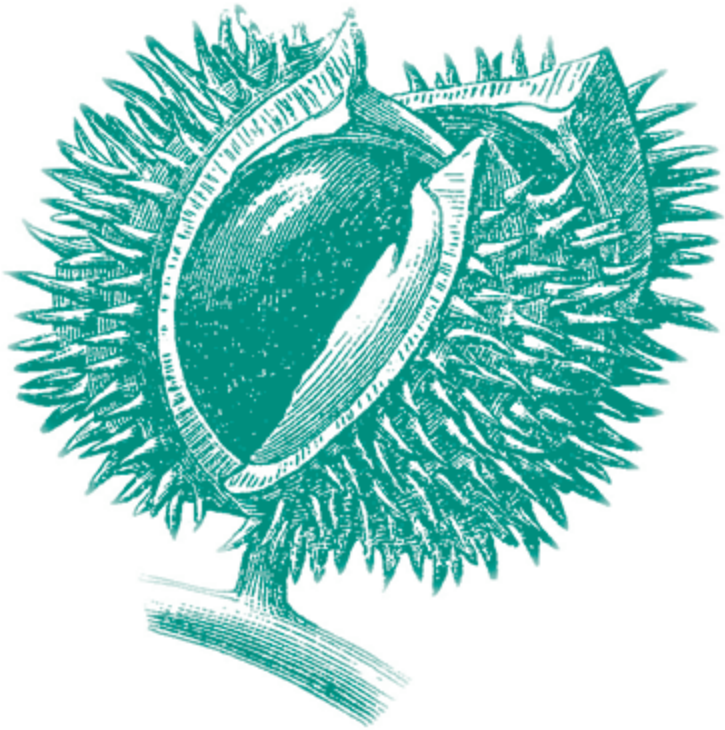
Natural Capital Markets

MARKETS FOR NATURAL CAPITAL

····· Status Quo and Prospects ·····



by the Global Nature Fund and the German Environmental Aid

www.naturalcapitalmarkets.org

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1 INTRODUCTION

This study provides an overview of two existing markets for natural capital. It offers information on their structural options and their relevance to the private sector. In addition, it presents case studies and explains which factors have to be taken into account with regard to the market design. The results will also be published on the internet platform www.naturalcapitalmarkets.org. After an introduction in chapter 1, the study presents the current situation of the biodiversity markets in chapters 2 and 3. Chapter 4 summarises the main points in a conclusion. Separate toolkits further clarify opportunities for participation of the different target groups.

The toolkits can be downloaded from the website www.naturalcapitalmarkets.org

1.1 BIODIVERSITY AND ECOSYSTEM SERVICES

1.1.1 BIODIVERSITY

Biodiversity is the variety of life forms ranging from the smallest level of genes (genetic diversity) to the diversity of plant and animal species and the diversity of ecosystems. Biodiversity forms the basis for ecosystem services, which humans depend on and which contribute to human well-being and prosperity. Intact ecosystems serve as livelihoods for human life and form the basis for prosperity and well-being by providing various services for humans. A species-rich forest, for example, provides us with wood, medicinal plants, clean drinking water and regulates the climate by storing CO_2.

However, biodiversity and ecosystems are strongly affected by human interventions and more than 60% of ecosystem services are being impaired by human activities.[1] Key factors that cause the loss of biodiversity are:

- Land use changes (e.g. clearing of forest for plantations)
- Climate change
- Pollution / contamination (particularly nitrate and phosphorus)
- Overuse / non-sustainable land use (e.g. overfishing)
- Invasive species (e.g. introduced via the ballast water of container ships)

1.1.2 ECOSYSTEM SERVICES

Ecosystem services are the result of complex interactions between biodiversity and the inanimate environment (such as water, light, or CO_2). For example, biomass in the sea is created through the interplay of algae, CO_2, water and light. This biomass serves as food for fish, which many people rely on as a food source. In general one can say: the higher the biodiversity, the more reliably ecosystems can provide goods and services upon which human well-being and economic activities depend on.

The concept of ecosystem services describes the various types of services provided by intact ecosystems (natural capital). There are four categories:

1. Basic services are essential for the provision of all other services, but they have no direct benefit to humans. For example: Soil formation, primary production, photosynthesis, nutrient and water cycle.
2. Supply services: this category includes the multitude of goods provided by ecosystems. For example: timber, fish, natural fibres and raw materials for medicines. Many manufacturing and trading companies depend on the continuous provision of these renewable resources.
3. Regulatory services include, for example, air, climate, erosion and flood regulation as well as pollination.
4. Cultural services particularly include recreation and tourism, but also aesthetic information and inspiration. This type of services are also relevant for companies that are active in the field of bionics (e.g. research, architecture and design).

In summary, ecosystem services refer to the diverse benefits that humans derive from ecosystems.

1.2 NATURAL CAPITAL

“Natural capital” is an economic metaphor for the limited stocks of physical and biological resources found on earth, and of the limited capacity of ecosystems to provide ecosystem services.[2] Natural capital is largely viewed as freely available public[3] or common goods[4], resulting in two fundamental problems: Users typically do not have to pay for the external costs that result from their use, for example, drivers are not charged for their

CO_2 emissions. On the other hand, actors who contribute to the protection of natural capital do not receive any financial compensation in the majority of cases – unless there are relevant governmental programmes in place. Private forest owners will not receive any additional compensation for preserving parts of their land with valuable trees or shrubs for insects and other animals or for preserving the vegetation adjacent to rivers. Thus, the use of some products and services has indirect consequences, which so far have only been insufficiently included in the cost-benefit analyses and profit loss accounts of companies and economies – or indeed have been neglected altogether. These indirect effects are called negative or positive externalities. They are not yet being included in the calculation of product prices. It is also true that ecosystems have external effects, which so far have not been taken into account. As an example: providing the positive externalities of a forest ecosystem – erosion protection, CO_2 storage, preservation of biodiversity – will not be remunerated and yet, everyone or at least a small group of people benefits from them. Ultimately, this means that society as a whole compensates for the positive as well as for the negative externalities – resulting in privatizing profits and socializing losses.

1.3 MARKET-BASED INSTRUMENTS

On the occasion of the 11th Conference of the Parties to the Convention on Biological Diversity in October 2012, an annual amount of $150 to $440 billion was estimated for preserving the status quo of biodiversity.[5] While this amount may seem massive at first glance, it only corresponds to a fraction of the services provided by the global ecosystems. As the conservation of biodiversity is currently only being supported with about $41 billion annually from public and philanthropic sources[6], it is evident that additional sources of funding are necessary in order to protect biodiversity. To raise the amount necessary for the preservation of ecosystems and biodiversity, private financial resources in addition to state funds will increasingly have to be mobilised. This includes market-based instruments.[7] Private-sector funds can be generated via market-based instruments. They can help reach the conservation goals laid down in national and international biodiversity strategies and action plans.[8] The Strategy for Resource Mobilisation[9] of the Convention on Biological Diversity stipulates that more private funding sources are to be mobilised for the protection of biodiversity and ecosystems. The German National Strategy on Biological Diversity suggests, that the "financing of global nature conservation should be attained from existing as well as additional innovative instruments which are yet to be developed."[10] This is also the objective of the EU Biodiversity Strategy, which intends to provide incentives for the private sector.[11]

1.4 NATURAL CAPITAL MARKETS

Natural capital markets are market-based instruments, which are either initiated by the government or arise from private-sector interests for the conservation of biodiversity and ecosystem services. These private interests are to some extent also connected with the intention to make profits.

The wide range of natural capital markets includes certified products, CO_2 offsets or entrance fees for national parks. Only two market types are discussed in this report:

- markets on which those who cause the impairment of biodiversity have to pay for it and
- markets on which beneficiaries pay for the preservation of a clean environment.

These two market types ask polluters or beneficiaries to pay for the negative or positive externalities respectively and therefore allow the external costs to be internalised. This report focuses on market-based instruments that directly generate money for the protection, conservation or improvement of biodiversity or ecosystem services, namely:

- biodiversity offsets (compensation measures) and the associated habitat banks as well as
- payments for ecosystem services (PES).

The following section takes a look at the geographical distribution and the financial volume of these two market mechanisms before discussing them in detail.

1.4.1 GEOGRAPHICAL DISTRIBUTION

The following two maps[12] show the distribution of the mandatory, statutory compensation schemes carried out world-wide (map 1) as well as biodiversity offsets currently traded on the market (via so-called habitat banks) (map 2).

Figure 1: Compensation programmes worldwide.

The map above shows that statutory compensation schemes exist in over 30 countries. The two pins that are placed in the Atlantic Ocean represent two cross-border programmes, namely the Roundtable for Sustainable Palm Oil and the Business and Biodiversity Offset Programme.

Figure 2: Habitat banks worldwide.

Map 2 shows that so far only a few compensation programmes are processed via market-based systems called habitat banks. Until now, market-based compensation programmes were identified in North America, Europe, Australia, and one programme in Malaysia.[13]

The situation is similar for PES programmes. Overall, there are about 200 PES projects. Most PES projects generate funds for the protection of watersheds (payments for watershed services, PWS). A map of these programmes is therefore shown below. Map 3[14] shows the number of PWS programmes in different countries and demonstrates that most of these programmes take place in China, Latin America and the United States.

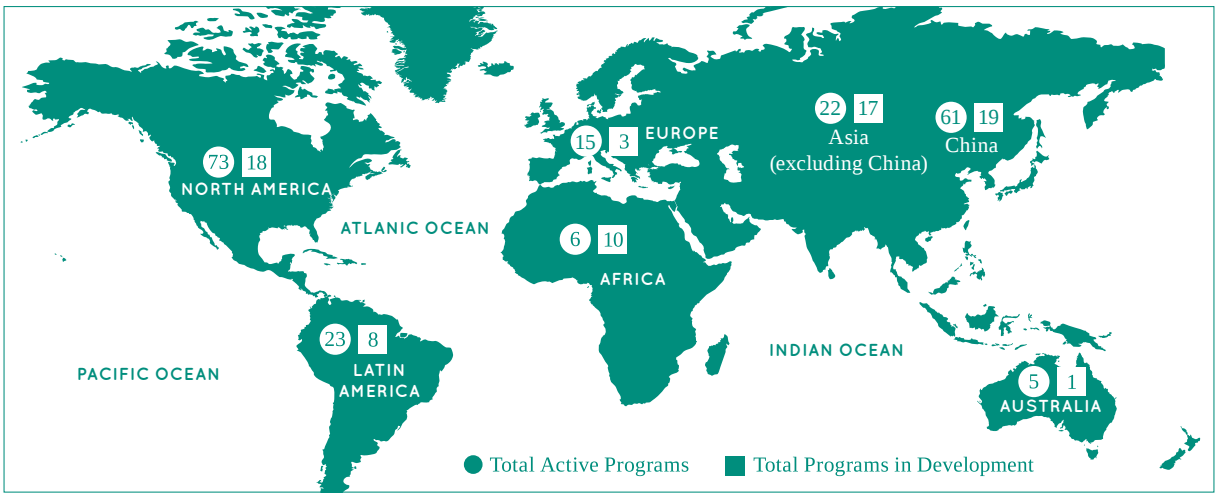

Figure 3: PWS programmes world-wide.

