Biodiversity Offsets – A Tool for Environmental Management and Biodiversity Conservation

MARIANNE DARBI
Leibniz Institute of Ecological and Regional Development, Weberplatz 1, 01217 Dresden, Germany, 0049 351 463 42356. m.darbi@ioer.de

Abstract

On the background of an increasing land use pressure it becomes clear that mere conservation cannot halt the global biodiversity loss. Hence, compensation for impacts on biological diversity is crucial. This is currently being discussed with regard to the so-called “Biodiversity Offsets”. Briefly, this means that negative impacts on biological diversity need to be compensated or counterbalanced by conservation or restoration measures in order to ensure No Net Loss of biodiversity. A general distinction can be made between two kinds of offsets: on the one hand Mandatory Offsets are required by legal and planning provisions and on the other hand Voluntary Biodiversity Offsets can either exceed these requirements or exist completely independent from them. The discussion about Biodiversity Offsets is both complex and controversial. They also include some risks which need to be taken into consideration seriously, while benefiting of the advantages and potentials. Nevertheless Biodiversity Offsets are commonly accepted and applied in practice, as the existing mitigation and offsetting schemes (e.g. German Impact Mitigation, US Wetland Mitigation) prove. A large potential that has not been sufficiently discovered, yet, lies in Voluntary Biodiversity Offsets. Little is known about the conditions under which these arise, which steering mechanisms they enable and how they can contribute to nature conservation and halting biodiversity loss.

Introduction

The Global Biodiversity Outlook in 2006 gave a report on the global state of biodiversity: Species and their habitats and biological diversity as a whole are facing an increasing threat through human activities. The relevant negative driving forces are well known and usually man made or at least intensified by man: population growth with the associated increased need for land for settlement and food production, poverty, economic development and global climate change. This has led to a fast and continuous biodiversity loss.

The loss of habitats and species is not a new issue, but formerly it was a discussion restricted to specialists, while only making a marginal impact as a political issue. With time this has led to the insight that mankind depends on the products and services that biodiversity provides for economy and society. Therefore, it is important to conserve biodiversity as the basis for human life.

Several approaches both at national and international level aim for biodiversity conservation. The focal point is the International Convention on Biological Diversity (CBD), which emerged as
a result of the UN Conference in Rio de Janeiro in 1992. Since then 168 national states and the European Union have signed it. It includes the conservation of species and ecosystems as well as genetic diversity and the sustainable use of the components of biological diversity.

However, on the background of an increasing land use pressure it becomes clear that mere conservation cannot halt the global biodiversity loss. Hence, compensation for impacts on biological diversity is crucial. Over the past years, a discussion has emerged on the consideration of biological diversity in (environmental) impact mitigation and compensation, the so called Biodiversity Offsets.

Biodiversity Offsets should be planned and implemented in accordance with the CBD. The provisions of Article 6 (a) and (b), Article 8 (c), Article 10 (a) and particularly those of Article 11, on incentive measures, and Article 14 (2), specifically referring to “compensation”, serve as legal basis for the development of national frameworks for Biodiversity Offsets: “The Conference of the Parties shall examine […] the issue of liability and redress, including restoration and compensation, for damage to biological diversity […]”. [1]

This article gives an overview on the concept and principles of Biodiversity Offsets. It distinguishes between two kinds, Mandatory Biodiversity Offsets and Voluntary Biodiversity Offsets and briefly presents these. To conclude, some points of critique on the one hand and the potentials of Biodiversity Offsets on the other hand are highlighted.

**Principles of Biodiversity Offsets**

**Polluter Pays Principle and concept of Biodiversity Offsets**

The “Polluter Pays Principle” is widely recognized in many countries. According to this, generally the project proponent is liable for the damages caused by a development, and has therefore to put in place appropriate compensation measures.

