES should not exclude other important ecosystem services, such as cultural values. In this regard, interactions between different ecosystem services need to be taken into account. One issue that will be particularly relevant for IPES is the management of large trans-boundary ecosystems. The preservation of the Meso-American Biological Corridor is an example of a transboundary project that could benefit from IPES (Huberman and Leipprand, 2006).

2.6 Habitat banking and offsetting

Biodiversity offsets are unique among other incentive based instruments in that they have the potential to simultaneously address some drivers of biodiversity loss (mentioned in section 2.2). They have the potential to create incentives for conservation at two levels. First, offset requirements discourage activities that reduce biodiversity by increasing the cost of development. Developers must pay an additional fee for their activities in the form of compensation for residual biodiversity loss. Second, offsets create a demand for conservation land. By increasing the demand for conservation, offsets provide an additional incentive to 'manage' land for conservation as opposed to more biodiversity-destructive economic activities. Initiatives for biodiversity offsetting have been developed in a number of regions around the world, e.g. in the US, Australia, South Africa.

Several types of biodiversity offsets can be identified (see Peterson, 2008), as depicted in Figure 5:

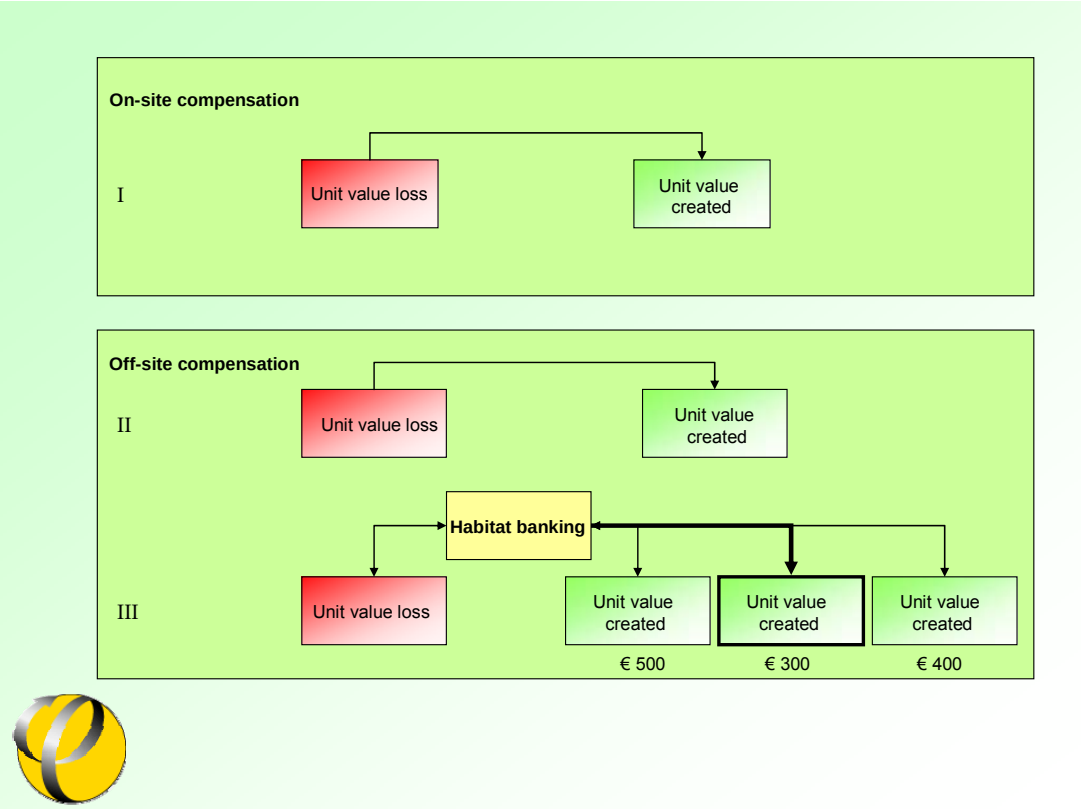
1 *On-site offsetting* (first row)
   It is the most rudimentary form of biodiversity offsetting. Compensation takes place on a project by project basis and requires on-site mitigation of development impacts to biodiversity.
2 *Off-site offsetting* (middle row)
   This type of offsetting creates the opportunity to compensate at a lower cost by allowing biodiversity conservation on another site with a lower (opportunity) cost, but equal or greater biodiversity value. Biodiversity loss within the project area is offset by the protection of an equivalent or greater amount of biodiversity at another off-site location. No trading is allowed under this regime, offsets are non-transferrable. An example is the Business and Biodiversity Offsets Program (BBOP, see textbox).

BBOP
The Business and Biodiversity Offsets Program (BBOP) is an example of voluntary offsetting undertaken by businesses through international partnerships in which companies, scientists, NGO's, government agencies, research institutes, and financial institutions are involved. Businesses compensate the caused loss in biodiversity through the financing of biodiversity supporting projects. The goal is to ensure 'no net loss,' and, preferably, a net gain of biodiversity. It is mentioned that offsets are only appropriate in the context of developments that are legal and appropriate, and when the developer has first used best practice to avoid and minimize harm to biodiversity.

Source: BBOP, 2008.

3 *Habitat banking* (last row).
   Trading in off-site compensation is introduced. Offsets can be traded through a standardized market. A third party - the habitat bank - will implement and maintain the offsets on behalf of the developer in exchange for financial compensation.

Figure 5 Concepts to offset development impact on biodiversity



Habitat banking is the relevant form of offsetting here as a market for offsetting is formed. It has some important advantages as compared to traditional (on-site) offsetting.

- Through habitat banking an implicit price is set for the quality of biodiversity that could raise the supply of biodiversity enhancing projects at a much larger scale than under traditional offsetting. In principle, through the establishment of habitat banking, *any* land owner is being faced with opportunity costs of not improving the biodiversity on their lands.
- Through habitat banking the establishment of larger conservation areas is possible. From a biological perspective, larger areas enhance biodiversity. Habitat banking can be seen as an effective mechanism for linking existing habitat patches into more coherent ecological networks.
- Through habitat banking compensation can - in principle - be achieved at lower costs than with on-site compensation. Static efficiency can be increased through economies of scale and dynamic efficiency can be enhanced by increasing competition of suppliers of biodiversity. In addition one should mention that for developers risks are being reduced as habitat banking allows them to use pre-defined prices for compensating measures.

Nevertheless, we also realize that there are some major controversies connected to the concept of offsetting:

- **Environmental quality of offsetting**. Difficulties with ensuring 'like' for 'like' are often cited as impermissibly great (Robertson, 2000; Robertson, 2004; Friends of the Earth, 2005). Guaranteeing equivalent biodiversity values requires measuring and quantifying biodiversity, determining an appropriate geological scale over which offsets can be located, and determining an appropriate time scale over which the offsetting conservation activity can be completed. Of these obstacles, the quantification of biodiversity appears to be the greatest. Complexities on measurement make biodiversity markets distinct from constructed markets for pollution (e.g. CO_2, NO_x, fish quota, etc.). This implies either considerable administrative costs for handling or (over)simplifying the scheme which could possibly harm the environmental effectiveness.
- **Additionality**. Other issues relate to the 'additionality problem'. One of the main challenges of habitat offsetting is to make sure that compensation only relates to the additional efforts undertaken and not ecological developments that would have taken place anyway. Some forest certification schemes have, for instance, been blamed for certificating 'business as usual' activities rather than additional efforts of sustainable forestry and similar complaints are being heard for the market of carbon offsetting or the Clean Development Mechanism (CDM).

Given these problems, offsetting should be seen the last step on the *'mitigation hierarchy'* - avoid, minimise, mitigate, offset (here), offset (there) - employed by many land developers[7]. In this light, economic instruments should not only generate funds for protecting unique and biodiversity-rich areas worldwide, but also have a significant contribution to a sustainable use of biodiversity from European consumption. We therefore also consider an offsetting scheme that allows for both compensation *and* mitigation of land use (see section 3.3.2).

[7] Yet, even before this mitigation hierarchy is pursued, development projects must first undergo a 'go' or 'no-go' evaluation.

2.7 The trading entity

One of the fundamental questions in the design of an offset market is who will be obliged to offset. Do consumers need to buy biodiversity offsets (debits) or should producers acquire them? In the case of imported products, should importers be charged? The trading entity refers to the party that is required to hand in biodiversity offsets (debits).

In systems of habitat banking the project developer, causer of land change decisions, is obliged to hand in the offsets. However, in theory many different parties can be eligible to do so, depending on their position in the product chain (upstream, middle stream, downstream). We can distinguish under a system of offsets:

- **Upstream**: 'high impact' international developers (such as mining, agro forestry and agricultural companies) that are responsible for the land use changes.
- **Midstream**: the importers and the national industry that manufactures these primary products from agricultural sources to products that are to be sold on western markets.
- **Downstream**: consumers of 'high impact' products in Europe.

Several criteria can be used to determine the optimal point of trading in the product cycle. These criteria are:

1 Effectiveness

- *Market coverage*. The trading system would be most effective in internalizing the external costs of biodiversity use if it covers most of the products whose manufacturing harmed biodiversity. In some cases, not all products reach the consumer so that this would not be the best choice of application. An example of such a case is wood usage in the Netherlands. A large share of wood is used by companies and will never arrive at the consumer (pallets, paper use), while it has the same environmental pressure as wood that does reach consumer markets. It is, therefore, preferable to oblige Dutch importers rather than Dutch consumers to buy biodiversity debits.

- *Steering intensity.* By steering effect, we mean the extent to which the instrument may be effective in ensuring reduction and compensation for biodiversity pressures. The impact on land use changes might partly depend on the choice of application point. In principle, it is argued that economic instruments have a larger impact when they are implemented closer to the source of the external effect, the land change decision. The effectiveness will be optimal when international developers will be obliged to compensate their biodiversity loss. Effectively, compensation can be achieved by the impacting company financing the protection of a commensurate amount of threatened land. At the level of consumers, a relatively small price increase might not have the desired effect on buying behaviour. For communication and awareness purposes, however, it is better to focus on consumers. At the import level, the biodiversity trading system may have more impact on the buying behaviour of importers.

