Benefits and minimising risks of the 'no net loss initiative'

CEEweb for Biodiversity

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CEEweb for Biodiversity is an international network of non-governmental organizations in Central and Eastern Europe. The mission of the network is the conservation of biodiversity through the promotion of sustainable development.

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Introduction

Global biodiversity loss is the main environmental challenge today besides climate change. The extinction of species is 100-1000 times higher than the background rate, and the natural habitats in most parts of the world continue to decline in extent and integrity. According to the EEA's State of Environment Report from 2010, in the EU-27 habitat changes — including loss, fragmentation and degradation — impose the greatest impacts on species. The report also points out that the success in some areas, such as extending Natura 2000, is overshadowed by the fact that biodiversity protection has not been adequately integrated into sectoral policies. Thus future progress will also largely depend on policy coherence with other sectors, as well as a more integrated ecosystem management approach.

In order to respond to these challenges and to meet global and EU commitments, in May 2011 the European Commission released its new Biodiversity Strategy titled as 'Our life insurance, our natural capital: an EU Biodiversity Strategy to 2020' as a follow-up on the previous '2006 Biodiversity Action Plan'. This Strategy has put forward six targets: to fully implement the EU nature directives, to maintain and restore ecosystems and their services, to mainstream biodiversity conservation in regulation and practice of agriculture, forestry and fisheries, to combat invasive alien species and to, going beyond the EU level, address the global biodiversity loss.

Aiming at maintaining and restoring ecosystems and their services the EU Biodiversity Strategy announces "proposing by 2015 an initiative to ensure there is no net loss of ecosystems and their services (e.g. through compensation or offsetting schemes)". Thus the European Commission set up the Working Group on No Net Loss of Ecosystems and their Services in 2012 to support the European Commission in its preparation of the NNL initiative.

This present study aims to carefully examine the potentials, risks and limitations of compensation and offsetting schemes to meet the objective of the NNL initiative, and to come up with recommendations for future policy discussions.

Analysing development projects in the context of the DPSIR framework

The objective of the NNL initiative is greatly ambitious: "there is no net loss of ecosystems and their services". Even though the definition, scope, operating principles and management and support instruments of the NNL initiative cannot be known yet, we take as a starting point that the ecosystems and their services shall be maintained on EU level, and possibly smaller scales would be included (e.g. biogeographic level, national level) in the further elaboration of the concept.

In line with the definition a wide range of ecosystem services (ESs), which work on several levels from local through regional to global levels shall be taken into account. ESs include supporting, regulating, provisioning and cultural services (table 1.), some of which are hard to identify and even more to quantify in the ecosystems concerned.

Ecosystem functions	Ecosystem processes and components	Ecosystem services (examples)
Supporting and regulating services		
Evolution	Evolutionary processes through reproduction, diversification and inheritance	Adaptation of species to changing circumstances, which is beneficial to humans (e.g. to be able to maintain ecosystem services under changing conditions) Creation of new (sub)species, types and traits beneficial to humans (e.g. development of new crop varieties) Regulation of ecological processes and interactions beneficial to humans (e.g. primary production, decomposition of waste, protection by the immune system)
Climate regulation	Influence of land cover and biologically mediated processes (e.g. dimethylsulfide production, emitting and sequestering greenhouse gases) on climate	Maintenance of a climate (temperature, precipitation, etc.) favourable for human habitation, health, cultivation Prevention of several extreme climatic conditions (e.g. storm, flood, drought, heat)
Gas regulation	Role of ecosystems in biogeochemical cycles (e.g. CO_2/O_2 balance, ozone layer, etc.)	UVb-protection by ozone (preventing diseases) Maintenance of (good) air quality Maintenance of a favourable climate
Water regulation	Role of land cover in regulating runoff and river discharge Role of soil and vegetation in evapotranspiration	Drainage and natural irrigation Medium for transport by humans
Disturbance prevention	Influence of ecosystem structure on dampening environmental disturbances	Storm protection (e.g. by coral reefs) Flood prevention (e.g. by wetlands and forests)
Nutrient regulation	Role of biota in storage and recycling of nutrients (e.g. N, P and S)	Maintenance of productivity on arable land
Soil formation	Weathering of rock, accumulation of organic matter	Maintenance of productivity on arable land Maintenance of healthy soils in ecosystems
Soil retention	Role of vegetation root matrix and soil biota in soil retention	Maintenance of arable land Prevention of damage from erosion/siltation
Habitat function	Suitable living space and reproduction habitat for wild plants, animals, fungi and microorganisms	Maintenance of biological and genetic diversity (e.g. for agriculture, aquaculture, hunting, fishing)
Pollination	Role of biota in movement of floral gametes	Pollination of wild plant species that are vital for other ecosystem services (e.g.

		for provisioning herbs) Pollination of crops
Waste treatment	Role of vegetation and biota in removal or breakdown of xenic nutrients and compounds	Pollution control/detoxification Filtering of dust particles Abatement of noise pollution
Biological control	Population control through trophic-dynamic relations	Control of pests and diseases Reduction of crop damage
Provisioning services		
Primary production	Production of plant biomass with the use of solar energy (autotrophy) Maintenance of trophic relations (e.g. predation, parasitism, decomposition)	Provisioning edible plants, animals and mushrooms Provisioning materials for building and manufacturing (e.g. lumber, skins, flax) Provisioning fuel and energy (e.g. fuel wood, dung, rape) Provisioning fodder and fertilizer (e.g. krill, leaves, litter)
Water regulation, waste treatment	Filtering, retention and storage of fresh water (e.g. in aquifers)	Provisioning water for consumptive use (drinking, irrigation and industrial use)
Evolution	Genetic material and evolution	Provisioning genes for crop resistance to pathogens and pests and for other applications (e.g. in health care)
Evolution, primary production	Variety of (bio)chemical substances in living organisms	Provisioning drugs and pharmaceuticals Provisioning chemical models and tools Provisioning additives for cosmetics and food (e.g. alginates)
Cultural services		
Aesthetic	Attractive landscape features	Enjoyment of scenery
Recreational	Variety in landscapes with (potential) recreational uses	Travel to natural ecosystems for eco-tourism, outdoor sports, etc.
Cultural, inspirational and artistic	Variety in natural features with cultural, inspirational and artistic values	Natural motives in folklore, painting, national symbols, literature, books, film, architecture, advertising, etc. Ornaments (e.g. from wood, shell, pearl, flowers)
Spiritual, historic and religious	Variety in natural features with spiritual historic and religious values	Use of nature for religious or historic purposes (i.e. heritage value of natural ecosystems and features)
Social value	Variety in natural features with influence on social structure	Maintenance of specialized social structures (e.g. hunting-gathering, herding societies, fishing communities)
Scientific and educational	Variety in nature with scientific and educational values	School excursions to nature Scientific research of biodiversity elements and ecosystems

Table 1. Ecosystem services, functions and components and ecosystem services; Source: adapted from R.S. de Groot et al. /Ecological Economics 41 (2002) 393–408

Virtually each ecosystem provides all supporting and regulating services to a varying degree, which also underpin the other types of ecosystem services. This can be most easily illustrated with food production provided by an agricultural ecosystem. Soil formation, soil retention, climate regulation, gas and water regulation, pest control, disturbance prevention and the evolution manifesting in the development of new varieties and habitats clearly provide the basis for agriculture, which eventually uses the provisioning service of food production. The table thus well illustrates the complexity of the functioning of ecosystems, while it is important to realise the difficulty of the quantification of each and every ecosystem services (especially supporting and regulating ecosystem services), which change as a result of human intervention in any ecosystem.