The question of compensation and/or restoration of biological diversity is currently discussed with regard to what is called “Biodiversity Offsets”. Briefly, this means that negative impacts on biological diversity need to be compensated or counterbalanced by conservation or restoration measures in order to ensure “No Net Loss” of biodiversity (see Box 1).

<table>
<thead>
<tr>
<th><strong>Box 1: Definitions of Biodiversity Offsets</strong></th>
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<tr>
<td>“Biodiversity Offsets are conservation activities intended to compensate for the residual, unavoidable harm to biodiversity caused by development projects” [2]</td>
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<td>“Biodiversity offsets seek to ensure that unavoidable adverse environmental impacts of development are counterbalanced by environmental gains” [3]</td>
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<td>“A biodiversity Offset is a piece of land that is set aside from development to maintain its biodiversity values and thereby offset the effects of development on biodiversity values elsewhere.” [4]</td>
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Biodiversity Offsets are defined as “measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken. The goal of biodiversity offsets is to achieve no net loss and preferably a net gain of biodiversity on the ground with respect to species composition, habitat structure, ecosystem function and people’s
use and cultural values associated with biodiversity”[5]. In this context, “No Net Loss” refers to the goal of restoring the state prior to the impact, and thus, maintaining the same level of biodiversity, whereas the "Net Gain" approach aims at improving biodiversity quality. However, in practice the concept of No Net Loss is most often encountered, but there may be differences in the scope of the components being considered. Ideally, abiotic and visual components and functions of the environment as well as biological components will be taken into consideration. Following the “no net loss principle”, biodiversity offsets should result in measurable compensation outcomes, beyond that which would have occurred in the absence of the offset activities [6]. This requirement of additionality implies that offsets cannot replace conservation and other obligations, for example those of environmental authorities. [7]

### Appropriateness of Biodiversity Offsets and Mitigation Hierarchy

Furthermore, with regard to the appropriateness of Biodiversity Offsets, it is important to note that offsets cannot provide a justification for proceeding with projects for which the residual impacts on biodiversity are unacceptable. [8] This means that the “No Go” option has to be considered seriously and applied in cases where the destruction of unique habitats, or irreversible loss etc would otherwise occur. [9] This fact is usually addressed by a “Mitigation Hierarchy”, as illustrated in Figure 1.

The adherence to the Mitigation Hierarchy implies that one should in a first instance seek to avoid or prevent negative impacts on the environment in general and biological diversity in particular. Secondly, the unavoidable impacts should be addressed through minimization and rehabilitation measures and only as a “last resort” should compensation measures (=Biodiversity Offsets) be established for the residual adverse impacts. This can be done either by restitution or by compensation payment. [10] Ideally Biodiversity Offsets can exceed the amount of compensation needed to counterbalance the negative impacts, thus creating a Net Gain for biodiversity (see Figure 1).

![Figure 1: Mitigation Hierarchy for Impact Mitigation and Biodiversity Offsets (adapted from Rio Tinto and Western Australia EPA) [11]](image)

#### Functional and spatial equivalence

With regard to the implementation of Biodiversity Offsets a number of principles or criteria are being discussed. One of the most important issues is the functional and spatial equivalence of
offsets and impacts, i.e. the question whether and how Biodiversity Offsets can be made comparable to the affected area and ecosystem to assure “No Net Loss”. [12] According to the functional relation two kinds of offsets can be distinguished. Whereas “in kind” refers to measures that are equal to the lost area with respect to habitats, functions, values or other attributes (like-for-like), out of kind measures (like-for-not-like) do have no or only a loose functional relationship with the impacted site.

The functional relationship of impacts and offsets is closely linked to their spatial relationship. While “on site” compensation includes measures in the impact area or nearby, “off site” compensation is spatially disconnected from the impact area. Usually, “in kind” and “on site” measures are preferable to “out of kind” and “off site” measures, especially when the affected area is of high local relevance. [13] However, in practice this is not always feasible or appropriate, as most projects with significant adverse impacts cause to some extent an alteration of the affected area, which makes it impossible to implement adequate functional (“in kind”) compensation measures directly in the affected area. [14] Furthermore, the geographical extent of what is considered to be “on site” offsetting is not properly defined and thus requires clarification.