2 Implementation

- *Transaction costs.* Transaction costs can vary considerably among the types of emission schemes as well as compared to a general tax. Schemes with expected high transaction costs are, generally speaking, not preferable from both the viewpoint of economic efficiency as well as political acceptability (PEW, 2003). The transaction costs of implementing an economic instrument are linked with the amount of actors that is liable to pay. If end consumers are the trading entity, transaction costs may be very high. From this point of view, the focus would lie on the group which relatively limited and easy to identify, presumably importers.
- *Synergy with other policy instruments*. When other measures are present, it is worth noticing which system design attunes best to these existing measures. For instance, an argument for using importers as application point is that the system would fit with the existing EU import tariffs.

Schemes directed at end users (buyers of high impact products) lead to high transaction costs and may be difficult to implement, compared to schemes aimed at the project developer directly responsible for land use change. On the contrary, in upstream (developers) or midstream (trade) schemes the number of trading entity can be relatively limited. Especially, when offsetting is the main principle, the environmental effectiveness is best guaranteed when the international project developers form the trading entity. Also the EU ETS scheme (carbon trading) is an upstream trading model in which only large industrial point CO_2 sources are the relevant entity.

A *first-best* option would thus be the inclusion of the international developers into an international scheme. The trading system is directed to actors engaging in extensive land use change activities in order to sell products with significant biodiversity impacts (e.g. wood, beef, oil, minerals, etc.) on international markets. The price effect of an upstream system would spread out throughout the economy, raising the price of high impact goods produced in proportion to their impacts. Upstream solutions will benefit from greater coverage and simpler implementation than downstream solutions.

However, upstream solution may be less politically acceptable given their wide coverage of sectors for which price increases may be particularly unpopular. This would require a broad international consensus on a global system that includes the large international developers to offset residual impacts to biodiversity. The effort to establish a multilateral institutionalized trading scheme can be comparable with the implementation of EU ETS (carbon trading). The process of negotiations will be time consuming and complex, and the outcome is even then highly unsure as the vested economic interest of certain countries are considerable.

This can be an important argument to fall back on a midstream European scheme targeting the importers and producers of 'high impact' products, as a *second-best* solution. Compared to end users offsetting a midstream offset scheme would mean a considerable reduction of transaction costs, whilst still guaranteeing a part of the steering intensity of a down stream model.

We consider implementation on the EU level as a first step in building a worldwide system, just as the introduction of the European Emission Trading System was (EU ETS) in 2005.

2.8 Revenues

Based on the typical costs of 11 Euro/hectare/year for offsetting the biodiversity impact, Figure 6 presents the total amount of compensation for the Dutch 'high-impact industry'. This figure is based on Global Economy scenario, assuming an annual growth rate of 2.1%.
The total amount in 2010 is expected to be 130 million Euros, covering an additional protection area of 12 million hectares. As can be expected from the land use perspective wood and meat are the largest financial contributors to offsetting biodiversity. European coverage of an offset scheme will generate approximately two to three billion dollar.

Figure 6 Total financial compensation of high-impact industry, Netherlands (based on Global Economy)

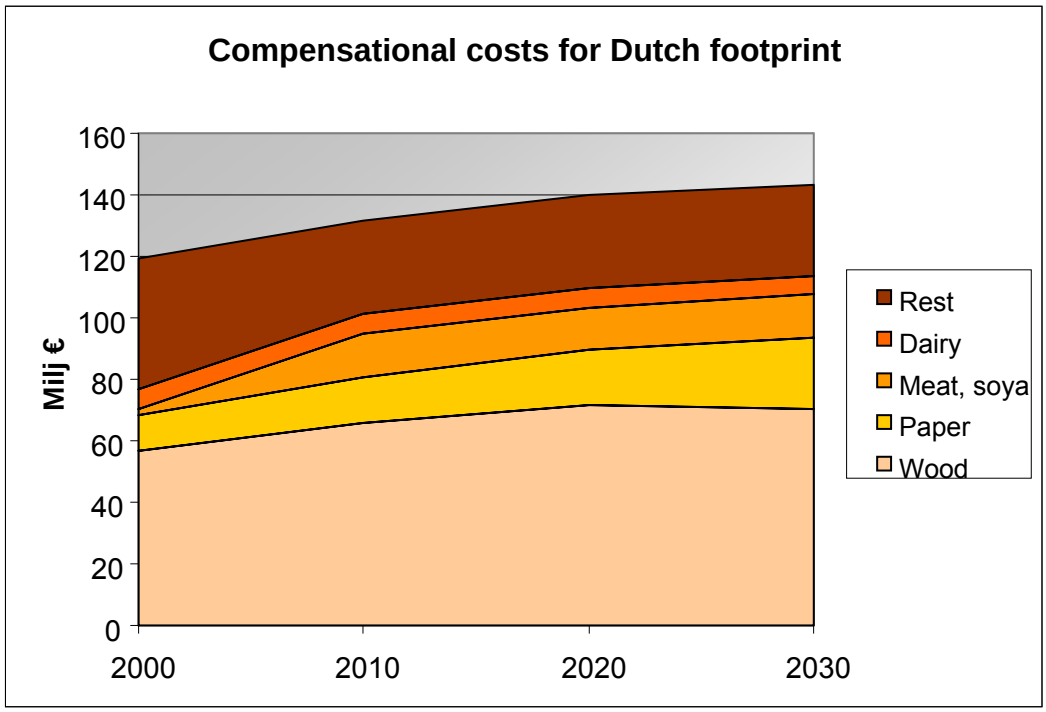
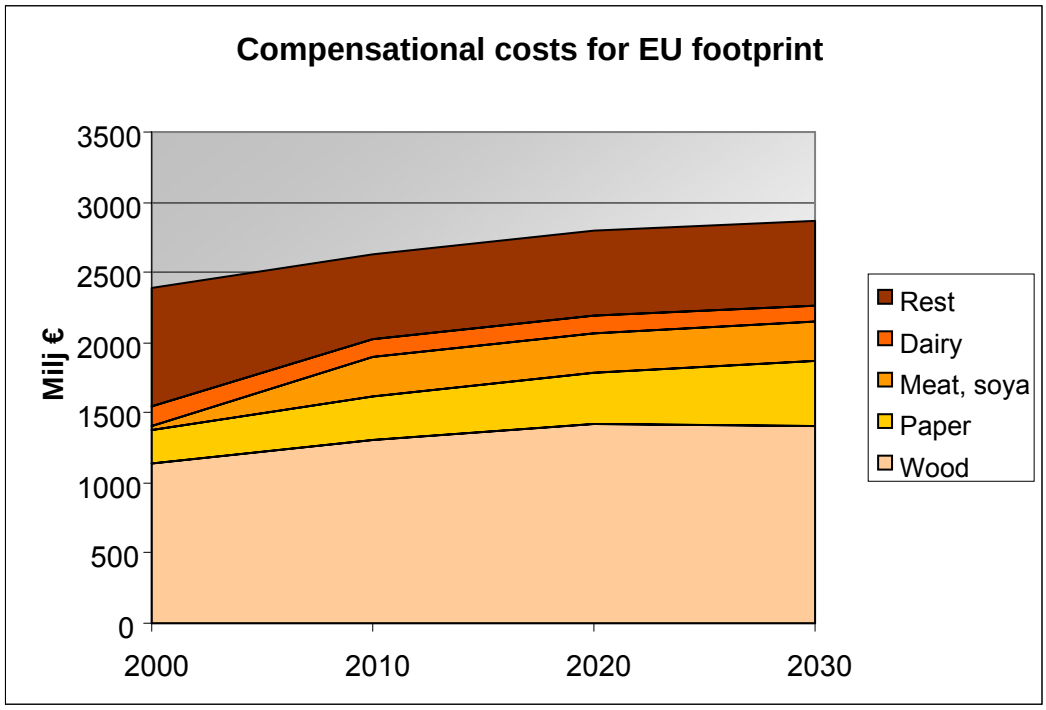


Figure 7 Total financial compensation of high-impact industry, EU (based on Global Economy)



2.9 Conclusions

We have drawn the following conclusions from chapter 2:

1 Without the introduction of new policies the current decline in biodiversity and the related loss of ecosystem services will continue and, in some cases, are even expected to accelerate.
2 The European consumption pattern is an important contributor to biodiversity loss as it shows a rising ecological footprint in terms of worldwide land use (and declining own bio capacity).
3 In order to be able to reduce this European footprint, incentive mechanisms must operate at the global level. Only then they will successfully modify the behaviour of those actors driving the pressures on ecosystems. Globalization and trade can help developing countries prosper but the accompanying excessive demand on resources may cause degradation of ecosystems in countries providing them.
4 In order to successfully change land use patterns incentive mechanisms should incorporate two price components:
   - Cost of protection measures.
   - Opportunity costs of alternative land use.
5 Offsets and habitat banking can, under certain conditions, provide these incentives.
6 Offsets hand habitat banking do have some major drawbacks (additionality of protection projects, valuation difficulties and transaction costs). Part of these drawbacks can be dealt with through a careful design of a framework and mitigation hierarchy. For example, offsetting should be seen as the last step on the *'mitigation hierarchy'* - avoid, minimise, mitigate, offset (here), offset (there). However there will always be remaining crucial questions on the lack of efficacy and potential of green washing of offsetting.
7 In this light, an economic framework should not only generate funds for protecting unique and biodiversity-rich areas worldwide, but also have a significant contribution to a sustainable use of biodiversity from European consumption. For this reason we will consider in the next chapter an offsetting scheme that allows for both compensation *and* mitigation of land use (see section 3.3.2).