Acknowledging the complexity of ecosystem functioning and the methodological challenges of identifying and quantifying all ecosystem services, how is it possible to ensure the ultimate aim of the NNL initiative, maintaining and enhancing ESs?

Even if each negative effect of a human plan or project cannot be compensated elsewhere resulting in the same level of enhancement of the ESs, it is important to understand how these projects and programmes can impair the wide range of ESs. This is a precondition to be able to develop the right and effective policy responses for maintaining and enhancing ESs on the whole.

For this the DPSIR (drivers-pressures-state-impact-response) framework adopted from the EEA model provides a useful causal framework (figure 1.). It describes the interactions between society and environment. In our analysis the *state* of environment is the biotic condition, i.e. ecosystems, which exert ecosystem services, i.e. ecosystem functions that humans benefit from. *Pressures* exerted by the society change the state of environment. They include the release of substances (emissions), physical and biological agents, the use of natural resources and the use of land. *Drivers* are the social, demographic and economic developments in societies, which manifest themselves in the exerted pressures. Cultural, institutional and structural drivers can be distinguished, where cultural drivers, such as knowledge, values of the society or sectoral/holistic approaches shape the institutional drivers. These institutional drivers include the institutional system of the society both in the public and private sectors, the economic regulatory framework, the EU and state budgets, but also the structure of the education system. The structural drivers are the manifestation of the cultural and institutional drivers on the ground, such as the urban structures, the infrastructure or the production and consumption patterns[1]. *Impacts* on human and ecosystem health (i.e. the decline of ecosystem services) result from the adverse changes of the state of environment. *Responses* are the measures taken to address drivers, pressures, state or impacts by the society.

It is also important to note that each human intervention exerts all three types of environmental pressures: using natural resources, changing the spatial structure and causing pollution at the same time. For instance constructing a biomass thermal plant obviously changes the spatial structure of the ecosystems through demanding land for the construction site, the land use of transport system (road infrastructure) for transporting the construction materials to the site. The construction requires natural resources (oil, concrete, steel, etc.) and causes pollution.

But these are only the pressures emerging during the construction phase; the operation and maintenance also exert long term pressures on the environment, though the relative importance of impacts will change. The biggest impact will clearly appear at the related biomass plantation, with all its spatial aspects (changing the land use on the site, causing fragmentation), natural resource use aspects (using the biomass from the site), and pollution aspects (e.g. use of pesticides, fertilizers on the site, using fuel for machinery, using alien genotypes for the plantation).

[1] Gyulai, I. (2012) A fenntartható fejlődés, http://www.ecolinst.hu/extra/A_fenntarthato_fejlodes_web.pdf

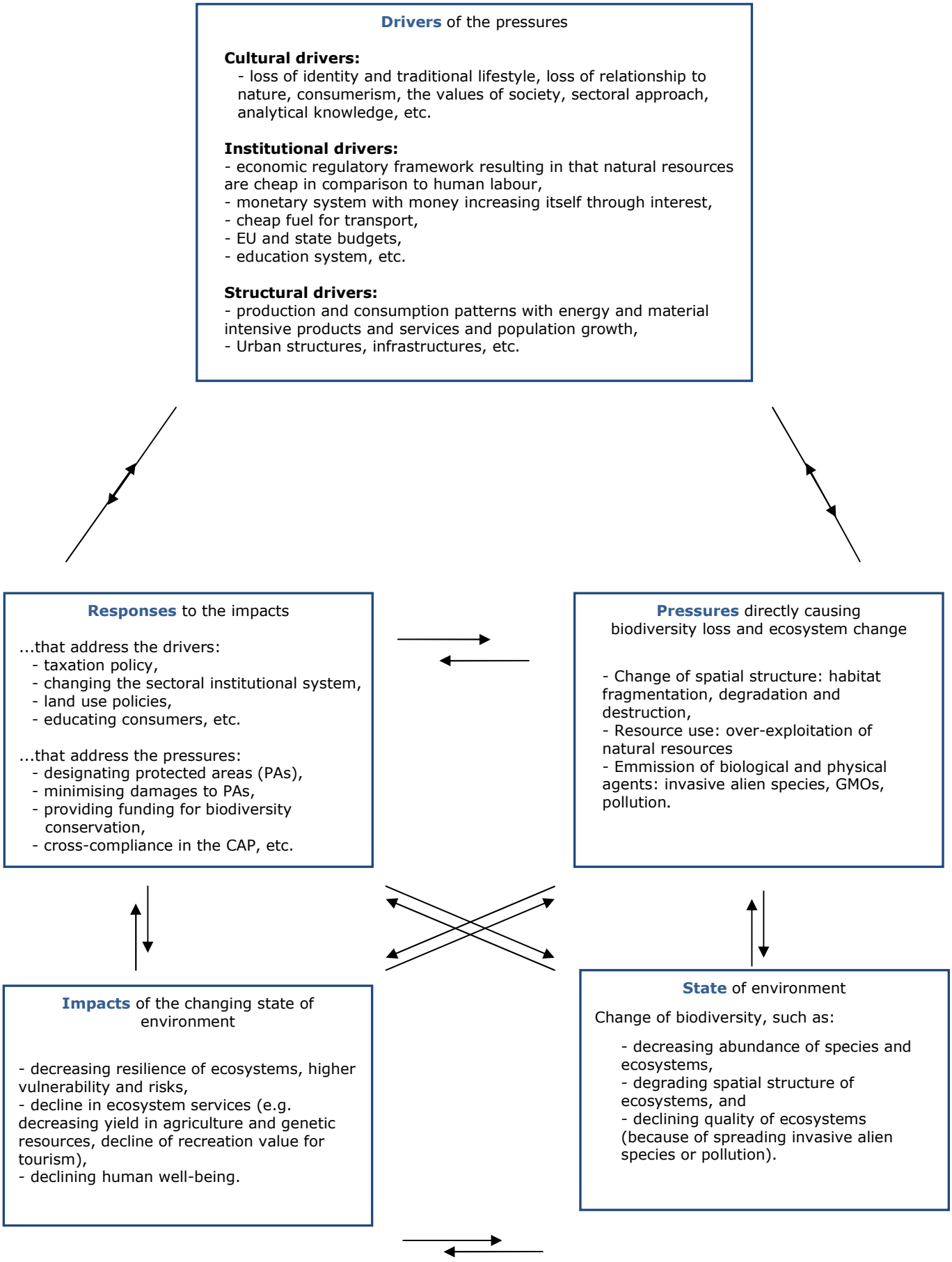

Figure 1. Change of environment in the DPSIR model

If we take the example of a highway project the pressures on the ecosystems can be manifold (table 2.) taking place both on the site of the construction and elsewhere. These direct and indirect effects shall be identified in all phases of the highway construction, including the construction, operation and maintenance.