1.4.2 FINANCIAL VOLUME

Of the total $52 billion that were mobilised through different financing mechanisms for the conservation of biodiversity in 2010 (national public funds, agricultural subsidies, organic products, official development assistance, biodiversity offsets, philanthropy, etc.), $3.2 billion were generated via biodiversity offsets, equivalent to approx. 6.2% of the total volume.[15] It is not clear whether these funds generated from offsets represent a real added value for biodiversity or merely sum up compensation measures.

So far, the financial resources generated from PES programmes have not yet been separately documented. They are partly covered by agricultural subsidies.

The following table presents estimates of the respective turnover volumes worldwide (according to Ecosystem Marketplace (2012)[16]):

	Obligatory biodiversity offsets	Voluntary biodiversity offsets	State-supervised PWS programmes
Market volume in billion US dollar/year (2010)	3	0,025	7,5
Estimated volume in 2020 (billion US dollar)	5 - 8	0,070	20

Table 1: Financial volume of obligatory and voluntary biodiversity offsets and the PWS programmes.

The estimates in table 1 show a considerable potential in the market mechanisms. For PES systems so far, there are only reliable estimates with regard to PWS systems which show significant growth.

Figure 2 above and the table below[17] show that developed countries make up the lion's share of the biodiversity offset market so far. This is mainly because the legislation with regard to interventions in nature and landscape is stricter in developed countries. The table also shows that in developing countries more biodiversity offsets were being demanded than initially generated (supply). It is however likely that the demand in developed countries was "artificially" created by laws. The table also shows that there is considerable potential in generating biodiversity offsets in developing countries in particular.

	Developed countries	Developing countries
Supply in million US dollar/year	2.1–3.7	0.4
Demand in million US dollar/year	2–3.6	0.5

Table 2: Biodiversity offsets generated vs. implemented in developed and developing countries.

Overall, the PES market generates approximately $8.5 billion per year,[18] of which $5 million come from the private sector, mainly from the national PES programme in Costa Rica.[19] Most PES projects are PWS projects and are being organised and financed by governments. This means that the public authorities remunerate the secure provision of specific ecosystem services. The funds required for the programmes can be generated from earmarked tax revenues, as is the case, for example, in Costa Rica.[20] Figure 3 and the following table show that most transactions in PWS programmes take place in China.

	USA	China	Latin America
Market volume in billion US dollar/year	0,005	7,46	0,087
Number of PWS programmes in 2011	21	61	28

Table 3: Market volume of PES and amount of PWS programmes worldwide adapted from Bennet et al. (2013).[14]

The PSA PES programme in Costa Rica

A PES programme, the so-called Pago por Servicios Ambientales (PSA, payment for environmental services) has been running in Costa Rica since 1997. Landowners who engage in sustainable forest management will be paid a certain amount of money by the government, generated via an earmarked tax on fossil fuels. The programme pays for the conservation of biodiversity, CO_2 storage, water services and the conservation of the landscape. The payments to the landowners are determined annually, based on the inflation rate and last year's payment. The agencies that sign the contracts carry out the monitoring, which itself is regularly reviewed. The effectiveness of the programme is controversial: although Costa Rica now has more forested land, it is not clear whether this is due to the programme. However, on the areas covered by the programme an increase of biodiversity as well as the storage of approximately 11 million tonnes of CO_2 could be shown between 1999 and 2005. The average annual cost for the first ten years amounted to $13.3 million. It is difficult to exactly determine the area protected by the programme, but it is assumed to be several hundred thousand hectares.[21]

After a first brief overview of the two market-based instruments in terms of geographical distribution and market volume, they will be discussed in more detail in the following two chapters.

2

BIODIVERSITY OFFSETS AND HABITAT BANKS

Biodiversity offsets (compensation measures) are measurable conservation and restoration measures, usually performed as a compensation for unavoidable and irreducible impact on biodiversity. Biodiversity offsets valued in credits[22] can be sold to project developers. That way, they can comply with their legal duty to compensate (obligatory biodiversity offsets) or support additional conservation measures (voluntary biodiversity offsets). If high-quality natural areas are excluded from possible offset areas (so-called "no-go areas"), impacts may be compensated and higher-quality habitats may be created.

Stockpiled compensation measures (biodiversity offsets) can be deposited on an eco-account. They can then either be debited for impacts and thus used for own purposes or sold to others. Area pools and eco-accounts are run by land agencies[23] or by private eco-point agents and are called habitat banks in the international context. Habitat banks[24] are areas on which compensation measures can be pooled in order to generate biodiversity offsets.[25] In addition to the stockpiling of land for future compensation measures (area pools), there are also compensation measures on offer which have already been carried out – those are expressed in credits (hereafter: eco-points). These measures already undertaken are offered to project developers who are obliged to carry out compensation measures. Among others, the measures include the creation, maintenance and placing under protection of flower strips, hedges and mixed orchards. In the wake of the new Federal Compensation Ordinance (Bundeskompensationsverordnung), they will also increasingly include measures to unseal and relink natural areas.[26] The creation of large areas increases the cost efficiency for providers of eco-points. In addition, large areas allow for a more resilient biodiversity.

Similar to the gradation of the impact mitigation regulation in Germany,[27] there is also a mitigation hierarchy within the principle of biodiversity offsets (see figure 4). The mitigation hierarchy determines that impacts on nature and landscape must be (a) avoided, (b) minimised, (c) restored as far as possible and that (d) residual impacts have to be compensated (obligatory biodiversity offsets). The "residual impact on biodiversity" refers to the damage remaining after all efforts of avoiding, minimising and restoring. It is this impact which eventually has to be subjected to compensation measures.

Additional efforts that produce a "net gain" of biodiversity correspond to voluntary biodiversity offsets.

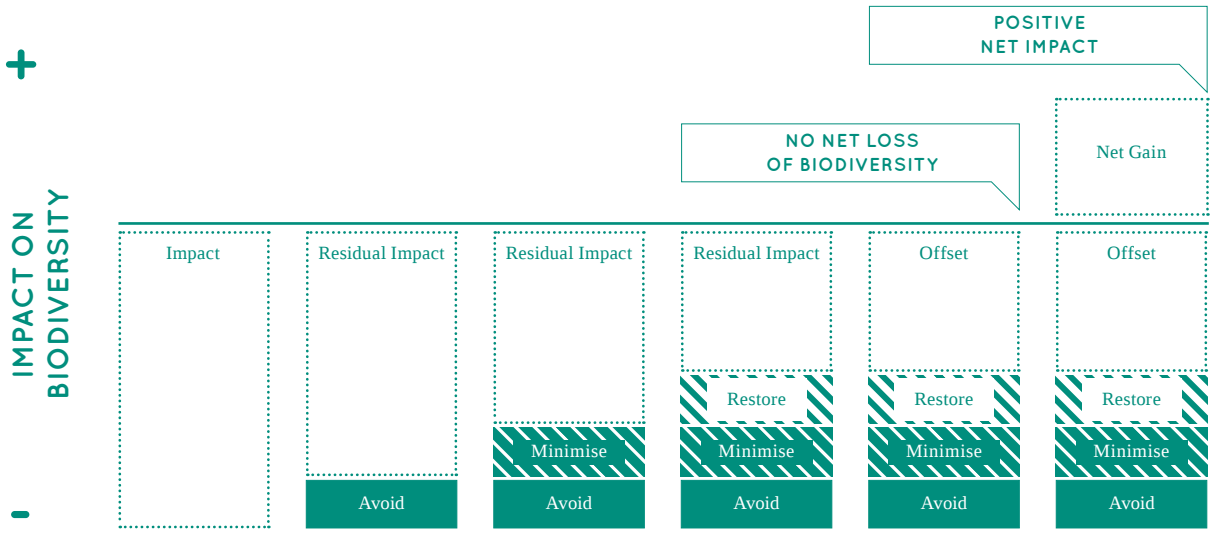

Figure 4: Mitigation hierarchy.[82]

The mitigation hierarchy – an example

Landscapes are fragmented due to the construction of a motorway. As a first step, all options of avoidance have to be considered, e.g. a section of the expansion could be avoided, the motorway could be built narrower or an alternative route could be chosen. The impact on biodiversity is being avoided – at least in part.

To reduce the consequences of the impact, green bridges or wildlife passages are to be built as a next step. This reduces the impact on biodiversity.

To further reduce the harm, affected ecosystem components have to be restored, such as the wetlands drained during the construction.

To compensate for the residual impact on biodiversity, mitigation measures must be carried out. They promote the protection and the conservation of biodiversity at a different location, in order to achieve the "no net loss" of biodiversity target.

Preferably, complementary measures should be undertaken in order to achieve the "net gain" of biodiversity objective.

Biodiversity offsets in Germany

Compensation measures are required by law in Germany pursuant to the impact mitigation regulation of 1976. In accordance with article 14 et seqq. of the Federal Nature Conservation Act (Bundesnaturschutzgesetz) and using an approach very similar to the mitigation hierarchy, impacts on nature and landscape have to be avoided, minimised and unavoidable impacts have to be compensated via compensation and substitution measures or compensation payments have to be made respectively. Impacts on nature are to be avoided wherever possible. If this is not possible, the value of nature will be recorded and valuated. Compensation is required, if habitats or other protected resources (animals, plants, soil, water, air and climate) are significantly affected. The respective amount is usually determined by using a biotope valuation method.

Since the amendment of the Federal Nature Conservation Act in 2009, compensation and substitution measures have been given equal preference. This has facilitated the implementation of the compensation obligation for developers of construction projects. It also allowed for the nationwide establishment of eco-accounts. The new federal regulation reiterates the increased use of area pools and eco-accounts[28] already mentioned in art. 16, par. 2 the Federal Nature Conservation Act.

While there are over 950 wetland and stream mitigation banks[29] in the United States as well as 115 conservation banks[30], which are partly run by private providers, Germany has a number of land agencies that are members of the Federal Association of Land Agencies (Bundesverband der Flächenagenturen)[31] as well as further service providers, private and other. In Germany, there are a few hundred pools.[32] The German area pool and eco-account landscape is not uniform due to the different laws and regulations at state level. Pursuant to art. 16, para. 2 of the Federal Nature Conservation Act, the stockpiling of compensation and substitution measures via eco-accounts, area pools or other measures varies according to state law. Also the recording, valuation or booking of stockpilled compensation and substitution measures in eco-accounts, their authorisation requirements and tradeability, as well as the transfer of responsibility to a third party (who perform compensation and substitution measures) in advance, is regulated by state law. The administrative burden varies between federal states and some of them have not yet adopted any legal provisions, which would regulate the allocation of eco-points. The Federal Compensation Regulation (Bundeskompensationsverordnung)[33] adopted by the federal cabinet[34] in April of 2013 is expected to harmonise this process across federal states and will produce better compensation measures. The Federal Council has yet to approve the regulation. Procedures will be standardised to enhance the transparency of the entire process. The regulation is also expected to speed up the process. In particular, the Federal Compensation Regulation should allow for the faster implementation of the energy turnaround. Moreover, its objective is to reduce land use by intelligently pooling the compensation measures.