**Timing and Aggregated Offsets**

A problem with the implementation of compensation measures is the time lag between the impact and the positive outcomes of the offset (e.g. newly planted trees may take decades to grow). One approach to resolve this lies in the application of an additional coefficient or ratio (more than 1:1) to calculate the amount of biodiversity that has to be gained by the offset compared to the amount of biodiversity lost by the project, taking into consideration the time lag between the impact and the maturity of appropriate offsets and the risk that these may fail. [15] A second approach regards the question of appropriate timing of offsets: It is preferable that Biodiversity Offsets are operational and proven prior to the occurrence of project impacts. [16] This anticipatory approach may be best addressed by Aggregated Offsets using pool and banking models. These aim at the provision or concentration of compensation areas and measures. Pools provide areas or measures, which are ready to be used. Banks are generally economic arrangements (banking, credit trading or trust funds), which technically and financially support the implementation of compensation measures.

In some cases the obligation to compensate for the residual adverse impacts may be linked to the possibility of a compensation payment in monetary terms instead of tangible compensation measures. [17] Nevertheless, a general preference should be given to natural compensation.

Finally, as a general principle, offsets must be designed for sustainability, aiming at long-term success. [18] [19] [20] Therefore, compensation measures should be (but are not always) subject to monitoring and follow up, to assure their effectiveness. [21]

**Kinds of Biodiversity Offsets**

A general distinction can be made between two kinds of offsets: on the one hand Mandatory Offsets are required by legal and planning provisions and on the other hand Voluntary Biodiversity Offsets can either exceed these requirements or exist completely independent from them. [22]
Mandatory Biodiversity Offsets

Environmental Impact Assessment

Compensation approaches and thus biodiversity offsets exist in numerous countries worldwide. Liability for damages is stipulated under various sectoral laws, e.g. environment, mining, forests, waste and water. However, the situation on the ground is very heterogeneous. While countries such as Brazil have long standing experience and well-developed environmental legislation, others, e.g. Madagascar have only recently acknowledged the need to act.

When considering the obligation for restoration of impacts on biological diversity and natural resources, in a worldwide context the most commonly encountered implementation tool is Environmental Impact Assessment in its pure form or several other variations e.g. Environmental and Social Impact Assessment. The focus thereby lies on major projects in different sectors, e.g. oil and gas, mining, energy, pipelines, road planning, traffic and hydropower.

German Impact Mitigation Regulation

In Germany the „Eingriffsregelung“ (Impact Mitigation Regulation IMR) entered into force as part of the Federal Nature Conservation Act in 1976 to regulate the use of natural resources and nature conservation. Since then, it has become the major landscape conservation instrument to address mitigation and compensation for impacts from developments and projects. The overall objective is to ensure the preservation of the existing ecological situation as a minimum standard by avoiding any impairment of nature and landscape.

However, in the case of unavoidable impacts, an evaluation procedure is started to determine counterbalancing measures. Thereby, a mitigation hierarchy (as shown in Figure 1), following different steps and resembling a cascade is applied: avoidance, minimization, “in kind” offsets and “out-of-kind” offsets. The extent of the compensation measures under law is determined by the principle of full compensation. This principle stipulates that any significant or lasting impairment caused by an impact on nature and/or landscape has to be compensated entirely by appropriate measures and, in the case of remaining adverse impacts, by a compensation payment.

With regard to the implementation of IMR the use of pool and banking models (Flächen- und Maßnahmenpool, Öko-Konto) and the related chances and risks are being discussed intensively since the beginning of the 1990s. A nationwide survey confirmed the broad application of pools of areas (Flächenpool), identifying several hundred pools, which are used both by public authorities and private project proponents.