	Construction	**Operation**	**Maintenance**
Direct effects of the highway project on the site			
Resource use	loss of ecosystems on the track of the constructed highway loss of ecosystems on the track of the construction roads and site along the constructed highway	roadkills	
Change of spatial structure	fragmentation of habitats, isolation of populations	fragmentation of habitats, isolation of populations	
Emission of biological and physical agents	mission including carbon-dioxide, carbon monoxide, heavy metals by the construction vehicles noise spreading of IASs as a result of new and increased transport routes	emission including carbon-dioxide, carbon monoxide, heavy metals by the vehicles noise spreading of IASs as a result of new and increased transport routes	emission including carbon-dioxide, carbon monoxide, heavy metals by the construction vehicles noise spreading of IASs as a result of new and increased transport routes
Indirect effects of the highway project exerted elsewhere			
Resource use	mining sand, gravel or stone for making asphalt concrete oil production for making asphalt concrete oil production for use by construction vehicles	oil production for making fuel increased environmental pressure including resource use as a result of greater access to remote areas through the	mining sand, gravel or stone for making asphalt concrete oil production for making asphalt concrete oil production for use by construction vehicles

		new highway	
Change of spatial structure	degradation and fragmentation of ecosystems as a result of mining and oil production	increased environmental pressure including ecosystem degradation and fragmentation as a result of greater access to remote areas through the new highway	degradation and fragmentation of ecosystems as a result of mining and oil production
Pollution	pollution from oil production, sand, gravel and stone mining	increased environmental pressure including pollution as a result of greater access to remote areas through the new highway increased emission of GHGs, pollutants and noise as a result of increased mobility induced by the new highway	pollution from oil production, sand, gravel and stone mining dumping of waste from the reconstruction work

Table 2. Direct and indirect effects of a highway project during construction, operation and maintenance

This table only includes the most visible pressures directly and indirectly linked to a highway project, but a deeper analysis would reveal additional impacts. For instance there are also environmental pressures linked to the use of construction vehicles in the form resource use (resource need of producing the construction vehicles, including steel, oil, etc.), change of spatial structure (building factories to produce construction vehicles and roads to transport them), pollution (from the production itself). These pressures can be significant on national and EU level, even if they are hard to quantify for the specific construction projects.

An overview of offsetting and compensation schemes in the EU and the US

The biodiversity market is gradually growing worldwide, with dozens of offset and compensation schemes working and being developed in all regions of the world.

According to a global survey in the project Ecosystem Marketplace[2] in 2011, 45 compensatory

[2] Source of information and data about the global and US offset programmes unless otherwise stated:

Madsen, Becca, Carroll, Nathaniel, Moore Brands, Kelly (2010) State of Biodiversity Markets Report: Offset and Compensation Programs Worldwide. Available at: http://www.ecosystemmarketplace.com/documents/acrobat/sbdmr.pdf

mitigation programmes operated around the world, ranging from rigorous and measurable biodiversity offsets to less direct efforts to compensate for impacts through financial donations and land protection. Each active offset program included numerous individual offset sites, amounting to over 1,100 mitigation banks worldwide. In addition there were another 27 programmes in various stages of development or investigation.

In 2011 the global annual market size was $2.4-$4.0 billion at minimum, though this could be an underestimation, as 80% of these programs are not transparent enough to estimate their market size. And the conservation impact of this market included at least 187,000 hectares of land under some sort of conservation management or permanent legal protection per year.

Definitions of compensatory instruments (Source: Ecosystem Marketplace)

One-off offset – 'do-it-yourself' offsetting conducted by the developer or a subcontractor.

Compensation Fund – a third-party mechanism that collects and administers fees from developers to offset their impacts to biodiversity. The money may go directly towards compensating biodiversity loss, or to more indirect biodiversity-related projects (i.e. funding protected area management, research).

Mitigation Bank ("bank")–a site, or suite of sites, where resources (e.g., wetlands, streams, habitat, species) are restored, established, enhanced and/or preserved for the purpose of providing compensatory mitigation for impacts. In general, a mitigation bank sells compensatory mitigation credits to developers whose obligation to provide compensatory mitigation is then transferred to the mitigation bank sponsor.

Well-developed programmes exist in North America, particularly the US wetland and species compensation programmes and Canada's fish habitat compensation programme. In total there are 14 active programmes and five in development in this region, where also the most offset credit banks exist in the world. The North American market involves a minimum of $1.5-$2.5 billion in compensation payments per annum.

Wetland mitigation started in the US already in the early 1970s and more sophisticated mitigation credit banking systems followed in the 1980s and 1990s. The US mitigation market allows all three traditional compensation instruments, i.e. compensation funds, one-off offsets, and mitigation banking (see box), although recent regulation favours credit banking. The market is dominated by the national wetland and species mitigation programmes, though several smaller offset programmes also exist.

Looking more closely at the national wetland and stream mitigation programme, several regional differences can be found in the implementation. The applied instruments, the actors realising the mitigation (developer, state, third party), the methods of measuring impacts and offsets (e.g. acreage, a functional assessment method, a combination of acreage and functional assessment, or some measure of functionality combined with best professional judgment), and level of enforcement vary greatly across the US.

At the same time it is required to preserve offsets 'in perpetuity' via a conservation easement agreement, which basically restricts the use of land for conservation purposes on the title that is legally tied to the piece of property. In addition, offsets are required to have funding set aside for long-term management. New regulation also gives preference to larger, landscape-scale offsets created before the impact, which can largely or partly eliminate the time lag between the destruction of the wetland and the offset – namely it may take decades until the wetland is fully restored and can deliver the same ecosystem services. On the other hand the preference of larger offset sites might also lead to the loss of lot of unique, small streams in a special spatial structure to a larger, homogenous wetland further away.