3 Practice: design of an economic framework

3.1 Introduction

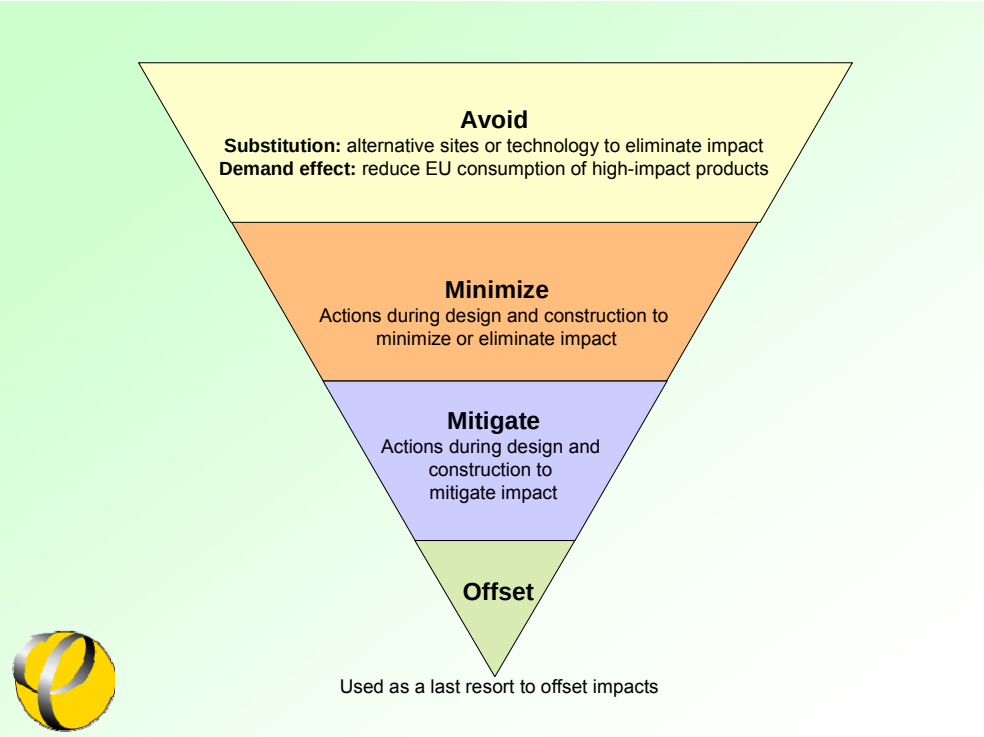
The scale of economic theory of a sustainable use of resources was covered in chapter 3. In this chapter will study in detail the implementation of an economic framework for the protection of world wide biodiversity, which we called Biodiversity Trading System (BTS). Two types of schemes are distinguished, with the main difference between them to the extent to which the consumption of high impacts commodities can be regulated.

3.2 The concept of European trade

Setting up an Biodiversity Trading System (BTS) would mean that European producers and importers are obliged to hold an equivalent amount of Biodiversity Debits (BD's) for the resulting biodiversity impact of their products. This obligation leads to a steadily growing and robust demand of compensation certificates (as production will tend to grow). Developers - and further down the product chain the European importers and producers - should pursue biodiversity offsets only at the end of the mitigation hierarchy, after they demonstrate to have reduced and alleviated residual environmental harm as much as possible. Biodiversity offsets can be used to compensate for the residual impact to biodiversity that cannot be mitigated onsite and therefore balance the impact of the project (see 'mitigation hierarchy' Figure 8)[8].

[8] Part of these effects are stimulated by the rise of prices caused by EU BTS, namely demand reduction and substitution to products with less direct land use.

Figure 8 The mitigation hierarchy



The supply of these biodiversity offsets, called Biodiversity Compensation Credits (BCC's) is provided by a European offset bank. Each offset must demonstrate additional, measurable conservation outcomes[9].

The total amount of biodiversity debits and credits should match each year, so that the total European usage of biodiversity is compensated. Through this offset market compensation can be achieved in a cost-effective manner. Secondly, an implicit price is set for the quality of biodiversity that could raise the supply of biodiversity enhancing projects at a much larger scale than under traditional offsetting. In principle, through the establishment of such a system, land owners will be paid by a fair coverage of their costs and foregone revenues.

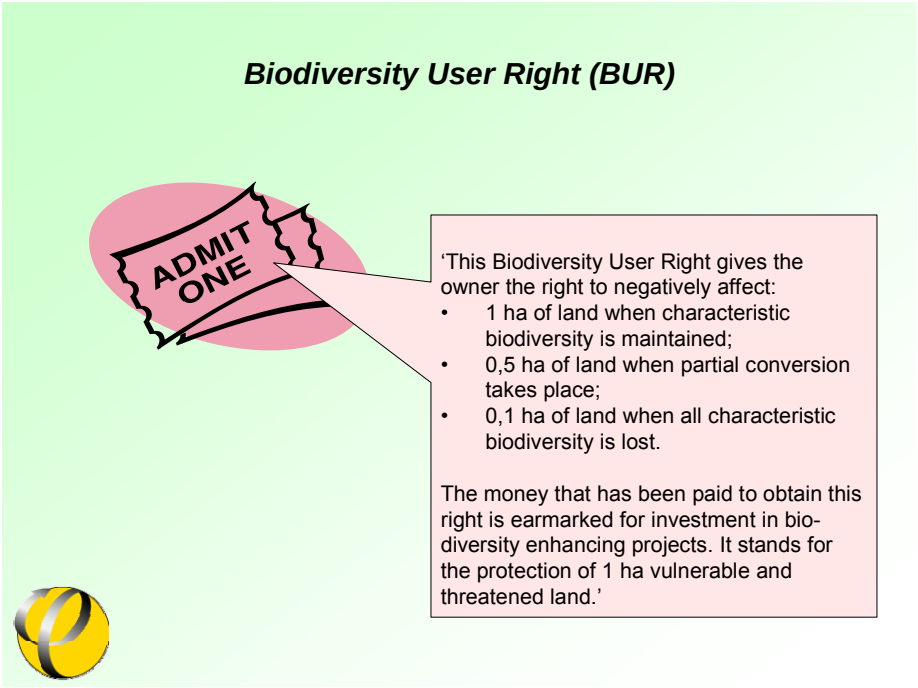
Each year, producers and importers are obliged to submit biodiversity debits (BD's) for each affected ha land to an independent international administration body (see section 3.6) that is set up to issue and collect the debits. However, the exact definition of a biodiversity debit depends on the quality of the land use (see section 3.5).

[9] While appropriate offset activities will vary from site to site, a range of different land (and marine) management interventions could typically be involved in biodiversity offsets.

One allowance covers the use of (see Figure 9):

- 1 ha of land when the characteristic biodiversity of the area has remained present (undisturbed land). Or,
- 0,5 ha of land if partial conversion took place, but where biodiversity values might be restored (intermediate state). Or,
- 0,1 ha of land whereby agricultural production is maximized and all characteristic biodiversity is lost (cultivated land).

Figure 9 Definition of a biodiversity debit



In order to reduce transaction costs and administration costs for European companies, an alternative set-up is that Member States are placed under the obligation to match BD's with BCC's. This might, however, remove the incentive to reduce the ecological footprint itself[10], which would reduce the BTS exclusively to a framework for compensation.

[10] It depends on Member States' budgetary policies. If BCC's are financed through the general public budget, individual producers and imports will have no incentive to reduce their ecological footprint. When, however, special taxes are implemented to gain revenues for buying BCC's, there can be in potential abatement incentives.

3.3 Type of trading system

Two types of schemes are distinguished, with the main difference between them the extent to which the consumption of high impacts commodities can be mitigated:

a *Compensatory BTS - baseline and credit*: establish a BTS with only a compensation obligation. Each European country, and thus its domestic businesses can use as much biodiversity (i.e. buy as much BD's) as they want as long as it compensates for this use. Compensation takes place through a baseline credit system, meaning that third countries can earn BCC's when they undertake additional efforts to protect biodiversity and sell them to the EU who needs them to cover their biodiversity footprint. This trading system is denoted as BTS_C.

b *Mitigating and compensatory BTS - cap and trade*: set up of a BTS in which governments not only require biodiversity offsetting but also regulate total biodiversity use by determining the total amount of BD's on the market (the cap). Each hectare used is compensated through a baseline credits system. This trading system is further referred to as BTS_{MC}.

The major differences between the two schemes are summarized in the textbox.

BTS_C:
- *No mitigation:* total biodiversity use of each EU country is uncertain; usage of biodiversity is unbounded. The only obligation is that compensation takes place.
- *Compensation:* compensation projects are carried out, but total usage of biodiversity is not restricted. Environmental benefits are therefore unknown; they depend on the competition between different types of land use.

BTS_{MC}:
- *Mitigation:* total biodiversity use of each EU country is fixed by a cap.
- *Compensation:* total usage of biodiversity is restricted and will be compensated through conservation projects. Environmental benefits are known.

The textbox reveals that it depends on the priorities of policy makers which type of trading system would be set up: compensation, mitigation or both. Each option will be further outlined hereafter.

3.3.1 Compensatory BTS

When setting up a compensatory BTS system, governments pursue the goal to generate revenues for financing project that restore/preserve biodiversity in order to offset the damage that has been done by business activities.

Biodiversity offsets (BCC's) are created through a *baseline and credit* system. It means that landowners can create BCC's by reducing their deforestation below a baseline level of deforestation. These BCC's credits can be purchased by EU countries that are under the regulatory limit. The fact that developing countries receive payments for their efforts to maintain their forests is considered as crucial for the preservation of biodiversity. Many valuable and threatened ecosystems

are located there. Offsetting is in fact a channel through which International Payments for Ecosystem Services (IPES) can take place (see section 2.5). There are various types of nature compensation:

- Yearly payments to land owners or the actual purchase of natural land.
- Donation to countries: countries receive credits for projects within their borders, f.e. Indonesia. In some countries, governments own much of the land property rights are often lacking.