A distinction is made between

- obligatory/mandatory (compliance) and
- voluntary biodiversity offsets.

2.1 OFFSET PROGRAMMES

2.1.1 MANDATORY BIODIVERSITY OFFSETS

Mandatory biodiversity offsets result from legal and subordinate regulations. If companies cause an impact on ecosystems and habitats because of construction projects, they are obliged by law to equivalently offset the impact.[35] This is usually done via direct compensation measures (carried out by the polluter) or compensation payments made to third parties who undertake appropriate compensation measures. The compensation obligation of project developers is an example of the internalisation of externalities (see mitigation hierarchy). Obligatory biodiversity offsets follow the "polluter pays" principle: the party responsible for negative externalities compensates for its impact. In Germany, the goal of obligatory mitigation measures (biodiversity offsets) is to compensate for impacts rather than creating a net biodiversity gain per se.

2.1.2 VOLUNTARY BIODIVERSITY OFFSETS

In countries with a legal offset obligation, voluntary biodiversity offsets usually go beyond statutory compensation obligations. If the regulations do not cover all types of impacts, it is possible that not even voluntary offsets adequately compensate for the entire impact. However, purely voluntary biodiversity offset systems, that are also demanded, could not be identified. So far, only two models are considered voluntary: the BayBank model in the United States, which established a voluntary offset market as well as a PES market for the Chesapeake Bay Watershed; as well as BioBanking in Australia. However, BioBanking is merely an alternative to the "assessment of significance" which is mandatory in New South Wales, Australia; it is therefore not really voluntary.

As table 1 above illustrates, the share of voluntary biodiversity offsets is comparatively small. At the same time, the estimates for 2020 show that voluntary schemes are expected to increase significantly. This is probably due to the enhanced CSR and environmental commitment of companies, the pressure of the public, other (European) laws, as well as the significant opportunities for the private sector to participate in these markets. The "no net loss initiative" launched by the European Commission therefore focuses on how to transpose compensation and substitution measures into European legislation. It cannot yet be estimated to what extent voluntary measures can be combined with the established offset system. In Germany, for example, concrete offers, as well as the demand for voluntary biodiversity offsets are still lacking at present. Voluntary CO_2 offsets, such as the MoorFutures, have become more widely established. No additional ecosystem servcies have been quantified into the MoorFutures so far, they are included in the carbon package so to speak. The next versions of MoorFutures are thought to include additional services, such as paludiculture.

However, companies can buy voluntary biodiversity offsets in addition to the obligatory offsets in order to achieve a net gain of biodiversity. The mining corporation Rio Tinto, for example, has set the goal to have a "net positive impact" on biodiversity, committing to leave at least as much biodiversity on its mining areas as before, if not more.[36] Companies that consider buying voluntary biodiversity offsets are most likely those who already carry out mandatory mitigation measures or buy eco-points due to their compensation obligation. They would then buy a few additional eco-points to achieve a "net gain" and support additional conservation measures.

Companies which are not legally obliged to compensate are probably more likely to implement other types of biodiversity conservation measures, for example, traditional nature conservation projects, donations or sponsoring in order to attract media coverage of their environmental commitment.

The consulting firm ICF GHK predicts that there will not be any significant growth of voluntary biodiversity offsets in the EU in the near future; however, they assume that the experiences and insights gained with voluntary biodiversity offsets contribute to the continuous improvement of the regulated systems.[37]

2.2 THE MARKET FOR BIODIVERSITY OFFSETS

As soon as it becomes possible to value an impact on nature and landscape (biodiversity) and express that impact in the same unit as compensation measures, the possibility of trading eco-points arises. So-called eco-points represent the value of lost biodiversity (need for eco-points – demand), as well as the compensation measures undertaken (supply of eco-points).

The habitat banking method (eco-accounts) converts environmental liability into tradeable assets; this creates a market system for compensation obligations. This means that biodiversity offsets (compensation measures) are generated (performed) in habitat banks and credited in eco-points. These eco-points can then be assigned to an impact or sold as biodiversity offsets.

The points are similar to the certificates in the EU CO_2 emissions trading system. Companies included in the EU emissions trading scheme are entitled to emit one tonne of CO_2 through the acquisition of one CO_2 certificate. The same applies to impacts on nature and landscape which are valuated and have to be similarly or equivalently compensated.

Demanders and suppliers of eco-points can also be brought together by third parties. Trading platforms have emerged from this model. Trading platforms allow companies, individuals, foundations and associations to offer already implemented ecological improvement measures or to implement and offer planned measures on suitable areas. On the other hand, the platforms allow developers of construction projects to find appropriate compensation measures (partly already valuated in eco-points).

An example:

The Foundation for Nature and Environment of Rhineland-Palatinate has been credited 920,000 eco-points for its creation of burnet and pepper-saxifrage meadows and a depression wetland in Speyer, in the Southwest of Germany. Habitat development measures serve to protect certain species of birds, butterflies and amphibians. The development generated eco-points, which were bought by Hermann Peter KG Baustoffwerk (a non-metallic minerals company) and used for their projects, including for the planned expansion of gravel mining.[38] A land agency acted as an intermediary between the supplier (the foundation) and the demander (the construction works company).

In Australia, the BioBanking system in New South Wales functions by generating eco-points (known as credits) for the protection of certain species (species credits) or of the natural vegetation (ecosystem credits) and selling them via an online trading platform.[39] The sites of the habitat banks and the type and number of credits generated, sold and required are publicly listed. The Australian BushBroker system operates a trading platform[40] with eco-points (so-called Native Vegetation Credits). BushBroker makes information on purchases available to the public on its website.

In Brazil, the so-called Forest Code stipulates, that a 20-80% share of the natural vegetation must be preserved (so-called legal reserve, LR), the exact percentage depends on the affected biome and federal state. If this cannot be guaranteed, new plantings are required as compensation. If the construction project developer does not have any suitable own land available, he can buy quotas (so-called quotas Environmental Reserve). Those landowners who receive and protect more legal reserve (LR) areas on their lands can convert them to environmental reserve shares (eco-points) and sell them to landowners, who do not have enough natural native vegetation on their plots. Currently, a market platform is being introduced with so-called quotas Environmental Reserve and credits Environmental Reserve. Buyers and sellers can register with the platform. Landowners who protect and

preserve natural vegetation can get credited quotas and sell them via the trading platform BVRio Green Stock Exchange[41]. This way they can generate additional revenue.

In Germany, an overview of available eco-points and advance compensation measures is given by the state offices; in other federal states this is done by land agencies. Individual state offices and land agencies also offer an overview of eco-points in the various natural areas and allow for public access to the eco-points offered and required as well as the compensation areas and measures. As an additional possibility, some online platforms also allow users to submit eco-points.

According to current knowledge, there is no Germany-wide overview of all offered compensation measures and eco-points or of the eco-points still required by project developers. Other countries have progressed more, such as Australia and its BioBanking trading platform in New South Wales, which even offers a free email alert service whenever eco-points offered or requested are submitted.

Biodiversity offsets as a business opportunity

Duke et al. (2012)[42] place biodiversity offsets as the number 1 business opportunity for the United Kingdom. Biodiversity offsets create a wide range of new businesses, including (a) environmental consulting for the design of offsets as well as consulting for project developers, (b) brokers who bring together demanders and suppliers, (c) registration and certification agents and developers, (d) financial service providers offering loans and insurance, and (e) biodiversity offsets offered by landowners. In the United Kingdom, biodiversity offsets are expected to be converted to a mandatory system by expanding the current voluntary system. Biodiversity benefits mainly arise from pooling measures in habitat banks, producing net environmental benefits through the creation of large habitats. Currently, there are six pilot projects on biodiversity offset areas in the United Kingdom running until April 2014.[43] Duke et al. (2012) estimate that compensation for new real estate areas in the UK alone could generate £50 to £300 million per year via a market for biodiversity offsets.

2.2.1 SUPPLIERS

Habitat banking systems and the generation of biodiversity offsets allow for the involvement of the private sector, by creating an incentive for companies and individuals who own land areas to protect their land. If the cost of biodiversity conservation is low for certain land owners, they can generate biodiversity offsets, measured in eco-points, and sell them to third parties. The generated compensation measures, valuated in points, can be used for own impacts or resold.

In Germany, municipalities, authorities, public administrations, nature conservation and landscape associations, foundations, landscape conservation farms, schools as well as private land owners and land users (in agreement with the owner) can participate in the eco-account system. As long as the ecological value of an area is being enhanced (even in your own backyard), everyone can be credited eco-points (valuated, stockpiled advance measures).[44] Winemakers in Baden-Württemberg,[45] for example, can repair sandstone walls/dry walls in order to provide shelter for lizards, spiders and insects. For the protection of these habitats, they receive eco-points, which they can use themselves or resell to others.

Municipalities gain a monetary advantage by performing such enhancement measures free of charge and generating more revenue. The municipality of Gedern (in the Hessen region in Germany), for example, was able to generate four million eco-points via conservation measures. In Hessen, eco-points have a monetary value of €0.35. If the eco-points were sold, a total capital of €1.5 million could be generated. The cost of the advance compensation measures amounted to about 10% of the current value.[46]

Project developers can stockpile compensation areas and measures (advance compensation measures) and later allocate them to own impacts or resell eco-points. Chevron U.S.A. Inc. offers eco-points (mitigation credits) from its 2.874 hectare habitat bank (Paradis Mitigation Bank).[47] Shell also plans to generate eco-points (mitigation credits) on its land in the United States and to use them to compensate for its own impacts or to resell them to third

parties.[48] The Environment Bank Ltd. in the UK offers eco-points (conservation credits), which are purchased by project developers as compensation for their impacts. In return, the bank uses the proceeds from the sale of the credits to finance investments by landowners, who forego agricultural production and restore their areas of land.[49] German companies, such as Deutsche Bahn, also plan to undertake compensation measures on their own land, to valuate these in eco-points if necessary and to stockpile them for own impacts.[50]

However, overall the introduction of private measures into planning proceedings is complicated and there is low demand by enterprises and project developers. This is mainly because the long-term sustainability of compensation measures cannot be ensured as transparent valuation methods and long-term monitoring are lacking. The project developers are also obliged to maintain and guarantee compensation measures as long as the impact persists, usually 10–30 years to permanently. Therefore, many project developers prefer having land agencies handle the process, as they will then take care of the future maintenance, monitoring and administration.