The new rules also give a stated preference hierarchy of offsets, where mitigation banks, i.e. land approved by regulators to sell mitigation credits for developers are the first preference. The

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Madsen, Becca, Nathaniel Carroll, Daniel Kandy, and Genevieve Bennett (2011) Update: State of Biodiversity Markets. Washington, DC: Forest Trends, 2011. Available at: http://www.ecosystemmarketplace.com/reports/2011_update_sbdm

second preference is In-Lieu Fee programmes, where the developer pays a fee into a compensation fund programme instead of creating their own offset or buying a credit. These programmes are run by government or non-profit organizations that use the funds to undertake offset activities. Today the last preference by the regulation is the do-it-yourself mitigation realised by the developer, which has been the most widespread practice since the beginning (in 2010 still 67% of offsetting was realised on national level this way in the wetland programme, followed by mitigation banks (26%) and In-Lieu Fee programmes (7%)).

From ecological point of view it is also an important characteristic of the programme that national regulations also give a preference for restoration and enhancement to reflect the inherent ecological uncertainty of wetland creation and the 'no net loss' policy. As 2008 data show, the majority of credit creation was realised through restoration (42%), followed by preservation (22%), enhancement (19%) and establishment (17%) in offsets realised by the developers. The possibility of allowing preservation as a means of offsetting threatens the 'no net loss' idea, even if in many cases restoration and preservation is combined, or multiple acreage of wetland is preserved than what is lost[3].

Biodiversity market is much less developed in Europe. Only Germany has a well-developed system for offsetting and mitigation, though there is a growing number of countries, like the Uk and Sweden, where initial steps have been taken for developing such national regulations.

The German Impact Mitigation Regulations (IMR) is based on the Federal Nature Conservation Act in 1976, setting a comprehensive framework for compensation. The IMR aims to prevent negative impacts and compensate unavoidable ones following a strict mitigation hierarchy[4] (figure 2.). The scope of the regulation is broad, putting not only valuable species and conservation areas, but the entire ecosystem and natural scenery into focus, applied to the total area, independent of its value in terms of biological diversity[5]. Due to this broad scope, most actions that are subject to authorisation are obliged to carry out an assessment (see figure 2.), regardless of the size of the action and whether a particularly valuable area is affected or not[6].

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[3] Leonard Shabman and Paul Scodari (December 2004), Past, Present, and Future of Wetlands Credit Sales, Discussion Paper 04–48

[4] Darbi, M.; Ohlenburg, H.; Herberg, A.; Wende, W., Skambracks, D. & Herbert, M. (2009), International Approaches to Compensation for Impacts on Biological Diversity. Final Report

[5] Peters W.; Siewert, W.; Szaramowicz, M. (2001): Eingriffsfolgenbewältigung im internationalen Vergleich. Kurzfassung des Endberichts für das F+E Vorhaben. Bundesamt für Naturschutz. 29 p.

[6] Peters, W.; Siewert, W.; Szaramowicz, M. (2002): Folgenbewältigung von Eingriffen im internationalen Vergleich. Endbericht zum F+E Vorhaben. Bundesamt für Naturschutz. BfN -Skripten 2002. 220p.

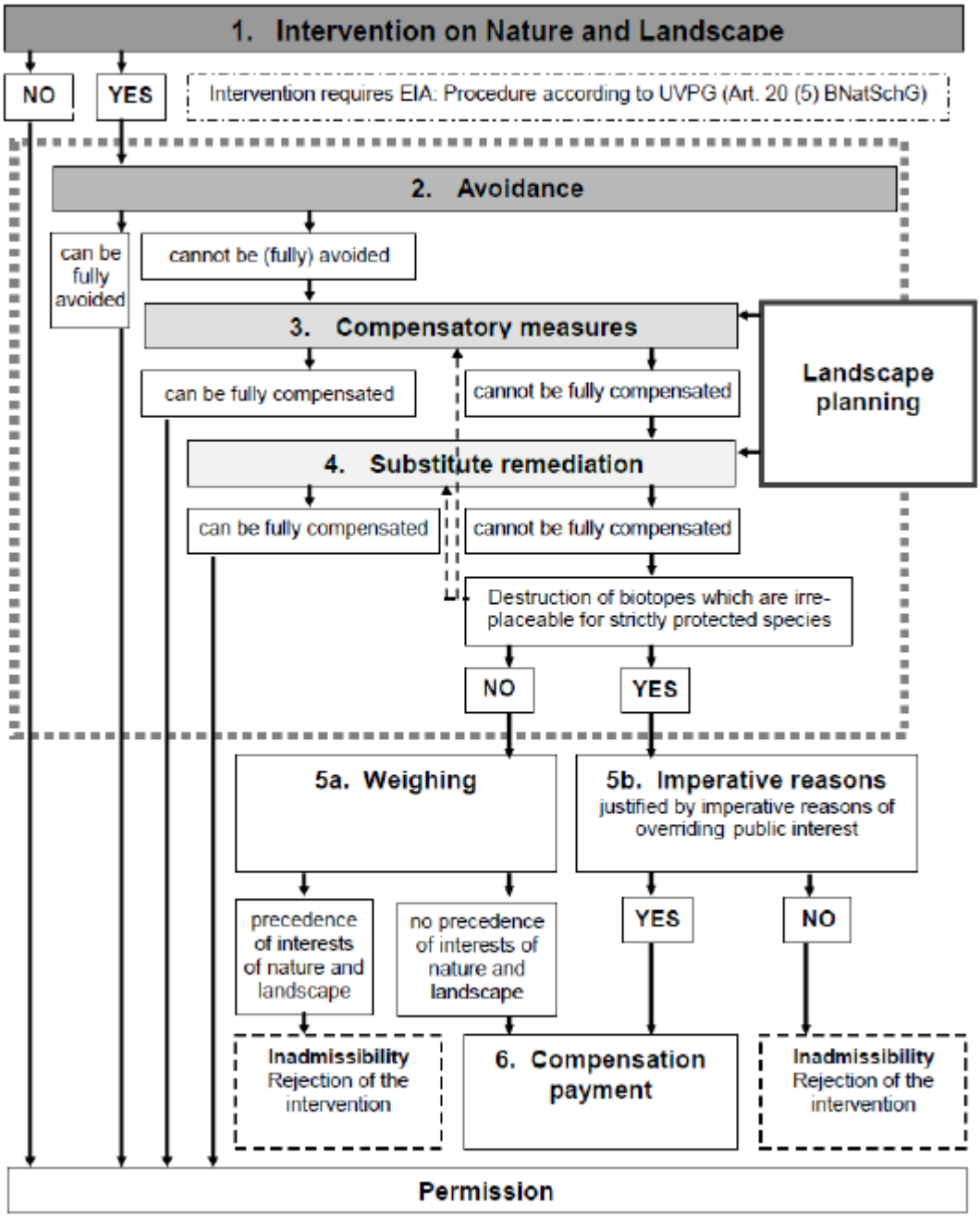

Figure 2. Steps of the German IMR (Marianne Darbi and Christian Tausch (2009), Loss-Gain calculations in German Impact Mitigation Regulation, http://www2.ioer.de/recherche/pdf/2010_darbi_loss-gain_calculations_in_imr.pdf)