In principle, it would be sufficient to introduce the yearly obligation that each producer/importer has to hand in an administration of their total land use and total compensation efforts, whereby these two should match. Firms then cover their footprint with biodiversity offsets (BCC's).

3.3.2 Mitigating and compensatory BTS

The introduction of a mitigating and compensatory BTS not only allows the EU to generate money for biodiversity compensation activities (as under a BTS_C) but also to mitigate biodiversity use. Such a trading system sets a limit or cap on the amount of biodiversity that can be impacted by the EU. Companies or sectors under the trading system receive biodiversity debits (for free or at charge) that cover a specific amount of biodiversity use. The total amount of debits distributed cannot exceed the cap, limiting total biodiversity use to that level. Companies that go beyond their allowances must buy allowances from those who impact less or face severe penalties. The buyer pays for polluting (more), while the seller is being rewarded for having reduced impact. Companies that can easily reduce their impact will do so and those for which it is more expensive will buy credits. This makes trading a policy instrument that reduces the footprint at the lowest possible cost to society.

Under such a so-called *cap and trade* system, there exists an aggregate EU goal for biodiversity resources worldwide. Setting a cap on biodiversity use could be based on some sort of Ecobalance view, in which a certain amount of the Earth's land is used for economic activities and another amount is preserved for nature. The exact division should be the outcome of a multi-stakeholder debate. Currently, a distribution of 50-50% is considered as optimal from a societal point of view (Ministry of Housing, Spatial Planning and Environment, 2007).

After the total EU cap is set, it is translated into a national cap for each EU member state. Based on this cap, a certain amount of biodiversity debits (BD's) is issued at the beginning of the trading period. These debits can be freely allocated among participants or auctioned under businesses (producers or importers) that operate under BTS. In the case of free allocation, businesses receive a certain amount of biodiversity debits for free. Those who use more biodiversity than they are allowed to based on this initial allocation, they need to buy additional debits. When they have less impact on the natural environment, they can sell debits to companies that need additional debits. All participating countries trade in biodiversity debits to determine who actually harms biodiversity and who preserves natural forests. In the case of auctioning, parties have to pay for each

impact they have on biodiversity. Supply and demand on this market determine the clearing price. Alternatively, the initial allocation of BD's can be based on tenders; firms that bid the most money for the available BD's, receive most of them. The revenues of an auction can be spend on biodiversity protecting projects (offsets, generating biodiversity credits). Through offsetting, a net loss to biodiversity would be avoided since the harm caused by business activities is expected to be undone by environmental projects.

In order to make the system effective in protecting nature, the price of a biodiversity debit must be sufficiently high. Otherwise, it is cheaper for companies to harm biodiversity and buy (additional) BD's than to take measures that reduce their footprint. The price of a BD is based on supply and demand (which in turn depend on the costs of abatement and on the cap) and on the definition of such a debit.
The revenues collected through auctioning of the BD's are used to pay for compensation (offsetting) projects. An international institute (EU offset bank) bears the responsibility of recycling these BTS funds by investing in biodiversity projects. Each debit must represent the protection of 1 ha vulnerable and threatened land (so one credit). The preservation of this type of land is the most urgent.

Offsetting projects can be undertaken within the EU region or abroad, so that the biodiversity protection takes place where it is most cost-effective. This is when the *baseline and credit* element enters into the BTS system. When additional nature conservation takes place in for instance the developing world, these countries can apply for Biodiversity Compensation Credits (BCC's). All BD's need to be matched by BCC's, so that EU countries indirectly buy them to cover their biodiversity usage. The price of a BCC depends thus on the BD clearing price in the market.

The working of this type of BTS system is thus twofold. First, the total amount of biodiversity impact is regulated by a targeted percentage of an annual reduction. A market for debits is created. Second, the amount of biodiversity impacted is compensated by an equal amount and quality of biodiversity in new areas. A market for credits (offsets) is formed.

3.4 Sectors to be included

A wide number of sectors use or affect natural resources, either directly or indirectly, and therefore also threaten world wide biodiversity. The impact in the complete product cycle of each of these sectors on biodiversity is depending on the consumption of final products from consumers. Most products on the markets cause a (small) biodiversity loss by mining for minerals, agriculture, wood use, etc.

Some sorts of products cause a substantial loss of biodiversity. These are mainly products with agricultural ingredients. The following products are considered as important for biodiversity policies in increasing order of land use (RIVM, 2000)[11]:

- Wood (demand for timber) and paper.
- Meat (or feed for cattle like soy beans).
- Dairy products.
- Oil and fat.
- Agricultural products (including wheat, sugar beet, coffee and cotton).

Together these 'high impacts' products constitute more than 95% of the land use claim of Dutch consumption. We propose to include these sectors in the BTS as they involve the largest amount of land coverage.

3.5 Key object of trading: land use

A tradable system should be based on a simple indicator that can be adequately measured and monitored. In order to minimize information needs in international trade en product chains it is necessary to base the biodiversity impact on a macro-indicator, limiting a certain number of possible ways to alleviate biodiversity pressures. To be able to calculate compensation for biodiversity loss in a simple manner, we suggest following a two step approach:

1 Estimate *quantity* of land use in hectares.
2 Estimate the *quality* of this land use representing to *species richness*.

The concept explained below should be seen as a first analysis of a possible indicator for the scheme. Further research is necessary to develop an indicator which will be able to fulfil all necessary conditions (simplicity, easy to monitor, adequately describing the amount of biodiversity in an area, etc) . Ecosystem processes and biodiversity are often **not linear**: one process can feed-back on the other. Expanding cropland may have no effect whatsoever on the diversity of large mammals until croplands prevent animal access to critical key resources or key corridors. This is a non-linear threshold effect. It is important to understand these linkages over a wide range of circumstances in order to develop a robust indicator. Another drawback is that only direct land use changes are taken into account and indirect effects (secondary leakage) are not accounted for[12].

3.5.1 Quantity of land use

Ideally land use for all products used in Europe, whether they are produced here or imported from outside the EU, should be registered to make the economic instrument as smart as possible. This would make it possible to influence the use of ecological recourses by the changing agricultural management and land use patterns in a more sustainable manner. For most agricultural products used in

[11] Direct land use for infrastructure is also considered as important, but is mainly a national matter of concern and will be thus excluded.

[12] Secondary leakage is not linked to project participants or previous actors on the area. It is often a market effect, where a project increases (by forest plantation) or decreases (deforestation avoidance) wood supply.

Europe there is no information available yet about the production methods and the corresponding land use. Only the region of production is communicated. Many products are sold as a commodity without exact chain information. Therefore this 'exact hectares approach' is not feasible.

On short term a solution is to use a simple macro-indicator reflecting the average land use for a certain 'high-impact' product category. The FAOSTAT database of the FAO (http://faostat.fao.org/) is useful for the short term. FAOSTAT provides access to over 3 million time-series and cross sectional data relating to food and agriculture. It contains data for 200 countries and more than 200 primary products and inputs. We propose to use this FAO information per region of production for:

- Yields per ha.
- Production methods.
- Type of land used.

This FAO data can function as the typical values on which the framework can be based. For products where interesting improvements of productions are feasible the option of introducing actual values from companies (with sufficient proof) may be introduced. This is similar to the way biofuels will have to report their sustainability (CO_2 reduction, etc.) in several years in Europe. An example of data output that can be obtained from FAO is given in Figure 10. It shows the yield per ha for rapeseed in Germany and soybeans in Brazil, both for the year 2006.

Figure 10 Examples of data output from FAOSTAT

Yield per hectare (kg/Ha) | Germany

^›	Year	
commodity		2006
	Rapeseed	3734.43

FAOSTAT | © FAO Statistics Division 2008 | April 2008.

Yield per hectare (kg/Ha) | Brazil

^›	year	
commodity		2006
	Soybeans	2379.10

FAOSTAT | © FAO Statistics Division 2008 | April 2008.

3.5.2 Quality of land use

An ecosystem quality value can attributed to hectares according to dose-effect relationships between pressure factors and biodiversity compared to the value for an undisturbed situation. The biodiversity in agricultural landscapes can then calculated as the average ecosystem quality multiplied by the area size of each farm type within a region. This method of attributing ecosystem quality values to other land use types allows comparison between different land use types.

Current results indicate that the lowest ecosystem quality values are to be found in intensively used agricultural areas in lowlands whereas relatively high values are found forest lands with no level of human management (undisturbed).

In a study published jointly by the Secretariat of the Convention on Biological Diversity and the Netherlands Environmental Assessment Agency it was found that about 120 published data sets comparing the species diversity of different land use types. Some of these studies include a pristine, undisturbed location (e.g. primary forest). The different land use types mentioned in these studies were categorized into six globally consistent groups:

1 Primary vegetation.
2 Lightly used primary vegetation.
3 Secondary vegetation.
4 Pasture.
5 Plantation forestry.
6 Agricultural land, including cropland and agro forestry systems.