CASE STUDIES

Fraport

Approx. 280 hectares of forest were cleared for the Frankfurt am Main airport expansion. This intervention has been valuated as a deficit of 100 million eco-points. To generate these eco-points, forests were planted elsewhere and spruce forests were converted into specious-rich deciduous forests. The cost of this project for the airport operator was approximately €160 million. Ultimately, Fraport has generated a surplus of 11 million eco-points, which it could now sell.[51]

Rheinkalk

The limestone mining company Rheinkalk received eco-points for the river restoration of the Hönne. The dismantling of ground sills and weirs, which improved the passability of the watercourse for fish, were some of the measures implemented. The balance of eco-points will be stockpiled to compensate future impacts on nature and landscape.[52]

Daimler

Daimler was awarded eco-points for its activities on company-owned greens, which it used to compensate for the extension of the Mercedes Technology Centre itself. The measures included constructing a dry-stone wall for the Wall Lizard (Podarcis muralis), planting species-rich rough grasslands, planting fruit trees on mixed orchards, as well as preserving old and dead trees for breeding birds.[53]

2.2.2 DEMANDERS

Buyers of biodiversity offsets are project developers who are obliged to compensate for their impacts on nature and landscape. By way of purchasing eco-points, they do not have to carry out own measures any more. These include companies with considerable land impacts, e.g. mining companies, oil and gas extracting companies, wind- and hydropower companies, the construction industry as well as tourism and agricultural enterprises. In addition to project developers that are obliged to compensate and (in theory) companies that want to demonstrate their environmental commitment to the public by purchasing voluntary biodiversity offsets, potential demanders also include public and private organisations aiming at improving and conserving biodiversity.[54]

Recently, companies themselves, policymakers, financial institutions and the public have increased vigilance to ensure that in accordance with the “polluter pays” principle, companies take full responsibility for their impacts on biodiversity, even if they operate in countries which do not stipulate mandatory compensation measures.[55] Thus, the demand for biodiversity offsets is not only a consequence of the legal framework. It is also an effect of companies striving to include and implement the “net positive impact” target in their biodiversity

strategy, such as mining giant Rio Tinto.[56] According to the British The Biodiversity Consultancy, in 2012, 38 companies indicated their internal biodiversity targets to be "no net loss", "neutrality" or "net positive impact".[57] And yet, as table 1 above shows, 99% of biodiversity offsets are required by law and only 1% is voluntary.

The ICF GHK consulting firm headquartered in London estimates that at least 187,000 hectares of land are placed under protection via the offset market every year. Furthermore, it estimates an area of 160,000 to 540,000 hectares annually to be subject to land-use change in the EU. This land constitutes the theoretical demand for obligatory compensation areas.[58]

2.3 DESIGN OPTIONS

The following section presents design options of biodiversity offsets and habitat banks and discusses the difficulties and limits of market-based instruments.

2.3.1 FUNCTIONAL CONTEXT

Most offset systems specify equivalence criteria ("like for like"). Australia requires that the impact on a threatened native species of vegetation be compensated by protecting the same native vegetation species in the same biome. This is similar to the Conservation Banking System in the United States, which stipulates that an impact on a specific bird species, for example, can be compensated only by the protection of the same bird species. The same is true for the Wetland Mitigation Banking System in the United States which determines that an impact on a wetland be compensated by restoring another wetland with similar functions and values. In Germany, this requirement has been levelled by the introduction of statutory equality of mitigation and substitution. In accordance with art. 15, par. 2, sentence 3 of the Federal Nature Conservation Act, an impact is substituted as soon as the impaired functions of the ecosystem are restored in an equivalent manner within the affected natural area and the landscape is appropriately redesigned.

Instead of applying the "like for like" principle, some biodiversity offset systems prefer the "like for like or better" or "trading up" principle. This means, the biodiversity (habitat/species) destroyed at one location is compensated for by "more" or "superior quality" biodiversity elsewhere. This compensation method is permitted as an alternative, if resources of higher quality are being protected as compared to the resources affected by the impact. This can also imply an exchange ratio of greater than 1:1, for example having to plant more than one tree for cutting down one. The Australian federal state Queensland stipulates that for the removal of every tree which is typical for koala habitats, five new trees should be replanted.

The German impact mitigation regulation provides for the occurring biotopes to be multiplied by the area. The point value of an oak forest, for example, is 30 points. This value is multiplied by the area of the impact. The clearing of 1000 m^2 of oak forest, for example, results in a deficit of 30,000 points. These 30,000 points can be compensated with any other 30,000 points, stemming from entirely different restoration measures, e.g. from wetland restorations.[59] The regulation is valid outside Natura 2000 areas.

Measures to ensure the ecological coherence must be planned for habitats and species occurring inside Natura 2000 sites. This means restoring precisely those functions that are being destroyed.[60] In addition, continued ecological functionality measures (CEF measures) need to be planned for any species under the "strict protection" system. This refers to measures often planned in advance, in order to conserve the habitats belonging to these species.[61] The destruction of habitats in areas covered by the Birds and Habitats Directive has to be offset by exactly the same habitat.

2.3.2 SPATIAL CONTEXT

In most offset systems, the spatial context is loosened, so that compensatory measures are also allowed "off-site" (spatially separate). However, in most cases they have to be implemented in the same natural area. In Germany, for example, it is possible to implement compensation and substitution measures "off-site" (spatially

separate) while remaining in the same natural area – in some federal states this only applies to the same district or municipality.[62]

There are quite a few cases of biodiversity offsets, where the compensation takes place in areas far from the site of the impact – in the same way as CO_2 offsetting. This includes for example offsets in geographically separate areas when migratory species are affected. If, for example, an impact affects the habitat of a species of migratory birds, compensatory measures can be performed in other areas inhabited by the same species.[63] This also includes cases where birds are caught as by-catch when fishing. As a compensation, invasive species which threaten the affected bird species on their breeding islands could be deliberately killed, or new breeding areas could be created for the species concerned.[64]

2.3.3 TEMPORAL CONTEXT

The temporal context refers to the moment at which a compensation measure takes place. It can be undertaken before the impact, at the same time as the impact or after it. Measures which are carried out before the impact are called stockpiled measures. These measures can be valuated in eco-points, and stockpiled in eco-accounts. Once the impact takes place, they can be withdrawn from the account and thus be allocated to the impact. Stockpiled measures have the best ecological effects because they create a surplus of biodiversity until they are being withdrawn from the account.[65]

Chart 4 (bottom right) in figure 5 shows that for impacts with stockpiled measures, the values and functions increase before the actual impact and are preserved rather than decrease after the impact (bold line); this corresponds to the "no net loss" objective. In contrast to this, graph 3 (bottom left) shows that impacts with a time-delayed compensation (compensation takes place only after the impact) leads to a reduction of the values and functions for a certain period, thus producing a "net loss". Gordon et al. (2011)[67] show that mitigation measures carried out prior to the impact have the best "net gain" result; this is an argument in favour of the stockpiling of measures, for example in habitat banks.

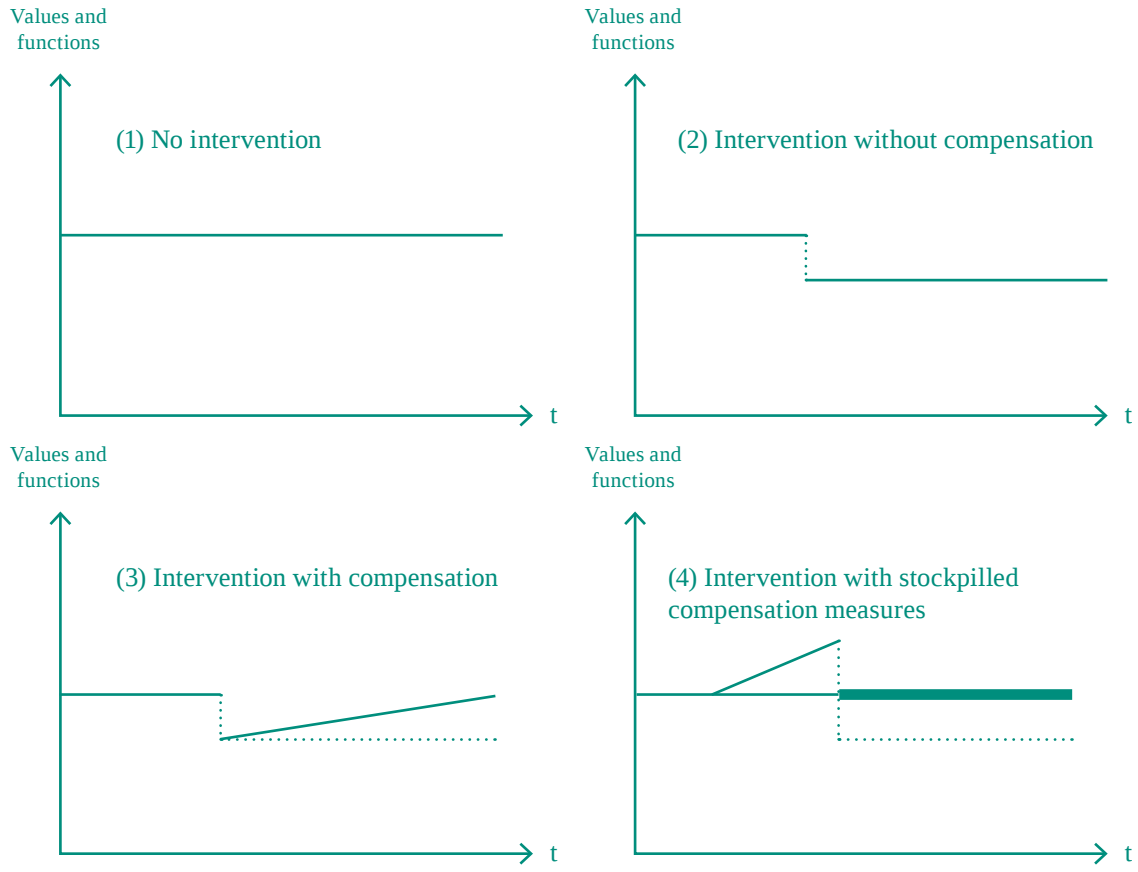

Figure 5: Time-lag effect.

On the other hand, simultaneous or time-delayed compensation measures are questionable in terms of their ecological scope. In the systems examined, the stockpiling of compensation measures is mostly mandatory.

2.3.4 PAYMENT OF IN-LIEU FEES OR COMPENSATION FUND

In some offset systems, there is also the possibility of the payment of in-lieu fees into a compensation fund. This "out of kind" option allows for more flexibility. It has to be ensured, however, that the funds will be used to implement biodiversity enhancing measures elsewhere in order to comply with the mitigation hierarchy. Therefore, it is necessary to ensure that the in-lieu fees provide a high-quality protection of biodiversity, representing a substitute of at least equal value compared to the impact. If compensation programmes include the "out of kind" option (payment of in-lieu fees), the legislator often requires the "like for like or better" or "trading up" option.[68] This is to ensure that at least the "equivalent" of the impact can be safely achieved, if a "similar" compensation is not possible or not necessary.