In a preventive approach the developer is obliged to avoid any negative impact on the nature and landscape, and if impacts are unavoidable, they have to be entirely compensated through nature conservation and landscape management measures (principle of full conservation). If they cannot be fully compensated by such measures, then substitute remediation is possible, when not necessarily the same functions are restored in the affected landscape, and which might have only a loose spatial and functional relation to the impact area[7]. Thus the IMR prefers measures of similar type (in kind) over measures of similar value (out of kind). However, it is also possible that compensation payment is made in case the impairment of nature and

[7] Louis, H. W. (2004): Rechtliche Grundlagen der räumlichen, funktionalen und zeitlichen Entkoppelung von Eingriff und Kompensation (Flächenpool und Ökokonto). In: Natur und Recht, No. 26, 11/2004, p. 714-719.

landscape cannot be compensated, but the project can still go on because of the imperative reason of overriding public interest.

Even though the general framework is established at federal level, there are no legal provisions (laws, ordinances etc.) that specify how to assess the initial state of the area concerned and the likely impacts of the intervention, and how to determine the appropriate compensation measures under the IMR. Thus several evaluation methods taking different approaches exist to determine the compensation measures. These varying approaches include qualitative descriptive (extensive) approach, the so-called "verbal argumentative" method (which builds on a case-by-case expert judgement taking into consideration the specific affected natural assets, functions or biotopes and the possible interactions) and more quantitative more or less formalised „biotope valuation procedures", approaches using compensation area coefficients and cost-of-restoration approaches[8].

In order to aid compensation measures, federal states may establish pools of areas or measures. According to a nationwide survey pools of areas (Flächenpool) are widely used in Germany, with several hundred pools, which are used both by public authorities and private project[9].

The potentials of offsetting and compensations schemes

International experiences show that there is substantial potential in the introduction of the 'no net loss' concept and offsetting and compensation schemes for the conservation of biodiversity and the maintenance and enhancement of ecosystem services for various reasons.

The approach of offsetting and compensation schemes in order to realise 'no net loss' of ecosystems and their services apparently has the potential to **better balance** human activities and development with the functioning of ecosystems and maintenance of ESs, especially if a strict mitigation hierarchy is taken fully into account in the implementation.

It is also appealing that dependent on the balancing of the unavoidable negative impacts and the offsetting measures, **"net gain" of ecosystems and ecosystem services** can be achieved in the landscape. This means that ESs can be more enhanced than what is unavoidably lost in the given landscape.

However, in order to have an overall picture about the potentials and benefits of compensation and mitigation schemes, it is worth analysing the impacts on all the elements of the DPSIR model. This means how the *state*, *pressures*, *drivers*, *impacts* and *responses* change as a result of a comprehensive compensation and offsetting scheme. Specifically the scheme is expected to reduce environmental pressures and the underlying drivers in order to protect and restore the state of environment (ecosystems) and reduce the negative impacts (decline of ecosystem services). For this analysis a general baseline is necessary, against which the added benefit of such a comprehensive scheme can be examined. This baseline includes general nature conservation and biodiversity integration measures and tools that are widespread all over

[8] Darbi, M., Tausch, C. (2010) Loss-Gain calculations in German Impact Mitigation Regulation

[9] Böhme, C.; Bruns, E.; Bunzel, A.; Herberg, A.; Köppel, J. (2005): Flächen-und Maßnahmenpools in Deutschland. Ergebnisse aus dem F+E Vorhaben 802 82 120 "Naturschutzfachliches Flächenmanagement als Beitrag für eine nachhaltige Flächenhaushaltspolitik" des Bundesamtes für Naturschutz. Bundesamt für Naturschutz (ed.). "Naturschutz und Biologische Vielfalt" 6. -Bonn -Bad Godesberg.

Europe, such as Strategic Environmental Assessments (SEAs), Environmental Impact Assessments (EIAs), protection of species and sites of great value, including (strictly) protected areas, where no human activities and development projects can take place, or only under strict conditions. The potential benefits of a comprehensive compensation and offsetting scheme listed below is of course hypothetical, whether these (or other) benefits are reaped through a future scheme greatly depends on the characteristics of the scheme.

Cultural drivers

The introduction of such a comprehensive scheme contributes to changing the values of people, as it **stresses the importance of ecosystems and ESs**, especially if a strict mitigation hierarchy is applied through the whole process. This would mean that no ecosystems can be lost without any consequence on the ground (as opposed to the current situation in most countries).

This scheme also reinforces the application of the 'polluter pays principle', as the developer needs to finance the related measures instead of the whole society.

Institutional drivers

A comprehensive compensation and offsetting scheme can increase financial, institutional and human capacities alike for biodiversity conservation, where ecosystem services are in the focus.

As a result of the increased demand for compensation measures (including assessment, planning and implementation), higher number of experts get involved in nature conservation activities resulting in the **increase of human resources** for nature conservation.

This might also have implications for the **institutional system** (e.g. building up know-how, educating experts about assessment or restoration, developing effective institutional system for the authorisation, planning and implementation work, employing environmental experts at companies).

A comprehensive scheme could also lead to greater sectoral integration e.g. through the development of a **comprehensive strategy on green infrastructure/ecological network**. Such a strategy could potentially be used as the basis to develop mitigation banks and could also have the potential to influence other sectoral plans.

Importantly this scheme is also able to channel substantial **additional (and first of all) private funds** into enhancing ecosystem services.

Structural drivers

Even from the international experiences it is hard to see how the *structural drivers* behind biodiversity loss (urban structures, road, energy infrastructures, etc.) would change to the better from environmental point of view as a result of compensation and offsetting schemes – compared to the baseline.

Environmental pressures

It is also hard to see how the environmental *pressures* (pollution, degradation of spatial structure, use of natural resources) would decrease on the whole as a result of compensation and offsetting schemes – compared to the baseline. This could only occur, if the mitigation hierarchy

would be much more seriously considered in the comprehensive new scheme than today in the planning and implementation of projects with SEA and EIA tools applied. This would also require very importantly a much greater emphasis on avoidance of negative impacts and consideration of alternatives. However, the introduction of a comprehensive scheme itself does not seem to guarantee this.