Table 2 GLOBIO3 categories of land cover/land use and the relative mean abundance of species, on the basis of about 120 published data sets, with corresponding GLC 2000 classes listed below

Main land cover/use	Sub land cover/use category	Description	MSA
Ice and snow (I)	Undisturbed Primary vegetation	Areas permanently covered with snow or ice. Considered as undisturbed areas	1.0
Bare land (D)	Undistrubed Primary vegetation	Areas permanently without vegetation due to originally occurring natural processes (e.g. deserts, high alpine areas)	1.0
Forests (F)	Undistrubed Primary vegetation	Minimum recent human impact, where flora and fauna species abundance are near pristine	1.0
	Lightly used Natural forest (u)	Forests with extractive use and associated disturbance (e.g. hunting and selective logging) where timber extraction is followed by a long period of re-growth with naturally existing tree species	0.7
	Secondary forests (S)	Areas originally covered with forest or woodlands where vegetation has been removed; areas now show forest re-growth, different cover or are no longer in use	0.5
	Plantation forest	Planted forest, often with exotic species	0.4
Shrubs and grasslands (G)	Undisturbed Primary vegetation	Grassland or shrub-dominated vegetation (e.g. steppe, tundra or savannah)	1.0
	Livestock grazing	Grassland or shrub-dominated occurring grazing is replaced by livestock	0.7
	Man made pastures (p)	Forests and woodlands that are converted to grasslands for livestock grazing	0.1
Mosaic (M) Cropland/forest	Agroforestry	Agricultural production intercropped with (native) trees. Trees are kept for shade or as wind shelter	0.5
Cultivated land (C)	Extensive agriculture	Low-external input and sustainable agriculture (LEISA); Subsistence and traditional farming; Extensive farming and Low-External-Input Agriculture (LEIA)	0.3
	Intensive agriculture	High external input agriculture (HEIA); Conventional agriculture; Integrated agriculture, mostly with a degree of regional specialization	0.1
	Irrigated or drained land	Irrigation based agriculture; drainage-based agriculture and greenhouse production, often accompanied by soil levelling practices and a high degree of regional specialization	0.05
Built up areas (B)		Areas built up more than 80%	0.05

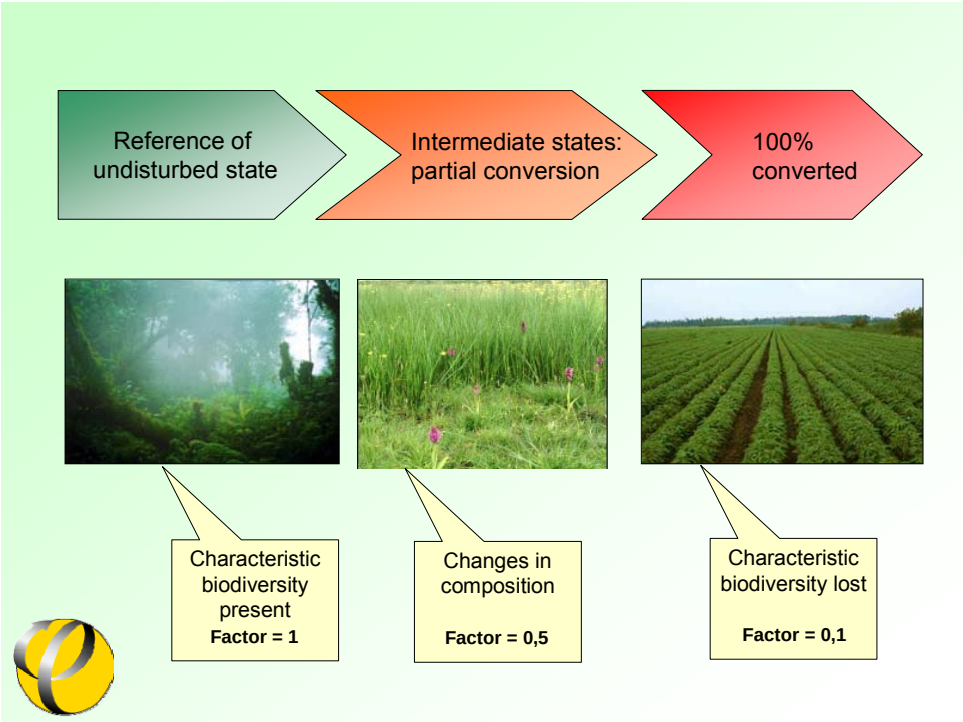
Corresponding GLC2000-classes:

(I) Snow and Ice; (D) Bare areas (sand, gravel and rock); (F) Broadleaved evergreen forest, closed broadleaved deciduous forest, deciduous needle-leaved forest, mixed forest, swamp forest, mangrove and other saline swamps, mosaic: forest/other vegetation, burnt forest; (G) Evergreen shrub, deciduous shrub, grassland, sparse shrub and grassland, flooded grassland and shrub; (M) Mosaic: cropland/forest, (C): Cultivated and managed areas and (B): Artificial surfaces.

In order to develop an indicator for the quality of land use with a manageable amount of classes, we suggest identifying three classes (see Figure 11):

1 *Undisturbed land:* there is a minimum of human impact. The biodiversity factor is equal to one.
2 *Intermediate states of land use:* partial or light usage takes place and extraction is followed by a sufficient period of re-growth. The biodiversity factor is 0.5.
3 *Cultivated land:* accent on maximising the agricultural production. The corresponding biodiversity factor is 0.1.

Figure 11 Discount factor for the amount of biodiversity per hectare



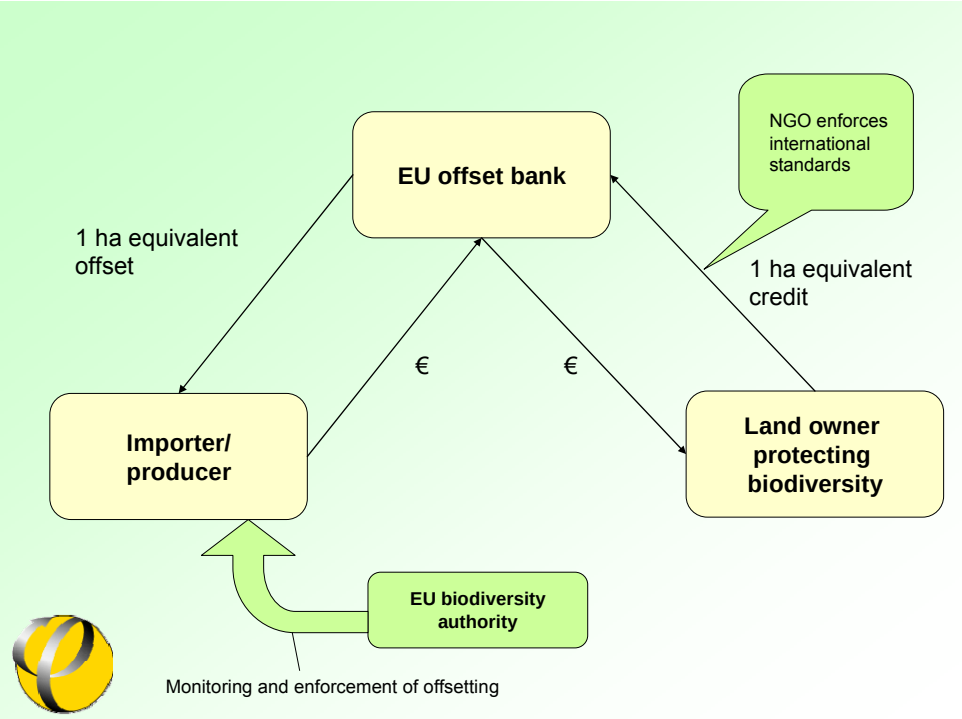
3.6 Institutional framework

In order to safeguard a proper working of the BTS system, two European organisations need to be set up, whereas a role for NGO's is also reserved.
Three areas are important (see Figure 12):

– Monitoring and enforcement of compliance by businesses.
  → Task of the European biodiversity authority.
– Ensure that compensation activities are actually taking place.
  → Task of the EU offset bank.
– Monitoring quality of compensation activities.
  → Task of NGO's.

Each one is discussed subsequently hereafter.

Figure 12 Rudimentary design of the biodiversity offset market



3.6.1 EU biodiversity authority

Under an EU BTS_C (compensation only) monitoring and enforcement of business compliance can be relative simple. An *EU biodiversity authority* is responsible for the measurement of the amount of land use of each participant. The calculation is straightforward: the sales for the European market are multiplied by the land use factor that applies that year for the specific product group. An equal amount of offsets is surrendered by the participant to compensate for its European sales (see Figure 12). When the design of the BTS_C system is such that biodiversity debits need to be bought to cover firms' footprint (to which firms have unlimited access), the role of the biodiversity authority is similar as under the BTS_{RC} option. The biodiversity authority then makes sure that compensation takes place.

Under an EU BTS_{MC} (mitigation and compensation), large impact sectors within the EU must monitor and annually report their use of biodiversity. They can reduce their impact by a more land intensive way of producing and/or change the quality of their land use in a more undisturbed land exploitation. Every year, say by the end the year, the sectors are obliged to surrender an amount of biodiversity debits to this EU authority that is equivalent to their total hectare coverage in that year. The *EU biodiversity authority* is responsible for the enforcement of the monitoring. The revenues of the auctioning are used to compensate for the residual impacts on biodiversity.

3.6.2 EU offset bank

With respect to the actual compensation. It is important that a third independent party is to implement and maintain the offsets on behalf of the developer in exchange for financial compensation. The existence of a third party will add credibility to the offsets and a potential mechanism for standardizing the practice. This can be institutionalized through establishing an *EU offset bank*.

In order to realize a cost-effective way of financing offset projects it is recommended that resources are allocated through tenders. In order to be eligible for financing the project should meet strict international standards. It is essential to reach broad agreement on conservation priorities; to assign values that allow a determination of what can be damaged, what needs to be protected, and what can be traded for what.

3.6.3 Role of NGO's

Requirements may not be able to fully prevent the 'green washing' that so many offset critics fear. One option for minimizing the possibility of green washing is the use of independent third parties - most likely non-governmental organizations (NGO's) - to implement the offsetting conservation activities. NGO's may act as executive organizations by determining residual impacts, establishing appropriate conservation areas to offset these impacts, and implementing conservation activities. They may also act only as intermediary organizations by monitoring conservation activities. Under either scenario, an independent auditor will be crucial for ensuring that offset requirements have been met.

3.7 Institutional design issues

Both from the *demand* and the *supply side* of credits there are some essential design issues to be dealt with.

Demand of credits

The obligation to compensate can be placed at European Member States or at the level of European producers and importers.

An advantage of placing European States under a obligation is that it gives more flexibility in developing alternative financial mechanism for collecting the necessary financial means for compensation. Secondly it will reduce transactions costs, but at the same time remove the incentive to reduce the own ecological footprint[13], which would reduce the BTS exclusively to a framework for compensation.