It is noteworthy that US legislation prefers habitat banking and in-lieu fees[69] over compensatory measures implemented by the project developers themselves.[70] It is likely that the option of in-lieu fees will play an increasingly central role in Germany due to the Federal Compensation Ordinance. So far, the option of in-lieu fees was only possible in those cases where full compensation was impossible. The payment of in-lieu fees was however no equivalent alternative for compensation and substitution measures. The Federal Compensation Ordinance stipulates that in-lieu fees are managed by the Federal Environment Ministry. The most important point of criticism against in-lieu fees is that this option is an even more severe form of "buying one's way out." The option of in-lieu fees also involves the risk that a natural area will be lost if the funds are used elsewhere.

2.3.5 MEASUREMENT OF BIODIVERSITY / VALUE AND DEFINITION OF ECO-POINTS

In the countries examined, the value and definition of eco-points (credit prices) are derived from the legislation as well as subordinate regulations and are based on the measurement of biodiversity. This includes the recording of a baseline (status quo as a reference value for comparison) on the impact areas as well as the compensation areas, in addition to the respective predicted or actual changes. The measurement of biodiversity is very complex, because biodiversity is broadly defined and several protected resources are usually affected. Unlike for CO_2 offsets, there is no uniform unit of measure.[71] It is very difficult to apply meaningful "proxies," that can describe the composition, structure, and functions of biodiversity. Species populations or other measures of diversity and commonness of species are directly determinable for some species; for other species, however, a greater availability of suitable habitats can indirectly act as a "proxy."[72] Since biodiversity and ecosystem services are multidimensional, the selection of a single indicator or multiple indicators is important when measuring biodiversity.[73] In order to address the problem of measuring biodiversity, most biodiversity offset methods take into account the following aspects: the size of the area available to the main species, the species populations, as well as the ability of these areas to support certain species; this measure falls within the concept of "habitat quality". In Germany, the procedures for assessing biodiversity (biotope valuation method) and the allocation of eco-points still vary in some cases. The Federal Compensation Ordinance is to introduce a uniform biotope valuation method. This plan has however been met with resistance from some of the federal states.

2.3.6 IRREPLACEABILITY OF BIODIVERSITY

The effectiveness of biodiversity offsets is limited and not every impact can be adequately compensated. The laws and regulations define clear ecological limits determining in which cases an impact may not take place, since it could not be compensated by any adequate compensatory measure. This includes for example the loss of species facing extinction, which cannot be compensated by any compensation measure.[74] Quértier & Lavorel (2011) note that some impacts in wetlands or forests are very difficult to compensate, as these habitats have evolved over the course of many centuries.[75]

2.3.7 ADDITIONALITY

According to the principle of additionality, biodiversity offsets need to exceed the conservation measures which are mandatory anyway. Thus, an area which already has the status of a nature reserve is not allowed as a habitat bank. Rather, the measures for the conservation of biodiversity and ecosystem services must be new or additional.

Darbi (2010)[76] and Maron et al. (2012)[77] generally question the compliance of biodiversity offsets with the additionality criterion. First, the additionality criterion is already violated by the stockpiling of land and compensation measures, because the eco-points were generated precisely for the reason of the future impact mitigation. Second, Maron et al. (2012) point out that the criterion of additionality is no longer met if measures were previously implemented without the prospect of eco-points and thus additional income but are then remunerated due to the increased demand and the new market situation. Maron et al. (2012) also report that in Australia, the restoration activities and land management of many landowners and municipalities already go beyond the duty of care on a voluntary basis. Third, biodiversity offsets should not be used to finance existing conservation obligations. Financing nature reserves would violate the additionality criterion. This criterion would also be violated if the financing of biodiversity conservation by private individuals lead to a reduction in government funding.[78] To meet the additionality criterion, offset activities have to be planned and implemented solely for the purpose of the offset and must not replace public conservation funds.

On the other hand, there are efforts to also generate biodiversity offsets in (national) conservation areas/natural parks/nature reserves, as these are often in a very bad state and may be strengthened by means of additional resources.[79] This is incompatible with the additionality criterion, yet it is still quite conceivable for some countries. Many non-OECD countries can only inadequately finance their conservation areas; therefore, funds from the sale of biodiversity offsets out of the conservation areas could produce real biodiversity gains.[80] Therefore, the financing of existing conservation areas via biodiversity offsets should not be rejected from the outset. Implementing biodiversity offsets in already protected, state-owned areas would (theoretically) ensure their permanence as they will remain conservation areas forever.

2.3.8 LEAKAGE

Leakage takes place if measures implemented cause the displacement of damages. If for example eco-points were emitted for environmental risks averted[81], but then the impact (e.g. gravel mining) was only displaced, this would constitute a case of leakage in the area of biodiversity offsets. Furthermore, leakage occurs, if (due to an impact elsewhere) an area is placed under protection as a compensation area and, as a result, biodiversity reducing activities in the compensation area are shifted to other areas (e.g. poaching, illegal logging). If leakage occurs, the result cannot be “no net loss” let alone “net gain” of biodiversity. Therefore, leakage risks have to be taken into account and leakage effects have to be avoided or tackled separately.

2.3.9 LICENSE TO TRASH

A further challenge with regard to biodiversity offsets is in the fact that compensation measures will be preferred if it is easier to implement them than to avoid the impact, hence neglecting the mitigation hierarchy. This phenomenon is known as the license to trash – this is the case if the purchase of biodiversity offsets leads to the approval of very harmful impacts, which would have not taken place in the absence of compensation options.[82] It is therefore necessary to review the possibility of a license to trash for any offset. If the offset does entail such a situation, it is essential to prevent the impact. The mitigation hierarchy must be respected in all cases.

2.4 DISCUSSION OF BIODIVERSITY OFFSETS

Although biodiversity offsets have many advantages in theory, there are several limitations to their application. At best, compensation measures contribute to maintaining biodiversity rather than promoting additional biodiversity. This is true unless voluntary biodiversity offsets, i.e. additional conservation measures, are performed, and there is actually a net gain of biodiversity.

A number of recommendations and best practices can be derived for habitat banks and biodiversity offsets on the basis of the advantages and disadvantages presented above, as well as the challenges and difficulties with their implementation.

First, it should be mentioned that as market-based instruments, biodiversity offsets and habitat banking are no panacea. They should rather be used as an additional tool for the conservation of biodiversity. The commitments made by each country to achieve its biodiversity objectives should not be bypassed. They should rather be supplemented by private sector funds. At the same time, biodiversity offsets and habitat banking are by all means well-proven and effective instruments, which are applied on a broad basis in the countries examined.

It was shown however, that companies in Germany do not yet perform any additional compensation measures. This is mainly because even the mandatory compensation measures are perceived as disproportionate, as an "overcompensation" and there is no incentive to do more than required by law.[83] Moreover, so far no additional eco-points have been offered and there were many difficulties to even find adequate compensation areas and compensation measures that meet all the requirements.

Some environmental groups argue that biodiversity offsets will not be able to stop the loss of biodiversity. This is mainly because there are only a few areas where impacts on biodiversity can be securely compensated by offsets in the long term. Furthermore, there is the transparency issue of biodiversity offsets.[84]

Walker et al. (2009) criticise all forms of trade in biodiversity and claim that so far, these instruments have not contributed to the reduction of biodiversity loss. In addition, they note that private interests (the interests of the project developers) dominate public interests (e.g. biodiversity) so that the private sector derives the greatest benefit from the trade of biodiversity offsets, rather than biodiversity itself. They suggest that the "no net loss" and "net gain" objectives that policymakers have committed themselves to are ultimately just empty words while the interests of the project developers are continuing to be pursued. In summary, Walker et al. (2009) postulate that the conservation of biodiversity cannot be ensured by new market structures.[85]

These considerations demonstrate that countries with clearly defined national laws and biodiversity targets, such as "no net loss" or similar have a solid basis for establishing biodiversity offsets and habitat banking structures. Laws, policies and regulations are the prerequisite for biodiversity offsets being offered and the formation of a market. The "no net loss initiative" of the European Commission might point the way. As seen above, although some voluntary systems are becoming established, statutory schemes generally account for the lion's share of compensation measures.

2.5 RECOMMENDATIONS FOR BIODIVERSITY OFFSETS

If the laws and regulations prescribe very "strict" or specific compensation rules, the formation of a market with a sufficient number of offers and sufficient demand for eco-points will become unlikely. On the one hand, it is possible for demand to emerge which cannot be satisfied, or that monopoly structures are being established, which severely limit the chances of an actual market development. If on the other hand the design options are very loosely defined, the quality might deteriorate, leading to a loss of credibility and ultimately to biodiversity losses. It is therefore expedient to create simple and transparent legislation in terms of the design options for habitat banks in order to allow for a functioning market and to ensure a smooth process; this includes a clearly defined framework with clear boundaries. Nature conservation legislation in Germany includes clear design options, and the impact mitigation regulation is internationally recognised as being strict, but also very effective. A standardised regulation in the form of the Federal Compensation Ordinance, which is being pursued in Germany, is a step in the right direction since it will be applicable in the whole country, and thus reduce differences between the state legislations. The Federal Compensation Ordinance favours the formation of area pools and gives rise to hope for a more transparent and high-quality mitigation and compensation.

It is advisable to codify low transaction costs for operators of habitat banks as well as the establishment of internet-based trading platforms. To minimise transaction costs, cheap loans are important for area pool operators to finance their up-front investments.

In order to guarantee the "no net loss" goal over time, it is expedient to stockpile compensation measures in habitat banks and later assign them to a certain impact.[86] By following this procedure, time-lag effects can be avoided (see figure 5). When measuring biodiversity, it is recommended to use the same procedure before and after the impact in order to ensure direct comparability of the two states. The biodiversity in the habitat bank and the compensation measure should therefore also be assessed according to the same method. The consulting company ICF GHK points out that some of the EU Member States do not use the same method in estimating the losses and gains in biodiversity.[87] In addition, when designing the offsets, it is decisive whether benchmarks (reference points) are being used against which changes are measured to find out whether the compensatory measure has compensated for the loss. It is fundamental in this context to further develop and improve standardised indicators for the measurement of biodiversity.[88] The Federal Compensation Ordinance provides for a national biotope valuation method, which evaluates impacts and determines the required compensation via a credit scheme.

Habitats particularly worthy of conservation such as wetlands, forests or habitats with species particularly worthy of protection should be declared as "no-go areas" in order to meet the challenges of the irreplaceability of biodiversity.[89] In addition, compliance with the mitigation hierarchy is to be ensured at any time. The compensation measure must be new, i.e. additional, therefore already planned and legally required conservation measures may not be recorded in eco-points. To address the problem of leakage, it is advisable to expand monitoring beyond the project area; of course, this inevitably leads to higher monitoring costs. To avoid the risk of a "license to trash", the strict observance of the mitigation hierarchy has to be ensured at all times. The compensation measure may only be implemented as a last resort.[90]

In order to assess the implementation of compensation measures and their value for biodiversity, it is advisable to carry out long-term monitoring of the measures and implement appropriate control mechanisms.[91] The establishment of a comprehensive monitoring system which shows all available sites (habitat banks) and all available eco-points is a suitable strategy for this purpose. This guarantees a strategic overview of all projects[92] and avoids associating the same compensatory measures with different impacts. It is also advisable to clearly define the responsibilities for the sites to ensure their permanence (in Germany land agencies and planning offices).