The environmental pressures could decrease though at the offsetting sites, where due to restoration/ recreation the intensity of land use decreases. This can happen for instance, if **mitigation banks take over areas that are in human use**.

State

Certainly the state of environment would significantly improve at numerous sites as a result of a comprehensive compensation scheme, being a main aim of the policy. The level of improvement could vary depending on the regulation, i.e. whether recreation and/or restoration are allowed (though it needs to be mentioned here that preservation is also used a possible compensation measure in some international examples, where improvement is not achieved per se).

Impact

The recreated/restored ecosystems would provide a wide range of additional ecosystem services for the society, having a positive *impact* on humans which shall offset the lost ecosystem services at the project site.

Responses

The comprehensive compensation and offsetting scheme itself is a *response* in the DPSIR model. It also has the potential to improve other responses in nature conservation, such as through the development of a **comprehensive strategy on green infrastructure/ecological network**, though most European states already have an ecological network established.

The risks of offsetting and compensations schemes

In order to be able to assess the risks of a comprehensive compensation and offsetting scheme, it is important to understand the **environment as a system**. The environment can be described with three attributes, such as the abundance of the (biotic and abiotic) natural resources, the quality of the environment, and the spatial structure of the elements. These three aspects cannot be separated from one another, and they jointly determine the state of environment.

The NNL concept aims to tackle the whole environment, as it aims at maintaining and enhancing ESs, which are in turn ecosystem processes (that benefit humans). However, it is important to see that ecosystem functions cannot be considered separately from any of the three attributes of the environment. Thus for an effective implementation of the NNL concept all of them need to be taken into account. Nevertheless, any comprehensive compensation and offsetting scheme (at least as it is defined today) focuses on one attribute of the environment, namely the abundance of natural resources, specifically ecosystems.

From the concept itself it is not clear how **the spatial structure** would be taken into account,

even if theoretically the concept could be expanded in this regard. However, the international examples have not shown good, working examples of a well functioning ecological network / green infrastructure, which is laid as the absolute basis of the compensation and offsetting scheme. In such an ecologically well founded scheme, the natural system would determine the coherent, ecologically representative network of (semi-)natural areas, where most areas would be no-go areas for most development projects for the sake of ecosystem functioning. Namely it is not possible that manmade infrastructures comprise a coherent system on various scales (e.g. urban structures connected with road infrastructure), while ecosystems are reduced to islands with limited connection to other ones. At first sight the NNL initiative could contribute to establishing a well working green infrastructure/ecological network, but it shall be kept in mind that its main aim is not that. Just on the contrary, it shall make human development projects more environmentally friendly and thus acceptable for the society. In this way the compensation scheme is introduced in a reactive approach, where the environmental priorities fall behind economic ones to realise developments. Thus it is questionable if compensation schemes can greatly contribute to a coherent network of ecosystems, where intensively used areas appear rather as islands.

But the spatial structure is not the only aspect, where the NNL concept can be compromised in the end. It is also not clear how **the natural resource use on general and pollution** can be taken into account, which can be both direct and indirect effects of the human activities leading to the loss of ecosystems and their services (see examples in table 2.). Clearly everything is linked to everything in the nexus of ecological processes and human development projects, but only some (the most significant) changes, and virtually only those, which directly appear on the site can be assessed and compensated in such schemes. The smaller, meaning separately smaller, but together significant, changes will not be compensated and will thus be cumulated at the end. Also the indirect effects that appear off site (see examples in table 2.) cannot be tackled within such a scheme.

It is no doubt that the compensation and offsetting schemes can compensate for some of the negative effects of the programmes and projects within the scope of the scheme. But these programmes and projects have several other impacts, which cannot be calculated and compensated in the scheme. For instance it is not taken into account how much a highway project contributes to climate change through increased road traffic, or to the loss of once remote ecosystems, which are opened up for development as a result.

From the point of view of the DPSIR framework the compensation scheme basically helps reducing one type of environmental pressure (the use of ecosystems), through influencing some of the underlying drivers and improving the state of environment at some sites, while leaving the vast majority of the drivers untouched. This results in, however, that these drivers can and will even increase, and the environmental pressure is shifted elsewhere. An example for this phenomenon is the case of biomass production, when the problem of pollution (the emission of carbon-dioxide from fossil fuels leading to climate change) was meant to be (partly) addressed through the use of biomass instead. However, the underlying driver that could not be tackled with the new fuel either was the ever increasing need for energy. This increasing need puts greater and greater pressure on the environment, which is manifested in the take up of land instead of pollution in the case of biomass. After all if there is a (seemingly) environmentally friendly source of energy then why to curb its greater and greater use? But as it is more and more recognised by now, the use of biomass puts an increasing pressure on ecosystems and their spatial structure, defined today as indirect land use changes.

Thus clearly another aspect of nature protection measures in general and also of compensation and offsetting schemes is that they close some negative feedback loops, which could give the opportunity to address the ultimate drivers behind the environmentally harmful activities. In the case of excessive fossil fuel use the negative feedback of pollution, and the resulting climate change gives the opportunity to the society to examine and change the ultimate driver behind: the excessive and increasing need for energy. No matter if this need is satisfied with the use of fossil fuels or biomass, both of them goes together an increasing environmental pressure either in the form of pollution or land use. However, if the on site, visible negative impacts are eliminated temporarily and shifted in space (to other continent) or time (through time lags of

negative impacts as in the case of many environmental changes), the drivers are easily remain unaddressed and continue to worsen.

That is why it is necessary to analyse the multiple level of drivers behind the environmentally harmful activities and scrutinize how they would change as a result of the planned responses. Below is a list of some of the possible negative changes as a result of a comprehensive compensation and offsetting scheme.

Cultural drivers

A comprehensive compensation and offsetting scheme can give the message to developers and the society as a whole that with enough financial and human resources ecosystems and their services can be recreated and enhanced, thus no strong protection is substantiated. Even if degradation of environment occurs today, subsequent corrective responses are still possible in the near or far future, when greater knowledge and advanced technology make this possible. Thus there is a risk that instead of preventive approach **corrective approach** gets even more prevailing in nature conservation and also in the case of other environmental issues (e.g. climate change).

This corrective approach also makes the concept of economic growth, even if it depends on growing resource and land use, more acceptable. A comprehensive compensation scheme could thus further **greenwash the economic growth agenda**, even if it contributes to environmental degradation through increasing environmental pressures (natural resource use, degradation of spatial structure and pollution).