[13] It depends on Member States' budgetary policies. If BCC's are financed through the general public budget, individual producers and imports will have no incentive to reduce their ecological footprint. When, however, special taxes are implemented to gain revenues for buying BCC's, there can be in potential abatement incentives.

Supply of credits

Supply of credits to the European Habitat Bank can be provided by individual project developers abroad to fulfil the requirements and monitoring protocols of the EU Bank.

As an alternative donations for compensation can be provided at the level of individual countries on the base of unilateral agreements. Under such a scenario the Habitat Bank is a financial intermediary which channels under strict conditions financial flows from European sources to nations protection unique and vulnerable habitat.

Irrespective of the specific role of the bank (or bank or intermediary), a certain degree of standardisation of an offsetting procedure is necessary at the international level. There are important benefits to approaching biodiversity offsetting through a global framework in terms of coordination, standardisation, and legitimacy[14]. An EU procedure institutionalised in a EU Habitat Bank can be the forerunner for a global mechanism that discourages biodiversity loss resulting from internationally-driven land use change by requiring all residual biodiversity loss from development by international actors to be offset through commensurate conservation elsewhere.

3.8 Linkage with EU ETS?

For the actual design of EU BTS, irrespective of whether BTS_C or BTS_{MC} is chosen, we could learn form the experiences with EU ETS. The EU ETS forms a combination of the two systems, since there is a CO_2 cap and trade in emission rights takes place between EU member states, whereby emission reduction in other countries can be used to obtain emission rights through JI/CDM credits. Insights derived from EU ETS regarding cap setting, allocation mechanisms and accreditation processes are all valuable for the BTS case.

In fact, it is even worth considering a link between EU BTS and EU ETS since the goal of halting climate change and the aim of preserving biodiversity are, in some cases, related. Avoidance of deforestation would help biodiversity and emission reduction. Ideally, countries are financially compensated for both CO_2 reduction and biodiversity conservation in order to give land owners the highest incentive to protect national resources. So, per preserved ha land they obtain a CO_2 value and a biodiversity value.

Several options to include avoided deforestation projects in Kyoto carbon markets have been investigated. One of them is the recognition of so-called Reduced Emissions from Deforestation and Degradation (REDD) programs under the Clean Development Mechanism of EU ETS[15]. The program would financially reward landowners for reductions in deforestation and degradation and are thus marginal systems. There is currently no mechanism for REDD under EU ETS.

[14] Localised offsetting projects are often implemented on a case-by-case basis and tend to utilise ad-hoc guidelines that are not required to comply with any externally imposed standards.

[15] Afforestation and reforestation activities are currently captured under CDM.

While some have argued that such a linkage would be fruitful, problems have also been identified. One of the perceived risks is that REDD credits will flood the market, thereby lowering the CO_2 prices ('hot air' problem). Eventually this would reduce efforts of carbon abatement altogether (UNEP/IUCN, 2007). Besides, REDD has not been reconditioned as an effective emission reduction option (ERO) (Peterson, 2007). This might have to do with the difficulty of determining the baseline scenario and subsequent the degree of additionally. One of the main challenges of a financial reward system is namely to make sure that countries are solely paid for the additional efforts they undertake and not for a slowdown in deforestation that would have taken place anyway (UNEP/IUCN, 2007). Some forest certification schemes have, for instance, been blamed for certificating 'business as usual' activities rather than additional efforts of sustainable forestry. The permanence (reversibility) of CO_2 sequestration of sinks is also questioned by several NGO's (among which CAN-E and WWF). Finally, a penalty system on deforestation is required.

Some economists and scientist are proponents of allowing forest credits to be used under EU ETS (among which Joseph Stiglitz). They pinpoint to the opportunity to involve developing countries and the urgency of halting worldwide biodiversity loss. They argue that many of the perceived risks can be solved by adequate technical methods of monitoring, verifying, etc.

The Commission has not rejected allowing REDD credits to enter the EU ETS, but it proposes waiting with the introduction of other mechanisms in EU ETS until there is a global agreement on climate change which would establish them (see EC, 2008). Accordingly, we propose to set up an EU BTS that is totally separated from EU ETS for the moment. Countries that protect biodiversity can not apply for EU ETS credits. This doesn't mean that countries that maintain forests receive no reward for their emission reduction. Alternative ways of payments for REDD can be through a centrally-managed fund or through a decentralized system of 'partnerships' (Peterson, 2007).

3.9 Risks and dilemmas

There are some major controversies connected to the concept of offsetting. Guaranteeing equivalent biodiversity values requires measuring and quantifying biodiversity, determining an appropriate geological scale over which offsets can be located, and determining an appropriate time scale over which the offsetting conservation activity can be completed. Of these obstacles, the quantification of biodiversity appears to be the greatest. Complexities on measurement make biodiversity markets distinct from constructed markets for pollution (e.g. CO_2, NO_x, fish quota, etc.). This implies either considerable administrative costs for handling or (over)simplifying the scheme which could possibly harm the environmental effectiveness. It is almost impossible to accurately measure biodiversity, especially relative biodiversity compared to the reference situation.
Rather than trying to measure the last bit of genetic variation, a commonly accepted framework should be established to assigned values for biodiversity related to habitat changes.

However, there will always be a risk that once credits are traded they will attract the value the market places on the credit, and therefore soon outgrow the need for a scientifically precise estimate of the value. For a biodiversity credit to retain value, the ecosystem upon which the credit is claimed must be protected. The monitoring and verification scheme to be established fulfill a crucial condition in protection the ecological values.

The question is of course if this can be established against acceptable transaction costs. It could be possible that transaction costs will be so high that this would hamper a good functioning of the credit market. One of the major arguments against offsetting emphasizes the institutional capacity required for monitoring offset requirements and contrasts this sharply with the notorious lack of capacity in many developing countries (Peterson, 2008). As a result, the administrative and transaction costs of ensuring compliance may make offsetting schemes infeasible. Administrative costs are especially high when property rights are unclear or land is owned communally, either of which may often be the norm in developing countries. Even if property rights are clearly assigned, land may be divided among a large number of small-scale landowners, in which case transaction costs may be impermissibly high.

An important category of arguments against offsetting is if European importers can be held responsible for a negative impact on biodiversity when land has already been converted into a productive land use. The net impact of an additional liter of palm oil imported on biodiversity is zero if the palm oil plantation has been already established. Why should this European importer be responsible for compensation when the net loss is zero? An argument against is that the palm oil plantation will obstruct a full recovery into the undisturbed state. This discussion can be a major obstacle for the European industry to give sufficient support to a system of European offsetting.

4 Conclusions and recommendations

4.1 Who pays: upstream or midstream system?

Land use change is a complex phenomenon deeply embedded in development activities pursued by the private and public sector at the global and local level. Such complexities can seriously complicate the implementation of a biodiversity incentive mechanism at the global level.

An import issue is the choice of obligation/trading entity in the product cycle of land using sectors. Schemes directed at end users (buyers of high impact products) lead to high transaction costs and may be difficult to implement, compared to schemes aimed at the project developer directly responsible for land use change. On the contrary, upstream (developers) or midstream (trade) the number of trading entities can be relatively limited.

An *upstream tradable certificate scheme* is from the point of limiting transaction cost preferable. Trading actors would be considered those actors engaging in extensive land use change activities in order to sell products with significant biodiversity impacts (e.g. wood, beef, oil, minerals, etc.) on international markets. The price effect of an upstream permit system would spread out throughout the economy, raising the price of high impact goods produced in proportion to their impacts. However, an upstream solution may be less politically acceptable given their wide coverage of sectors for which price increases may be particularly unpopular. *Upstream solutions* would require a broad international consensus on a global system that includes the large international developers to offset residual impacts to biodiversity. The effort to establish a multilateral institutionalized trading scheme can be comparable with the implementation of EU ETS (carbon trading). The process of negotiations will be time consuming and complex, and the outcome is even then highly unsure

This can be an important argument to fall back on a *midstream* European scheme targeting the importers and European producers of high impact products, as a second-best solution. Compared to end users offsetting a midstream offset scheme would mean a considerable reduction of transaction costs, whilst still guaranteeing a part of the steering intensity of a down stream model.

4.2 Type of trading system: BTS_{MC} or BTS_{C}?

Of the main design issues for a tradable certificate scheme is whether or not it is desirable to cap or regulate the total amount of biodiversity use of the consumption of *high impact products* like meat (feed like soy beans) and wood. Apart from volume effects it is obvious that in the long run schemes that regulate biodiversity impact can substantially provoke substitution and innovation (recycled materials, alternative ways of agricultural exploitation, land use efficiency). These innovation and substitution effects form important reasons to cap the total impact on land and biodiversity use for agricultural purposes.

In order to set a cap on total ecological resources the world community would need to decide how big the planet's ecological budget is and how it will be shared. The Ecobalance can be of help by dividing the total usable land that is available worldwide into two parts: (1) land used for economic activities and (2) natural land. The BTS_{mc} requires a proper certification schemes so that the degree of sustainability of production patterns can be identified. Product chains are complex and involve highly international trade flows. For these reasons a full EU BTS scheme is complex and will involve substantial transaction cost for government and private parties in the *high impact sectors*, comparable with the current EU ETS. If the biodiversity debits are initially allocated trough auctioning the revenues can be used to compensate for the residual impacts on biodiversity (the impact of allowed level of land used).
If it is politically undesirable or unfeasible to cap the total amount of biodiversity use from European consumption, an offset scheme can be considered to compensate for the BAU impacts of high impact sectors. In that case debits do not serve a specific purpose and can be ignored. A full market of biodiversity credits (or offsets) is necessary to provide a cost effective way to offset the biodiversity footprint.