Lessons learned from CO_2 offsets

Businesses and public institutions can generate and sell CO_2 credits on the mandatory and voluntary CO_2 offset markets. Companies, whose own cost of avoiding CO_2 emissions are high, are buyers of CO_2 offsets. For them it is cheaper to buy CO_2 offsets than to forego CO_2 emissions.

CO_2 offsets basically face the same difficulties as biodiversity offsets. In terms of measuring CO_2 offsets, there is however a standardised unit of measure, namely CO_2 equivalents, which are emitted by an activity or stored by a measure. A uniformly applicable and useful unit of measure for biodiversity is still a long way from being achieved.

The so-called grandfathering is the biggest problem on the CO_2 offset market. This means that certificates are awarded free of charge on the basis of historical emissions. As a result, companies increase their CO_2 emissions in the years prior to the introduction in order to later obtain sufficient certificates. The surplus of certificates pushes down the price and thus reduces the incentives to reduce emissions.

Another issue discussed with regard to biodiversity offsets compared to CO_2 offsets is to what extent the spatial link[93] should be loosened in order to at least compensate for the impact on biodiversity by means of an offset (or to achieve a net gain in biodiversity preferably). It does not matter where CO_2 emissions are produced, because they have a global impact in the atmosphere. Impacts on biodiversity however often directly affect the nature in their immediate surroundings. In balancing CO_2 emissions with CO_2 storage or impacts on biodiversity with biodiversity offsets, it is possible that areas different from the ones affected by the impact will benefit from the conservation measure. This is true although the equivalence criterion is applied to these spatially separate compensation measures.

To avoid the mistakes that were made with the CO_2 offset market, the biodiversity offset market should be designed as a heavily regulated and controlled market-based instrument from the outset. In theory, the cap-and-trade system for CO_2 offsets is useful to reach the actual target of capping CO_2 emissions. As a result of the biodiversity and nature conservation goals laid down by policymakers, biodiversity offsets are also capped.[94] Such goals include the “no net loss” objective or the specification of the proportion of land, on which construction is not allowed. For the most part, the requirements for the design of biodiversity offsets (as discussed above) result from the legislation present. In the countries considered, these requirements consist of strict conditions and restrictions for impacts on biodiversity as well as their compensation. A state-regulated certification scheme can be a good remedy against the circulation of dubious eco-points while at the same time ensuring that the “no net loss” or preferably the “net gain” target is achieved. As an example: in the German system, quality standards are developed by the Federal Association of Land Agencies Bundesverband der Flächenagenturen. To prevent a price erosion of eco-points, the practice of grandfathering should be avoided in the framework of biodiversity offset trading when issuing eco-points. Grandfathering means awarding certificates free of charge on the basis of historical emissions. This practice was common for many years in CO_2 emissions trading. This would produce competitive advantages for a small number of companies.[95] No such case is documented for biodiversity offsets and in the countries considered, project developers must provide adequate compensation for their impact as stipulated by the law.

PAYMENTS FOR ECOSYSTEM SERVICES (PES)

The basic idea of payments for ecosystem services (PES) is that beneficiaries pay a direct contractual sum to the "provider" of ecosystem services. The "provider" of ecosystem services, in turn, implements measures that guarantee the conservation or restoration of ecosystem services.[96]

With payments for ecosystem services (PES) the beneficiary pays principle applies – the user of ecosystem services pays for their provision.[97] Positive externalities are rewarded and thus internalised. The term "provider" is initially placed between quotation marks, because in fact it is not a person providing the ecosystem services, but rather an intact ecosystem. The "provider" (this can be an individual or a group of people, such as a municipality or a company) does however affect the quality of the ecosystem services and will therefore be called the provider of the ecosystem services hereafter.

Wunder (2005) defines PES as a voluntary and conditional agreement between a provider and a buyer on a well-defined ecosystem service or land use.[98] This definition implies two fundamental requirements:

- The measure must be new or additional, not one that was going to be implemented anyway (additionality).
- The project will only be carried out because the efforts will be remunerated (conditionality).

3.1 PES PROGRAMMES

As this very narrow definition often does not apply in practice,[99] PES programmes will be understood to include many market-based mechanisms that provide ecosystem services or protect the environment.[100] Only those PES market mechanisms are considered in this report which focus on concrete changes in ecosystem services, e.g. agricultural practices which lead to an increased number of protected lizards (the actual change in the ecosystem). PES programmes that create credits, such as an offset market, will not be considered. Some authors also mention PES programmes for CO_2, however these are actually CO_2 offsets.[101]

PES programmes differ from subsidies, since the measures and payments are voluntary and would not be implemented without the PES programme. In addition, the user, the beneficiary directly pays for an ecosystem service. However, the funds do not originate from the private sector in all cases: many countries directly remunerate the conservation of ecosystem services, for example agri-environmental measures.

Most of the PES projects feature payments for water or biodiversity. In addition, there are agri-environmental measures, although they do not comply with all of the PES criteria.

3.1.1 WATERSHEDS

Most PES projects are management projects in watersheds called payments for watershed services (PWS). Like any PES programme, PWS programmes are based on financial incentive mechanisms, but also on in-kind benefits if applicable. In such programmes, upstream landowners are compensated for maintaining, adapting or changing a certain land use in order to improve or ensure the water quality downstream. A classic example is the upstream farmer and the downstream brewery. In this case, the upstream farmer receives a payment for good land use (e.g. conservation of tree populations, disuse of fertilizer) as a compensation for his lost revenue, which he would have obtained with an alternative land use (deforestation, use of fertilizers).

In PWS projects, it is mainly land owners, such as farmers, who are being paid (compensated) for practices resulting in a reduced impact on the ecosystem service of clean water by municipalities, beverage companies or hydroelectric power plants.

The Vittel PES programme (France)[102, 103,104]

In the 1980s, the intensificaton of agriculture in the catchment area of the Vittel mineral water manufacturer posed a threat to the stable mineral composition of its mineral water. As French legislation stipulates that the mineral composition must not change, Vittel faced the risk of losing its brand name. Forcing farmers who contributed to the contamination of the spring to change their farming practices via legal

means was not a viable option, since the mineral values remained just within legal requirements. Alternative options, such as the purchase of the land or a relocation of the facility had to be dismissed as well. Purchasing the land was not possible for financial, legal and social reasons; relocating the facility would have resulted in the loss of the brand name. The only option that remained, was convincing the farmers to voluntarily change their farming practices.

After four years of research by the national agricultural research institute INRA, in addition to another ten years of negotiations between the farmers and Vittel, a PES programme, headed by Agrivair, was eventually introduced. The programme stipulated that farmers would receive training in addition to the monetary compensation for converting their farming practices. The compensation payments were based on the conversion costs of farmers, since the exact contribution of individual farmers to the pollution of the spring could not be identified. Compliance with the agreements was ensured by monitoring the water quality as well as the farmers' management measures. The PES programme covered an area of approximately 3,500 hectares and has cost Vittel at least 16 million Euros to date. It does however ensure the continuation of the brand name "Vittel."

3.1.2 BIODIVERSITY

Biodiversity itself is an ecosystem service, which can be protected by a PES system.[105] However, in the majority of cases, biodiversity is included in other ecosystem services. A good example is the Tmatboey project in Cambodia: Tourists who spot a Giant Ibis (Thaumatibis gigantea) or a White-shouldered Ibis (Pseudibis davisoni), have to pay more money than those who do not catch sight of them.[106] In Sweden, there is a similar project, in which villagers are remunerated by the government for the number of living carnivores.[107] In both cases it is financially viable to undertake protective measures or to create or maintain an attractive habitat for the species concerned.

3.1.3 AGRI-ENVIRONMENTAL MEASURES

In OECD countries, agri-environmental measures are carried out mainly in the United States, Norway, Switzerland and the EU,[108] for the EU in the context of the second pillar of the CAP. These include the ESA (Environmentally Sensitive Areas) and the CSS (Countryside Stewardship Scheme) programmes in the United Kingdom[109] as well as the contractual nature conservation programmes in Germany.[110] Most of the agri-environmental measures pay farmers for implementing certain conservation measures (e.g. mowing on certain dates to protect ground-nesting birds). Certainly, not all funds awarded within the framework of the EU CAP can be described as PES programmes. On the one hand, conditionality is not guaranteed, and on the other hand, the ecosystem services are not well-defined.[111] The funds that farmers receive for agri-environmental measures are rather intended to compensate reduced or lost revenues. To a much lesser extent, they are funds for the protection of ecosystem services as these ecosystem services are mostly public goods.

3.2 THE MARKET FOR PES

So far, there is no market yet that would bring together providers and beneficiaries of ecosystem services. This is mainly because most current PES systems have been initiated by public authorities. This market gap is expected to be closed by a research project.[112] The objective of the project is to develop a real market for ecosystem services. A web-based marketplace will provide landowners or land users with the opportunity to voluntarily offer projects for conserving or restoring ecosystem services.

3.3 DESIGN OPTIONS

In addition to the different PES systems, there are different design options within these systems. PES systems, much like biodiversity offsets, face the difficulty of measuring biodiversity. There are, however, also difficulties with regard to additionality, leakage risks as well as the requirement of permanence.

3.3.1 MEASURING BIODIVERSITY

In addition to the above-mentioned difficulties in measuring biodiversity, there are further aspects to be taken into consideration for the design of PES systems. First, it should be clarified which "benefit" the beneficiary will pay for. The "benefit" depends on the final ecosystem service provided. Wood is an example for a final ecosystem service which in turn relies on so-called intermediate ecosystem services, such as functioning nutrient cycles in the soil. If ecosystem services are protected in the framework of a PES programme, the indicator should exhibit the benefit or value for the beneficiaries based on the final ecosystem service. In addition, the indicator should be location-specific. If, for example a lower sediment load in the water is the objective, one of the "benefits" for the beneficiary of the ecosystem services is the lower cost of drinking water treatment. In this case, an indicator should be found for the appropriate ecosystem service, such as the reduced sediment load in a certain location. The indicator should be assessed at the location at which the benefit is created.[113]

Moreover, in order to measure the biodiversity, a baseline must be defined. The baseline is the reference value used to determine whether a change has happened in the provision of the ecosystem services. The baseline should not only include the trends of the past, but also take into account future developments and risks.[114] The baseline determines what will be remunerated at a later stage: the conservation of ecosystem services, an increase in ecosystem services or their reduced loss (see Figure 6).[115]