Institutional drivers

Even if this is not the aim of such a comprehensive scheme, there is some risk that with its introduction a **lower protection level for protected areas and Natura 2000 sites** is realised in practice in Europe. While the Habitats Directive already requires compensation measures if damage to Natura 2000 is unavoidable for any plans or projects, there are no alternatives, and the case is qualified for imperative reasons for overriding public interest (IROPI), it is a question how a comprehensive scheme would relate to the existing EU legislation and the accompanying European Commission guidance documents. This is especially important in an environment where commercial actors have been pushing for less stringent legislation and interpretation. The risk is even higher for protected areas outside Natura 2000 sites though, where no EU rules exist for compensation measures. In this case it depends on each EU member state if they prevent any weakening of the national nature conservation law as a result of a new comprehensive compensation scheme.

As for the limited financial and human resources for nature conservation, a new scheme could not only provide opportunities, but it could also mean a **threat to using the existing resources most effectively**. Depending on the setup, new compensation schemes could also divert existing resources to corrective measures, leaving even less for preventive measures, research, environmental education, etc.

Structural drivers

As a structural driver behind biodiversity loss, **polarisation of land use** has been already taking place for decades in Europe. On one hand this means introducing more and more intensive land use practices in many areas, such as in agricultural fields or through the development of infrastructure and urbanisation. On the other hand the establishment of the Natura 2000 network, the use of agri-environmental schemes or restoration of ecosystems

reduce the pressure on the environment in other areas. These two processes in parallel lead to the polarisation of the landscape, which can further accelerate if development plans and projects are realised at a growing rate. There is a risk that a comprehensive compensation scheme could also contribute to this, if it makes development more acceptable and efficient – after all seemingly there is no net loss of ecosystems at the end. As long as economic growth is the final aim, which overrules everything else (being a cultural and institutional driver behind biodiversity loss), and there is no absolute limit to the use of natural resources and land at the same time, this is expected to happen. This expedited establishment of human infrastructures puts additional pressure on the environment also in the form of pollution and resource use, even if green infrastructure is created parallel through the compensation scheme.

Another risk associated with improved nature conservation policies that put additional financial or administrative burden on developers is that these activities are **moved to other countries** with less stringent regulations. This simply shifts environmental pressures in space, as the demand for those products or services connected with harmful activities remain the same in the economy.

Environmental pressures

As described above, a seemingly "greener" economic growth concept (cultural driver), which is manifested in economic development strategies, sectoral targets, plans and projects (institutional drivers) and then materialised in human infrastructures (structural drivers) lead to measurable environmental pressures on site. Through this mechanism a comprehensive compensation scheme could contribute to **increased natural resource**, as it is not effectively and horizontally regulated in the economy today: if there is economic growth, there is also natural resource use growth on the whole. (The correlation with pollution might be opposite in some cases, though it could be just concealed by the exportation of dirty technologies). Consequently there is a risk that a comprehensive compensation and offsetting scheme indirectly contributes to the increase of the use of natural resources (and partly pollution).

The risks of a comprehensive offsetting scheme related to the third type of environmental pressures, the use of land and thus the degradation of spatial structure are hard to assess. As mentioned above, the **polarisation of land use** is expected to accelerate, which itself has a negative impact on the spatial structure through reducing landscape permeability on the large scale. Even if the compensation measures ensure that the absolute coverage of (semi-)natural ecosystems do not reduce (it is hard to measure, if the same could be true for ecosystem services as well), if there is no absolute limit to the conversion of (semi-)natural areas for human purposes, it is hard to imagine that the spatial structure could continuously improve in an accelerated development scheme.

The overview of environmental pressures above relate to the economies, where the compensation scheme is introduced. However, in the globalised economy of today it is also worth considering how the environmental pressures are influenced elsewhere. As it could be seen in table 2 above, some of the environmental pressures are exerted **off site**, which could be geographically far away from the project sites, in many cases on other continents with different environmental standards in place. Thus accelerated development projects can increase environmental pressures on other continents as well, of course influencing ecosystems and ecosystem services at faraway locations and on various scales too. These pressures can also lead to ecosystem degradation, along with increased natural resource use and pollution.

The above mentioned increased risks are related to the possible acceleration of development plans and projects, compared to the baseline when nature conservation considerations (together with other factors) curb human activities. But there is another aspect of development plans and projects, which can put additional pressure on the environment than what is calculated into the compensation measures. Namely it is greatly difficult to calculate the environmental pressures that are generated during the **operation and maintenance phases** of a project (see examples in table 2). These pressures primarily take the form of natural resource use and

pollution, but ecosystem degradation and the negative influence of spatial structure is also possible (for instance the maintenance work of a wind farm could also affect the ecosystem where it is situated).

State

Looking at the risks of increasing environmental pressures, the state of the environment could also continue to deteriorate on regional, European and global scales, even if improvements are achieved on local scale as a result of the compensation measures and no net loss of ecosystems is realised on regional level. However, it must be kept in mind that local ecosystems are of course also influenced by the **regional and global environmental conditions**, such as the changing climate. Thus if the compensation scheme indirectly contributes to increasing environmental pressures off site within or outside the country or the continent, that could have negative impact on the restored ecosystems as well.

When it comes to compensation measures and the planning of policies, it is also important to take into account, when it is reasonable to apply compensation scheme and which ecosystems shall be **no go areas** for developments and attempts for restoration because of their ecological characteristics. There could be a risk that complex, long evolved ecosystems that cannot be ecologically restored could be lost if compensation scheme is introduced with less stringent regulations. In this case there is a general threat to biodiversity, as the diversity of ecosystems is expected to decrease along with the decline of certain ecosystem services.

But beyond the difficulties of restoration of certain ecosystems, another challenge that influences the state of ecosystems at the end is the need of management after restoration and the **future of the restoration site**. A key factor in the success of compensation measures is the time line of the actions that could ensure that the restored ecosystem becomes resilient and self-sustaining without future human interventions. Thus if the restored ecosystem is abandoned too early for instance because of the ill-defined responsibility or lack of funds, there is a risk that even though the restoration of sites has been made in order to achieve the no net loss of ecosystems, the integrity and health of the restored ecosystem can decline by time. In this case the 'no net loss' target would not be achieved in the end. Also it would be the inefficient use of financial and human resources if the restored/recreated ecosystems are lost again in future development projects. Thus the compensation scheme could risk the efficient and effective management of nature conservation, if the future preservation of the restored/recreated ecosystems is not ensured.

There are several challenges in determining the initial state of the area for development and the likely impacts of the intervention, as well as the appropriate compensation measures to offset the negative impacts. There is a risk that **inconsistent methodologies and unclear responsibilities** of the compensation tasks can threaten the ecological outcomes and 'no net loss' of ecosystems and their services.

It is also worth mentioning that the compensation measures also have natural resource need. Even if ecosystem restoration involves a great amount of typically human labour intensive activities, the whole process requires some natural resources as well (through direct energy use, the use of machinery, transportation, the needs of the associated office work, etc.). If this **natural resource use and pollution of the nature conservation activities** also adds to the environmental pressures (instead of substituting more harmful activities with these less harmful activities) there is a risk that their positive impact on the state of environment is reduced on the whole.