4.3 Institutional blueprint

Independent of the above mentioned design issues two new European institutions are pivotal to ensure an effective and cost effective approach to offsetting and trading:

- *EU biodiversity authority*. It will guarantee the enforcement of the offset market and, in case of a *cap and trade* system, the debit market. Every European producer and importer is required to have sufficient biodiversity credits to cover their footprint or needs to surrender enough debits for their footprint. The biodiversity authority seeks to the process of transferring sufficient credits or debits by European companies according to their individual production.
- *EU offset bank*. This organization will be responsible for establishing an effective and cost effective market for offsetting. It is an independent organization that implements and maintains the offsets on behalf of the developer in exchange for financial compensation. An independent European institution will add credibility to the offsets and creates a mechanism for standardizing the practice ensuring a large scale and cost effective market for offsetting. This can be institutionalized through establishing an EU offset bank.

One option for minimizing the possibility of green washing is the use of independent third parties - most likely non-governmental organizations (NGO's) - to implement the offsetting conservation activities. NGO's may act as executive organizations by determining residual impacts, establishing appropriate conservation areas to offset these impacts and implementing conservation activities.

4.4 Recommendations

In conclusion, this study shows that international incentives are called for in order to correct for market failures and halt biodiversity destruction effectively. Europe can make an important start as Europe accounts for 17% of humanity's footprint. At our current rate of consumption just over twice of our own land and sea space would be required to support resource Europe's demands. Trade is the mechanism that makes it possible for Europe to maintain its current way of life.

We recommend to start with a 'simple hectare trading system' in which importers and manufactures are *obliged* to offset their biodiversity footprint, according to three classes of land use management (no conversion/undisturbed state, partial conversion and full exploitation). For their footprint they buy biodiversity credits/ offsets. Through the offset requirement, 'balancing biodiversity' creates a global demand for conservation land. By increasing the demand for conservation land, offsets bring land use for 'nature' in closer competition with land use for agriculture and other forms of economic development. In the presence of this emerging demand, lower-return land use change activities should shift from exploitation to conservation.

If the results in terms of land destined for conservation ('Ecobalance concept') are insufficient, it should be considered to implement the a cap and trade scheme in order to reduce the total impact on biodiversity on a year-to-year basis and compensate the *residual biodiversity footprint* according to the *Ecobalance principal* through using the auctioning revenues.

We conclude that this two stage approach looks promising against the background of Europe's rising ecological footprint, but there are still important remaining questions left to be answered. Insight on the following aspects is essential in order to asses the desirability and feasibility of a BTS system:

- Accuracy of accounting and measurement methodologies of land use.
- Available statistical and trade information to assess the loss biodiversity adequately.
- Indirect effects of EU BTS on land use (leakage).
- Indirect effects on food prices.
- Implementation costs and transaction costs of BTS in Europe as well as the costs of monitoring and verification of projects in developing countries. The question is if the efficacy of a scheme can be guaranteed against acceptable transaction costs for monitoring offset requirements.
- Additionality of conservation project in developing countries.

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Economic instruments for biodiversity

Setting up a Biodiversity Trading System in Europe

Annexes

Report

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A Other economic instruments at the international level

A.1 Introduction

In this chapter a number of economic instruments that function on the international level are described. This means European systems aimed at protecting biodiversity at a worldwide scale. For the purpose of clarity the various policy options are described separately. They can, however, be combined.

A.2 Micro-level approaches

In many countries, micro-level compensation projects are carried out. They concern societal actors like consumers, producers or importers. Many infrastructural projects in European countries have to compensate nature destruction. Also voluntary compensation is introduced in several countries. These approaches are interesting but not considered in this study. In this section, we will focus on tradable certificates for biodiversity use, taxation and tariff exemptions for environmental goods.

A.2.1 Taxation

As said, the majority of economic instruments are available to policy makers at the national level. However, economic instruments may also be developed and applied at the international level. There is currently no international tax scheme and adoption of such a scheme does not seem obvious. Setting up global taxation schemes is extremely difficult, partly because it implies that sovereign nations agree to transfer a portion of their sovereignty to a supranational authority. At present, the political will is probably lacking and EU-decision rules (unanimity of votes) make it difficult to reach wide support, as the long during historical record of the EU carbon tax has showed.

Nevertheless, in the future, an international tax scheme might, if adopted, be applied to conservation purposes. Among the international taxes proposed, three are most relevant to the environment (Bayon et al., 2000):

- A tax on foreign exchange transactions (also known as the Tobin tax).
- A tax on international air transportation. And,
- An international tax on carbon.

Of these, only the carbon tax was proposed for purely environmental reasons. Since the EU ETS scheme was introduced in 2005, a carbon tax will not be imminent.

Tobin tax

The Tobin tax was suggested as a tool for slowing down financial flows rather than as a revenue-generating scheme. In other words, Tobin's original suggestion was more concerned with the impact of the tax on the financial system than with the revenues it might generate.

Air tax on vulnerable destinations

The tax on air transport was proposed for a number of reasons, including as a way of financing the alleviation of problems caused by pollution due to air travel. One can imagine however, that western countries propose a flight tax motivated on the ground of making use of unique natural areas worldwide. This flight tax could be based on flights to vulnerable destinations all over the world (like for example Greenland, Indonesia, Nepal, Malaysia, Costa Rica, South-Africa, Brazil, Chilli, etc.) that could not account sufficiently for own conservation policy. France has motivated a flight tax on comparable development considerations (see text box).

France air tax aims to help poor

A new tax has come into effect on all flights leaving France, with money going to humanitarian projects in developing countries. It is expected to raise 200 million Euros (£ 130m) for development aid in its first year of operation.

The levy is one Euro on short haul flights in Europe, rising to 40 Euros for first-class long-haul flights. The project was personally backed by French President Jacques Chirac, who wanted the wealthy West to follow suit. Added together, the tax will raise millions in development aid, with the money going towards an international medical fund to fight Aids, TB and malaria.

Source: BBC NEWS, 1 July 2006.

Tax on biodiversity harmful products

In fact the above mentioned incentives have, when present, only limited relation with the effects on biodiversity. The behavioural effect of such a designed tax will be limited. For reasons of regulating harmful effects and economic efficiency it is important to connect closely with the externality caused by the biodiversity-harmful effect. The idea behind a biodiversity tax is that countries make an arrangement to impose a tax on importing harmful products and own production activities that have an impact on biodiversity. Taxed products include timber, meat (fish and dairy and other sources of protein), biofuels, etc.; the tariff depending on their land coverage and compensational costs. These activities need to pay a certain amount per hectare valuable land that is affected, in line with the Ecobalance concept.

The revenue generated by international taxation systems, including taxes on timber trade, flight tax, etc. must contribute to offsetting the gap between conservation monetary needs and current expenditure. These tax schemes should be viewed as additional sources of income, rather than a replacement for current multilateral and bilateral donor mechanisms.

Phillips (2000) mentions several potential advantages of using tax mechanisms to generate income flows for conservation:

1 Tax-based mechanisms for the generation of income flows for conservation may generate financial resources ‘nationally, reliably and sustainably’.
2 The burden of the payment can be targeted towards actors causing environmental degradation.
3 Accountability for the implementation of conservation is to the public and not to a specific donor agency.

The Dutch government is currently coming up with plans to implement a tax on non sustainable wood (see textbox).

Taxation of wood considered in the Netherlands

The Dutch government wishes to support the use of sustainable wood in the Netherland. Until now researchers have estimated that 35% of the wood products in the Netherlands are produced from wood with sustainability certificates like FSC and PEFC. A main driver for this policy is to stop deforestation to prevent further loss of biodiversity.

The Dutch government is considering introducing a tax on non-sustainable wood to steer producers and consumers towards the use of sustainable wood. The tax could be introduced for all wood using sectors including, paper, furniture and energy. Depending of the tariffs this tax will raise 100-300 million Euros in the Netherlands. The tax will be between 25 and 100 Euros per tonne (1,000 kg) of wood. This tax would be part of the aim of the Dutch government to green the taxation system. (Less tax on labour and more tax on activities with a high environmental impact).

The WTO and EU rules check of this new tax is positive. Because both national and import are treated alike this tax is possible. Furthermore also the indirect effects of the tax will not be extra profitable for Dutch producers. Most wood for the Dutch market is imported and this will also be the case with the tax on unsustainable wood.

In general, the Ministries of Finance do not like to spend environmental taxes for a certain goal. In the Netherland this year an exception has been made for the packaging tax (also a new green tax). Above this tax also a tariff has been set for raising money for local governments to prevent litter and to treat packaging waste. The 250 million Euro tax has been combined with a 115 million Euro levy which is used to prevent litter and to process packaging waste. Like the extra tariff above the packaging tax it is interesting to consider raising the unsustainable wood tax a bit to raise money for biodiversity.

A difficult question is what should be done with certified sustainable wood. This products will not be taxed under the proposed scheme but do have a biodiversity impact (although much smaller than the impact of not sustainable wood). A smaller biodiversity tax could be considered for this wood.

Source: CE Delft, 2008.

A.2.2 Tariff exemptions for environmental goods

Tariff exemptions for environmental goods and services negotiated at the international level can also affect biodiversity conservation. The World Trade Organizations (WTO) mandate includes negotiations on the reductions or elimination of tariff and non-tariff barriers to environmental goods and services. The final definition of environmental goods and services might conceivably include products or services (e.g. products from sustainably managed forests, non-timber forest products, carbon offsets, etc.). The reduction of tariff and non-tariff barriers to trade in these goods and services could constitute an incentive for more environmentally friendly production and trade.

A.3 Macro-level approach

Besides instruments that attempt to guide the behaviour of actors on a micro-level, there is a macro-economic approach possible. It concerns countries rather than individuals. A potential initiative in this field could be that countries' GDP is linked to the financing of an international biodiversity fund. A fixed percentage of GDP would be transferred to the fund. This option matches the so-called 'De Boer' norm, which indicates that pressure on the environment increases per definition with economic growth and subsequently advocates that a percentage of this economic growth should be used to invest in environment and landscape to compensate for the additional environmental impact.