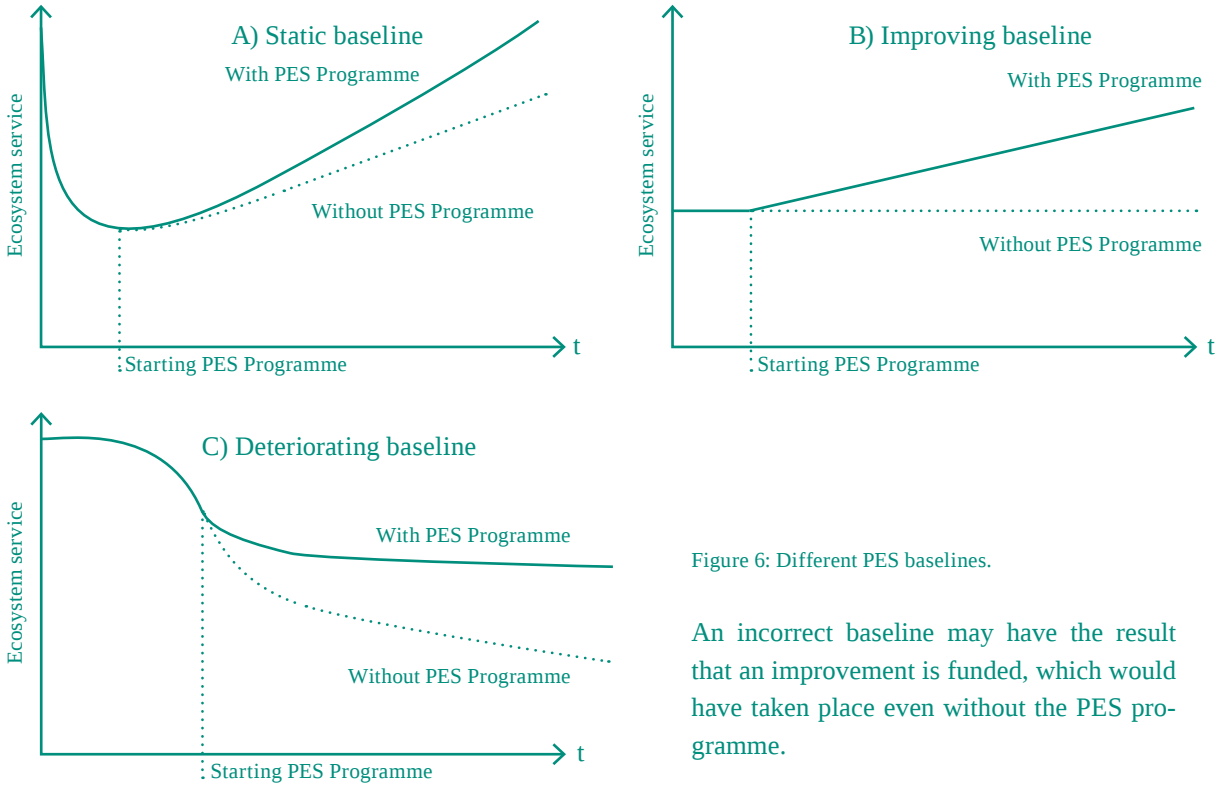

Figure 6: Different PES baselines.

An incorrect baseline may have the result that an improvement is funded, which would have taken place even without the PES programme.

3.3.2 COMBINED SALE OF ECOSYSTEM SERVICES

Instead of only offering one ecosystem service (e.g. CO_2 capture) in a PES programme, it is also possible to bundle and offer multiple ecosystem services (e.g. CO_2 capture and erosion protection). The most important reason for offering multiple ecosystem services in a bundle is that PES programmes which only focus on one ecosystem service run the risk that other ecosystem services are negatively affected.[116] A tree plantation, for example, can store a lot of CO_2, but perhaps it does not have any positive impact on biodiversity, or maybe even a negative one.[117] An advantage of the bundled PES is reducing fixed costs and transaction costs.[118] Also, an ecosystem service for which there is no willingness to pay can be co-financed that way: via the so-called "piggy-backing" method.

3.3.3 MONITORING

To ensure that biodiversity and ecosystem services are preserved by PES programmes, changes in their provision must be measured by means of monitoring. Monitoring can take place on two important levels[119]:

- At the implementation level, monitoring observes whether the land managers implement the agreed management programme (action-based remuneration).
- At the ecosystem level, monitoring assesses whether the programme achieves the desired effect (results-based remuneration).

It depends on the PES programme, at what level the monitoring takes place. Some aspects of biodiversity and ecosystem services are fairly easy to measure.

In a results-based remuneration, the RUPES PWS programme in Indonesia, for example, remunerates a certain degree of sedimentation in the catchment area of a hydroelectric power plant instead of the management measures which are its cause.[120]

RUPES PWS programme in Indonesia

The World Forestry Centre runs the "Rewarding Upland Poor for Environmental Services" (RUPES I) programme in South-East Asia. As part of this programme, several pilot projects examined how to reward the provision of environmental services. As a result, PES programmes were introduced in several regions in Indonesia.

A hydroelectric power plant in the Way Besai watershed in Lampung, Indonesia had to be closed down several times, because the turbines turned more slowly due to the low amount of water and had to be cleaned constantly. The high sedimentation rate resulting from the high erosion upstream was the reason for the contamination of the turbine. The plant operator estimated that 50% of the reservoir was filled with sediment. Turbine contamination caused by erosion cost the hydropower company approx. $307,000 per year and resulted in annual losses of approximately $360,000. In addition, the sedimentation had a negative impact on the downstream flora and fauna.

Due to these reasons, the River Care Programme was implemented in 2007-2010 as well as an additional PES programme in 2008-2010 in which the providers committed to carrying out anti-erosion measures, such as terracing slopes and planting grass strips. These measures were developed jointly with the local community and the success was measured via the concentration of sedimentation. The baseline was determined before the start of the project by means of several measurements of the sedimentation rate. Although the 30% reduction in sedimentation agreed on initially was not achieved, the water operator was satisfied with a 20% reduction and delivered the agreed mini power plant worth about $2,000 to the community.[121]

Another example are the PES programmes in Sweden and Cambodia mentioned above[122] or the agri-environmental measures in Saxony, Germany which will be presented hereafter. In these systems of results-based monitoring, monitoring at the ecosystem level is sufficient. In this case, the provider bears the risk of achieving the desired results[123] and may therefore demand a higher remuneration.[124]

Protection of the European hamster in Saxony, Germany

The European hamster (Cricetus cricetus) lives mainly on farming land. Its population in Western Europe has declined sharply in recent years. Modern agriculture is a prime cause for this decline. Therefore, a project to protect the species was initiated in Saxony (Germany). It offers a range of protective measures to farmers which they can integrate into modern land management practices. The project is based on a cooperation agreement between the Saxon Foundation for Nature and the Environment as the financial manager, the Saxon branch of Birdlife as the partner for public relations and the Landscape Conservation Association Northwest Saxony as a mediator on the ground for the implementation of hamster-friendly measures in current land management practices. Elements from extensive farming are the basis for the measures proposed, as well as crops that are no longer marketable, i.e. crops which can no longer be grown and sold due to their appearance or their growing conditions. The measures include, for example, the cultivation of strips of hamster-friendly plants or the late stubble clearing for grain crops. Since 2010, measures were implemented on 645 hectares of land annually. This corresponds to 30% of the priority habitat. Different means of financing are being used for the implementation of the measures. All annual contracts are being financed via funds by the Saxon Foundation for Nature and the Environment (mainly from donations). In particular, these include late stubble clearing as well as attempts to integrate hamster-friendly measures into the current land management. The Free State of Saxony provides funding for multi-annual measures. This applies in particular to alfalfa or clover strips. In all cases, the financial assistance is only paid as a reimbursement for expenses or losses in order to compensate for yield losses and additional costs. The compensation depends on the measure and the area provided and varies between €10/hectare and the complete compensation for non-harvesting and non-utilisation according to the available contribution margins. For individual areas, for example, the costs for the acquisition of suitable seed mixtures were reimbursed.

For many PES programmes, however, it is difficult or too costly to measure the changes in the ecosystem. One of the reasons for this is that many ecosystem services are produced at one location, but are used at a different one (e.g. clean water).[125] In addition, the high costs of monitoring leave little money to remunerate the provider.[126] In some PES programmes, only those measures contributing to the desired environmental effect are therefore being monitored. The implementation of measures in the framework of the EU agri-environment schemes, for example, is monitored by satellite systems (e.g. compliance with mowing dates). The satellite images show, for example, whether the fields have already been ploughed, they do not show however, whether the local biodiversity has been protected. This causes the disadvantage of not being able to ascertain whether the measure actually has the desired effect at the location at which the ecosystem service is used.[127] Even if the impact of a measure is known in detail, nature can be influenced by external factors (in the positive or negative sense).[128] Another disadvantage is that the beneficiary bears the risk for the non-provision of the ecosystem service.[129] Therefore, it makes sense to monitor the changes of the ecosystem service (the result of the measure) in these PES programmes, in order to verify whether the measures produce the desired effect.

Monitoring allows for the funds available to be employed in a more efficient way: if no additional ecosystem services are provided, there will be no payment. Another disadvantage for the beneficiary is that risk-averse providers may not participate in the PES programme.[130] Ideally, the increased transaction costs will be compensated by increased efficiency.[131] If the monitoring intensity is low, more providers will be remunerated without deliv-

ering the agreed ecosystem services. Latacz-Lohmann and Schilizzi (2005) show that monitoring is necessary: they cite studies that have analysed programmes of agri-environmental measures and show that fraud is a major problem in the United States, United Kingdom and Germany.[132] The optimum monitoring intensity depends on a trade off between the additional costs of monitoring and the ecosystem service output increased by monitoring.[133]

3.3.4 COSTS

The costs of PES programmes result from several cost items. Firstly, these are the costs of the measures that have to be paid to the provider to achieve the desired input or output. Secondly, the provider is refunded for his opportunity costs, i.e. the lost income, which he would have generated, had he cultivated his land differently.[134] This can be illustrated by the following example: if a forest manager places part of his forest area under protection and thus does not use it for the production of timber, he will want to be refunded for the lost revenue. Thirdly, the provider does not only want to be refunded for the actual cost of the measures, but rather make a profit. Fourthly, the beneficiary incurs transaction costs, e.g. for monitoring the provider, negotiating payments in the PES programme, etc. Costs can increase very rapidly, especially if a beneficiary needs to negotiate with many providers, or if certain parties have a very high degree of bargaining power. Kemkes et al. (2010) therefore recommend a so-called monopsony model, in which the companies involved in a PES programme are represented by an organisation. The providers therefore only negotiate with one buyer. This way, transaction costs can be reduced.[135]

The beneficiary can choose to equally remunerate all participants in the PES programme (uniform remuneration), or to adapt the remuneration to the characteristics of the ecosystem service[136] or to the specific opportunity costs of the provider (differential remuneration).

Three more factors influence the provision of the agreed services in addition to increased monitoring: (1) the level of penalty for non-provision of an ecosystem service, (2) the severity of the required management measures, and (3) the amount of the remuneration for ecosystem services.