Impact

The above described risks of declining state of environment naturally affect ecosystem services as well, with a risk of negative *impact* on humans.

Responses

When assessing the risks of a nature conservation policy in terms of *responses*, the main questions are the effectiveness of the planned policy, and how it could influence the development of other ones.

Recognising the potentials and risks of a comprehensive compensation scheme, it can be expected that it does not lay the ground for holistic land use policy because it seemingly achieves its main target: the no net loss of ecosystems and their services. Thus there is a risk that the scheme contributes to **postponing the development of a holistic land use policy**, which aims to shift land use practices towards sustainable use on the whole territory while stopping landscape polarisation.

The limitations of offsetting and compensations schemes

As we can see there are numerous possibilities and risks involved in comprehensive offsetting and compensation schemes. The careful planning of the policy can ensure that these potentials are fully exploited, while it can also reduce some of the risks of increased drivers and environmental pressures.

However, the approach of compensation schemes entails some limitations, which cannot be compensated within the same framework, no matter how careful policy planning is realised.

The first limitation is that the compensation scheme necessarily contributes to **landscape polarisation**, as it allows the intensification of land use and the restoration/recreation of ecosystems at the same time. Landscape polarisation can only be reversed through applying a different approach, where the aim is the same for all land use practices, namely to reduce intensity, no matter if the land is used for urban, transport, agricultural or other purposes. Within such a holistic land use policy a comprehensive compensation scheme can be a valuable complementary, but not the main tool to ensure the no net loss of ecosystems and their services.

The other limitation of the compensation scheme is that it **only concerns ecosystem use**, even though the health of ecosystems is influenced by the other environmental pressures as well, such as natural resource use and pollution. Thus even if it was able to tackle land use questions effectively, it cannot be expected to be able to ensure that ecosystem health and ecosystem services are maintained by this policy alone – effective natural resource use policy and pollution control are equally important for this. It means that land use, resource use and pollution shall be tackled at the same time in order to limit environmental pressures and ensure no net loss. Only this could also avoid the shifting of pressures among the three attributes of the environment.

Conclusions

The potentials and risks of a comprehensive compensation scheme are both numerous, and how they are balanced eventually in the implementation greatly depends on the characteristics of the compensation policy and, maybe even more, on other policies determining economic development, resource and land use.

Much was said above about the risk that economic growth contributes to growing environmental pressures, where the compensation scheme would be only a tool to compensate for the negative human impacts on ecosystems, not a tool to regulate and limit them. Of course there could be other tools and policies for this aim, the recent Resource Efficiency Framework Initiative of the EU being an important one towards the sustainable use of resources. Nevertheless, resource efficiency alone does not lead to reduced resource use because of the rebound effect. This phenomenon, also known as the Jevons paradox has been proved in history for several times. Hence looking at a possible compensation scheme in the framework of current European policies, the increasing use of natural resources and landscape polarisation would necessarily lead to increased environmental pressures at the end. This would also compromise the concept of 'no net loss'.

In summary the compensation and offsetting schemes can be effective and useful tools of nature conservation, but only if they are embedded into holistic natural resource and land use policies.

Recommendations

Based on the above analysis and the conclusions, the recommendations concern both the future compensation scheme and the policy environment, where such policy could achieve its final target, the 'no net loss' of ecosystems and their services.

- Address the problem of the decline of ecosystems and their services in a **holistic** manner, where all drivers are taken into account and influenced at the end. For this aim develop a **land use policy**, which covers all land use types, including urban, agricultural, transportation, conservation, etc. By this the drivers underlying negative land use changes can be addressed and the trend of landscape polarisation halted. A holistic land use policy can lead to the implementation of an ecological network/green infrastructure on the ground, which is coherent and is able to sustain the ecosystems and their services. The compensation and offsetting scheme can play an important role in a holistic land use policy.

- Develop a resource use policy, which can **limit and ultimately reduce natural resource use**. This could eliminate the risk that even if the ecosystem use of projects is compensated in a comprehensive scheme, the environmental degradation continues as a result of increasing the (in)direct natural resource use through the same projects. This could also prevent that the compensation measures themselves contribute to environmental degradation through their natural resource use. Only a holistic land use and resource use policy applied at the same time, which is accompanied by effective pollution regulations can prevent the shifting of environmental pressures. The European Resource Cap Coalition developed a proposal for a holistic resource use policy in the form of a European non-renewable energy quota scheme[10]. This scheme contains innovative tools, which can make a huge contribution to transforming production and consumption patterns. Already this would significantly reduce environmental pressures

[10] http://www.ceeweb.org/rcc/

on the whole (while mitigating the risk that harmful activities are moved elsewhere), making a great contribution to the NNL target.

- **Apply strict mitigation hierarchy** in the future NNL scheme in order to minimise the risk of losing valuable ecosystems and also for raising awareness about the importance of ecosystems and their services.

- Based on sound scientific information **identify no go areas** for the compensation scheme in order to prevent the loss of ecosystems that cannot restored/recreated through compensation measures.

- Clearly determine the relation of the compensation scheme to the existing EU regulations, specifically to the **nature directives** in order to ensure that the protection of Natura 2000 is not threatened in any way by this new scheme. Member States shall also ensure that the protection of protected areas is not weakened by the new scheme either.

- Ensure that the implementation of compensation scheme **does not drain human and financial resources** from other, equally important nature conservation activities on national level. There shall be a clear institutional framework for the implementation, where **independent expertise** is provided for the whole process from planning to long term management on the site as needed.

- Develop **strategy on green infrastructure/ecological network** on national level in order to identify the best ecological options for compensation and the development of offset banks.

- Ensure that compensation measures lead to **actual improvement of ecosystem health and the enhancement of ecosystem services** through the careful selection of tools. These tools shall be first of all restoration and recreation based on best scientific judgement, while the preservation of ecosystems (from future environmental pressures) or payment into compensation fund supporting biodiversity research or general conservation activities shall be excluded from the NNL scheme as possible compensation measures.

- Develop **clear guidelines** on how to determine compensation measures with the aim of offsetting the negative impacts of the plans and projects. These guidelines of the future NNL scheme shall assist the involved actors that the initial state of the area for development and the likely impacts of the intervention, as well as the appropriate compensation measures are determined on a scientifically sound basis.

- Ensure that the restored/recreated ecosystems are managed in a timeframe that is necessary to maintain ecosystem health and integrity in the long term. At the same time it shall be targeted that the restored/recreated ecosystems become self-sustaining and that they are **preserved 'in perpetuity'**. Following the US example this shall restrict the use of land for conservation purposes on the title that is legally tied to the piece of land.