An existent example of such an approach is the Dutch budget for development cooperation. It contributes 0.8% of its Gross National Product (GNP), of which 0.1% is targeted at the environment. This approach is based on an agreement between western countries to reserve 0.7% of GNP for official development assistance (ODA). This target was firstly affirmed by United Nations member states in 1970 (UN, 1970) and repeated in many international agreements over the years, including the Monterrey Consensus of 2002 (UN, 2003). However, the only countries to reach or exceed the ODA target of 0.7% were Denmark, Luxembourg, the Netherlands, Norway and Sweden (OECD, 2007). This experience indicates that reaching a targeted donation for the international biodiversity fund might also be difficult. After all, there is no punishment for countries that do not reach the target.

Another question is whether all participating countries would be expected to contribute the same fixed percentage of GNP or that the percentage should depend on the actual degree of environmental damage a particular country causes. In that case, the more severe the environmental impact, the higher the percentage. Aggregate indicators like the ecological footprint could then be used to measure the environmental impact, although this indicator is not without controversy (see Bergh and Verbruggen, 1999).

A.4 Conclusions

In this chapter, we discussed several options to use economic instrument for the preservation of biodiversity worldwide. At the macro-level, governments can destine a certain percentage of the country's GDP for environmental protection. At the micro-level, the focus has largely been on taxation of 'harmful' activities and the use of tradable certificates for biodiversity utilization (Biodiversity Trading Scheme).

In the Netherlands, politicians wish to make the national tax system greener. However, the implementation of environmental taxes might be troublesome, especially on EU level. Setting up EU-harmonised taxation schemes is extremely difficult, partly because it implies that sovereign nations agree to transfer a portion of their sovereignty to a supranational authority. It will be extreme difficult to reach wide support, as the long during historical record of the EU carbon tax has showed.

Also at the national level (a Dutch *'Alleingang'*) or a frontrunner arrangement with some EU Member States, there are major fiscal drawbacks. It seems to be difficult to determine which activities are to be taxed and which activities are not to be taxed, particularly in cases like biodiversity when the tax base is somewhat uncertain. Tax measures need to be in line with existing tax legislation, whereby the definition of 'like products' is crucial.

Second, public finance rules make it difficult to earmark tax revenues for specific purposes, like biodiversity. The conservation of biodiversity will have to take place for a large part in developing countries in order to be effective. The profitability of conservation as a land use activity in these countries should be increased through the revenues of an incentive-based instrument[16]. Thus earmarking the tax revenues for creation of incentives to encourage conservation is a crucial aspect of an economic instrument. In the Netherlands there a very few practical examples of generic taxes that are recycled to one specific sector. When tax revenues are recycled to environment, the same private sector obviously would like to see an important part of the revenues back. This can significantly obstruct the support for an *earmarked biodiversity tax*.

For these practical limitations of taxation on biodiversity use we chose to explore in more detail a framework for a *tradable certificate scheme for biodiversity utilization* in the next chapter. This group of instruments has the potential to generate revenues for incentives for increasing the profits of conservational measures, while at the same time regulate the amount of biodiversity use from consumption of harmful products.

[16] Incentives therefore have the potential to bring land management for conservation in closer competition with more destructive management activities such as mining and agriculture.

B Other economic instruments at the international level

B.1 Effects of economic instruments

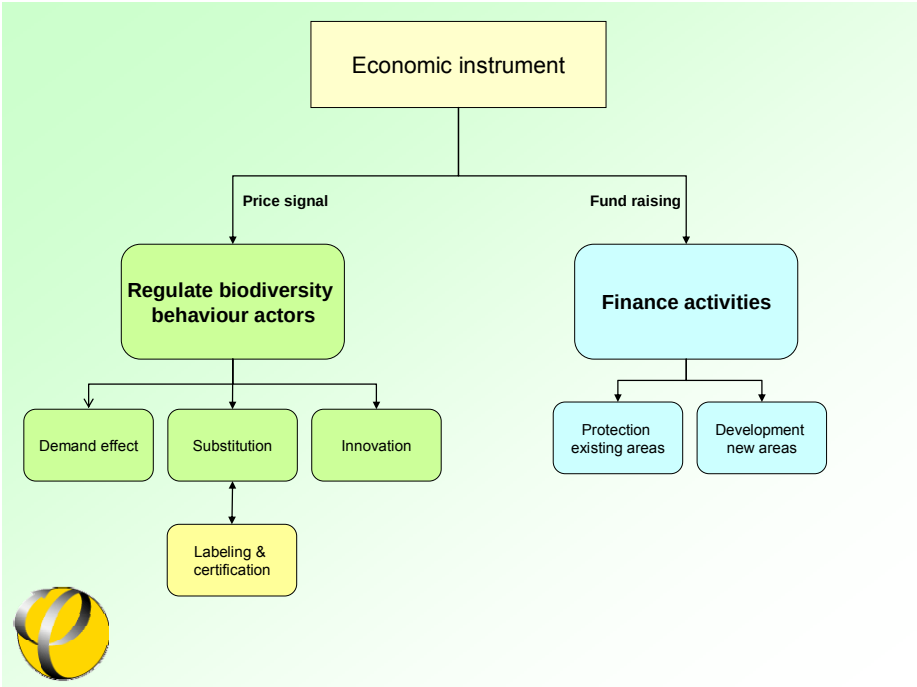
The economic framework of internalisation and compensation can have the following effects:

1 *Regulation/mitigation:* the aim is to influence behaviour by internalizing (part of) the external costs, so that prices become 'right'. Consumer price of biodiversity harmful products increases causing:
   - Demand reduction.
   - Substitution.
   - Innovation.

2 *Revenue generation*: through levying 'harmful' activities or products, revenue are collected for the financing of environmental supporting projects.

It needs to be realized that there obviously is a negative trade-off between these two goals; they cannot be reached at the same time. After all, a regulatory 'tax system' is only effective if behavioural changes take place in society. When people, however, reduce their 'harmful' activities, they no longer need to pay the environmental tax. So, the 'tax base' will eventually be eroded and no revenue will be available for e.g. recycling.
Nevertheless, it is useful to see both effects (internalising and revenue generation) as potential working of economic instruments. In Figure 13 we make a difference between these two aspects of economic instruments.

Figure 13 Two aspects of economic instruments



B.1.1 Regulating/mitigating effects

Economic instruments should be used to reward behaviour that helps achieve the set targets and penalise behaviour that hinders them. The prices of products that cause biodiversity loss through the economy will need to significantly increase over the medium and long term to achieve this in the most cost-effective manner. Taxation and tradable biodiversity certificates are means to deliver such changes. Imposing economic incentives can help to reduce the demand for relevant products and processes and the associated pressure on natural resources. The environmental effectiveness of any economic instrument depends critically upon the price elasticity of demand for the concerned good or service. If the elasticity of demand for biodiversity-harmful products is low, then governments would need to set very high taxes in order to have a noticeable impact on consumption levels. This might well make such a tax politically unacceptable.
However, substitution effects towards less harmful products from a biodiversity perspective are certainly possible. Elasticity's can rise quite significantly when alternative products become available. The development of substitutes, and subsequently behaviour changes, takes time. For example Pearce (1990) reports short-term demand elasticity's for gasoline in Mexico in the range of -0.1 to -0.2; in the long run, however, they rise to over -1.0.

The extent to which these substitution effects take place depends to a large part upon the design of economic instruments. The implementation of an economic incentive (for instance an environmental tax) requires a proper certification scheme so that the degree of sustainability of production patterns can be identified. So in that manner, the development of labelling programs is supported.

In addition, when companies have to pay the tax unless they prove that their actions are sufficiently sustainable, the avoidance of financial costs will give businesses an incentive to provide more information on the environmental impact of their production activities and other processes in the value chain. Laying the burden of proof on companies is necessary, since third parties still have insufficient insight in the biodiversity impacts that take place in the complete product chains. These chains are often complex and involve highly international trade flows. A reliable 'chain-of-custody' is needed to make sure that sustainable products and unsustainable ones remain separated. The implementation of economic instruments thus gives an incentive to companies to certificate/label their products and improves the quality of the certification scheme.

Innovation can also be fuelled by regulatory policy, since companies attempt to lower their costs. Developments in the wood market illustrate this (see textbox). The Netherlands considers the implementation of a tax on non-sustainable wood. The idea is to tax non-sustainable timber and exclude certified sustainable timber (with a certificate like FSC of PEFC) from taxation. This certified wood is more sustainable in several ways. The biodiversity loss would also be lower.

In the soft-wood market (Scandinavia, Canada, etc.) most wood is expected to be certified and sustainable. This market will therefore be hardly influenced by the tax. For hardwood (mostly of tropical origin) the situation is much different. In this market there is a scarcity of sustainable wood. Taxation will result in a higher price of sustainable hardwood and non-sustainable hardwood. This means that the price difference between softwood and hardwood will increase.

Wood tax fosters innovation
In the market more and more techniques are being developed to transform soft wood into hardwood without toxic chemicals. Companies like Plato Wood, Titan wood convert soft wood into hardwood with innovative techniques. Until now the growth of these companies is rather slow. This new innovative options will gain a bigger market share when the tax will be introduced and innovation in this sector will be much faster.

Source: http://www.platowood.nl en http://www.titanwood.com.

B.1.2 Revenue generating

Another objective of an instrument could be to simply raise revenues to be used to finance projects that evidently contribute to protection and conservation of natural areas, with less initial emphasis given to directly changing the behaviour related biodiversity.

Ecological funds are not per se an economic instrument, but they can be used in a manner that complements the use of economic instruments. There are several possible ways of financing such funds: a contribution from the general government budget; a donor contribution; revenue from pollution charges or some combination. In the event that such charges are levied on biodiversity-harmful consumption and that charge revenue is used to finance ecological funds, the instrument can generate a ‘double environmental dividend’. Fund management can be delegated to a semi-governmental body, associated to the EU of the UNEP, or a national body when preferred. Most existing funds in the biodiversity-related Multilateral Environmental Agreements (MEA’s), such as the Ramsar Small Grants Funds, are significantly based on voluntary, bilateral contributions.