One way to reduce the monitoring costs incurred by the PES programme operators, is to increase remuneration, which causes the provider to deliver the agreed services more readily so that less monitoring is necessary. This makes sense primarily when monitoring is technically difficult. An alternative solution to reducing monitoring costs for PES programme operators, is to focus monitoring on farmers with high costs. These providers have high implementation costs for a PES programme and therefore gain the least when modifying their land use through a PES programme.[137]

3.3.5 PAYMENT METHODS

The remuneration of the providers of ecosystem services can be carried out in different ways. Payment can be made in cash or in kind. The advantage of cash payments is that recipients can spend the money at their convenience. In contrast, in-kind benefits can have a long-term impact not guaranteed for cash payments, as cash can be spent freely.[138] Moreover, a cash payment can be made in installments or in a one-off payment. If a staggered payment scheme is agreed on, a contractually fixed payment is made to the provider of ecosystem services in addition to a payment depending on the output. The advantage of this approach is that the provider can expect a certain level of compensation. The downside is that the provider is rewarded in any case, even if he does not provide any additional ecosystem service.[139] Last but not least, a combination of action-oriented and results-oriented remuneration is also possible. Action-oriented remuneration pays for implementing (or omitting) certain measures, whereas results-oriented remuneration pays for pre-defined objectives (e.g. the presence of specific indicator species).

3.3.6 INFORMATION ASYMMETRY

The amount of the beneficiary's payment to the provider depends on the latter's costs as well as general costs, such as monitoring costs. However, the beneficiaries do not know what costs the provider incurs: thus, there is an asymmetry of information between beneficiaries and providers. The provider will attempt to get more money than the provision of the ecosystem services actually costs him. In many cases, providers participate in PES programmes who had already planned the environmental measures. This violates the additionality criterion. In Costa Rica, for example, many participants of PES programmes receive remuneration for providing ecosystem

services which they would have also provided without a PES programme.[140] On the other hand, beneficiaries naturally want to pay as little as possible, in order to conserve as many different ecosystem services as possible. For this reason, the beneficiary tries to gather information on the value of the ecosystem service. The two most commonly used methods to obtain information about the actual value of ecosystem services are: collecting information about so-called "costly to fake" signals and using an auction as part of the tender.[141] "Costly to fake" signals are signals related to the opportunity costs of a provider which are difficult to change.[142] The distance to roads or the type of soil are examples of such signals, because they show how much it will cost the farmer to transport his products and how high the productivity is.

The problems described above can also be bypassed by means of a contract auction. In the process, the necessary measures or the desired output are being tendered and sold in an auction to the providers with the lowest cost via so-called blind bids. In doing so, the providers have an incentive to determine the real cost of the measures as otherwise competitors with lower figures would win the contract. If, however, they understate their costs, they will lose money with the measure. However, one disadvantage of auctions is that many bidders have to independently take part in the auction. If the bidders communicate with each other in advance, they can agree on a common minimum price.[143] After the end of the contract period, the conservation of the ecosystem services can be tendered again. Bidders can access information from the first round of bidding, determine the price paid previously, and use the information for the second round in order to adapt their bid. For this reason, it should be avoided to communicate the price that was paid in the first round.[144] The advantage of an auction-based programme is that the beneficiary of ecosystem services (in our case the buyer) can purchase a maximum output of biodiversity at the lowest possible cost and can therefore achieve the cost-efficient distribution of a given budget ("best value for money").

3.3.7 ADDITIONALITY

The additionality aspect also applies to PES systems. For PES programmes, the criterion of conditionality must be met in addition to the additionality criterion. The PES programme should ensure that more ecosystem services are provided than would be provided without it (additionality). This must be the case solely for the reason that this exact provision is being remunerated (conditionality).[145] The additionality aspect demonstrates that agri-environmental schemes violate the additionality criterion and therefore do not belong to PES programmes in the traditional sense. However, this is also true for entrance fees for nature reserves which conflict with this definition, since they had already been in place before. Nevertheless, entrance fees for conservation areas are sometimes considered as being PES programmes.[146]

3.4 DISCUSSION OF PES

The in-depth analysis of PES programmes shows that there are hardly any PES programmes without government participation. The low participation of the private sector is mainly due to the following reasons:

1. Lack of direct demand for ecosystem services in the region
2. The ecosystem services required for the production are available free of charge for companies at the level of quality or quantity desired
3. The cost of launching a PES programme is substantially higher than the value of the required natural capital. This can be the case because there is no substitute or the natural capital is highly relevant for the company
4. It is relatively easy for the company to relocate the ecosystem service or to move its own production to a new location
5. Companies are uncertain if other actors might not negatively impact the natural capital (rights of use and access are insufficiently safeguarded).

First, PES markets are driven by demand: if there is no demand for a specific ecosystem service, it does not make much sense to provide these ecosystem services. As an example, it would be difficult to establish a PWS programme, if there are no beneficiaries of clean water in the region, such as a water bottling company.

Second, a company will only be willing to pay for ecosystem services if it cannot continue to exploit them at the same level of quality and quantity free of charge. A company will not pay for bee pollination, if the pollination takes place free of charge. Only if the number of bees decreases to the extent that pollination would not no longer be guaranteed, e.g. as a result of the use of pesticides, the company would be willing to pay for their conservation.

Thirdly, it is only worthwhile for a company to implement a PES programme if the price of the ecosystem services is high enough, i.e. higher than the implementation and running costs of the programme. The provision of an ecosystem service will fetch a high price if it is rare and needed by the company. The rarity of ecosystem services can be a natural condition or be created artificially, for example, by introducing a cap-and-trade market. If an ecosystem service is the input for one of the most important products of a company (as in the Vittel example), it is of high or even irreplaceable value for the company. The company will therefore be willing to pay a lot for the secure provision of the ecosystem service. The same applies to the Tmatboey project in Cambodia, which depends on the White-shouldered Ibis and the Giant Ibis to attract tourists.

In addition, a company will be willing to pay if an equivalent artificial substitute is more expensive than the natural ecosystem service. The presence of birds in the Tmatboey project, for example, cannot be substituted. Other examples include water treatment plants or the manual pollination of fruit trees, which are more expensive than the conservation of the natural ecosystem services.

Fourth, the local nature of an ecosystem service plays an important role. If an ecosystem service can not be transported, the company would have to relocate in order to benefit from the same ecosystem service. This can be more expensive than paying for the use of ecosystem services at the current location. One example is the use of natural water purification. Likewise, the Ibis species are unique and a special feature of the region. Relocating would not make any sense, because it would no longer be possible to offer the main attraction.

Finally, the company needs a guarantee that the quality or quantity of ecosystem services will not continue to decrease when implementing a PES programme, because this is exactly what it will pay for. The hydropower plant in Indonesia, for example, would not have participated in the PES programme if there had been other actors who had negatively impacted the ecosystem services. These could have been construction companies from outside the region, who contribute to water pollution, e.g. by depositing construction waste into the river. In that case, the payments to the farmers would have been in vain, since they were not solely responsible for the quality of the water, i.e. they were not the only providers of the ecosystem service.

In summary, companies will only pay for ecosystem services if they are relevant to the company. This is usually the case for direct production inputs, such as clean water, pollination, or genetic resources.

Although it would be easy to calculate the number of cases in which PES programmes might be interesting for businesses, there is a surprisingly small number of studies on the effects of the introduction of these programmes. Examples from Mozambique[147] and Vietnam[148] show that a well designed PES programme can protect biodiversity, but often, the results cannot be clearly attributed to the PES programme. This is also documented by the contradictory results in Costa Rica.[149] The main problem is that the effectiveness and cost-efficiency of PES programmes are hard to determine, if there are no control areas.[150]

3.5 RECOMMENDATIONS FOR PES

PES is only interesting for companies under very limited conditions. Therefore, PES systems should rather be viewed as regulating market-based mechanisms. The result of most PES programmes will therefore be the efficient distribution of existing funds for the conservation of biodiversity. The scope of the respective PES programme is crucial in this regard. Even if the PES programme is only used for a more efficient distribution of funds, it is important that PES programmes are only implemented, if the measures exceed the legal requirements. Encouraging individuals to observe the law by means of financial incentives is counterproductive because laws have to be effective even without financial incentives. In addition, it has not yet been fully resolved, whether the public funds could be employed more efficiently than for the organisation and management of a PES programme, e.g. for a better or more comprehensive protection of conservation areas. In order to ensure the adequate involvement of the private sector, the government should at least partly bear the transaction costs incurred at the beginning of a PES programme. However, sufficient checks have to be in place to ensure that the focus is actually on the protection of biodiversity, rather than the state merely subsidising the transaction costs.

It is difficult to convince companies to participate in a PES programme, in particular if it concerns public goods, since it is impossible or almost impossible to exclude others from the use of ecosystem services. These cases illustrate that government programmes achieve the best results if they reward the providers of public goods that serve the general public, e.g. for the protection of endangered species or agri-environmental programmes.

One advantage of PES programmes compared to subsidies is a more efficient use of the funds. If a PES programme is properly designed, there will hardly be any costs after the initial phase besides the payments for the implementation of the measures.[151] Moreover, it is possible to use the funds only on those areas where the greatest benefit can be realised.[152] The cost effectiveness of PES programmes should be monitored over an extended period of time. Although many costs are incurred at the beginning, it is possible to increase the cost-effectiveness, e.g. of monitoring activities, at a later stage.[153]

4 CONCLUSION

Given the CBD (Convention on Biological Diversity) objectives and the EU's demands for the increased involvement of the private sector, biodiversity offsets and habitat banking systems as well as PES programmes are market-based instruments which can complement the funding of biodiversity conservation.

The call for a stronger involvement of the private sector is driven in particular by the fact, that 75% of the threatened and endangered species in the United States are located on private lands.[154] The involvement of the private sector is therefore essential for the protection of biodiversity. However, responsibilities and obligations of governments must not be transferred to the private sector. At best, market-based instruments should provide additional funding for the conservation of biodiversity. Clear legal guidelines and a national regulatory framework are a prerequisite for market-based instruments to be able to contribute to realising biodiversity objectives.

The two market-based instruments presented in this report allow for the generation of private sector funds for the conservation of biodiversity. They are suited to help reaching international, EU and national biodiversity objectives. While doing so, the instruments should not replace state resources, nor should they contribute to the alteration of the regulatory law. They should rather be utilised to complement government funds for the protection of biodiversity. In addition, they contribute to the internalisation of positive and negative externalities.

Companies and to a lesser extent financial institutions should be given more information on the application and design possibilities of market-based instruments. By making use of these, they could further contribute to the future conservation of biodiversity. The participation of the public authorities is indispensable in this regard. NGOs should continue to keep a critical eye on the development and application of these market-based instruments and should get involved in the development of instruments that promote biodiversity. Policymakers create the general conditions for the participation in such markets. Without participation by public authorities or civil society, PES programmes can only be set up under very limited circumstances. It is therefore recommended to use PES as a more efficient distribution mechanism. In many cases, PES programmes are a better option than subsidies. Although the costs of launching the programme can be very high, cost efficiency can be boosted in the medium term.

Germany's system of compensation measures is acknowledged to be among the best worldwide, indicating that a strong regulatory framework is necessary. This also illustrates that a clear and well-defined regulatory policy is vital and that this development should not be left entirely to market forces.

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