As a result of more than thirty years of experience, high quality standards have been established in practice and German IMR is one of the best developed formal compensation systems worldwide and the only one in Europe.

US Wetland Mitigation

Wetland Mitigation according to the Clean Water Act is the second most important approach to addressing impacts on biological diversity in the US. In principle activities in wetlands are forbidden, if thereby, the wetland would be significantly damaged or if a feasible, less environmentally harmful alternative exists. However, permissions can be granted under
exceptional circumstances by the responsible authority, the US Army Corps of Engineers. In this case a compensation process is initiated, including procedures and measures to reach the goal of “No Net Loss” of wetlands and aquatic ecosystems. In basic terms, the process includes a three-step mitigation hierarchy. First, the project proponent has to avoid alteration of wetlands by using the least environmentally damaging site. This may include sites that are not owned by the proponent. Second, a plan has to be developed to minimize the adverse effects of the unavoidable impacts. Finally, if after the rectification and reduction over time, impacts still remain, the proponent has to adopt appropriate compensation measures. [29] [30] This may either be done by paying monetary compensation or using the services provided by a third party, usually a private investor with a commercial interest, a so-called mitigation bank.

**Voluntary Biodiversity Offsets**

Darbi et al. (2009) concluded that voluntary and alternative instruments such as incentives and economic instruments (e.g. payments for ecosystem services and certification) are playing an increasing role. [31] More recently, Voluntary Biodiversity Offsets have emerged. In contrast to Mandatory Biodiversity Offsets, they are implemented without prior obligation, in response to the growing public pressure on corporations and governments to demonstrate that they are addressing the environmental impacts of their activities. Several companies have made a commitment to have no negative impacts on biological diversity in their overall balance. [32]

Figure 2 illustrates in which cases Voluntary Biodiversity Offsets may emerge. They are especially important where the legal basis and general guidance are lacking. However, Voluntary Biodiversity Offsets have also been noted as complements to mandatory approaches in some cases.
The interest on Voluntary Biodiversity Offsets is growing, especially from companies, but also researchers, NGOs and authorities. Thus, a number of institutions has set up initiatives and defined standards on their implementation, e.g. “Business and Biodiversity Offset Program” and “Energy and Biodiversity Initiative”. The latter claims Voluntary Biodiversity Offsets should serve as minimum standard for all companies in order to assure „No Net Loss“ of Biodiversity. [35] Thereby the role of “Global Players” has to be highlighted. For instance, Rio Tinto has made a commitment to make a net positive impact on biodiversity at its operating sites around the world by intending “to leave as much, if not more, natural variety in place [...] than existed before”. [36]

Furthermore, these new instruments open up new possibilities and biodiversity markets for business, e.g. reputational advantages, access to capital and the first-mover competitive advantage (see table 1). They also offer a number of chances and improvements for political decision makers, nature conservation organizations and the concerned population. [37]

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<th>The business case for Biodiversity Offsets</th>
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<tr>
<td><strong>License to operate</strong></td>
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<tr>
<td>Access to land and resources, acceleration of licensing procedures, avoidance of costly delays, influence on emerging environmental regulation and policy</td>
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<tr>
<td><strong>Reputation</strong></td>
</tr>
<tr>
<td>Good PR, enhanced reputation and „social license to operate”, better relationship with local communities, governmental regulators, environmental groups and other stakeholders</td>
</tr>
<tr>
<td><strong>Access to capital</strong></td>
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<tr>
<td>Higher standards of international financial and funding institutions</td>
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<tr>
<td><strong>Efficiency</strong></td>
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<td>Management of social and environmental risks and liabilities</td>
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<td><strong>New markets</strong></td>
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<td>Competitive advantage as „First mover”</td>
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Table 1: Advantages of Voluntary Biodiversity Offsets [38] [39]

**Business and Biodiversity Offsets Program**

The Business and Biodiversity Offsets Program is a partnership of companies, scientists, NGOs, government agencies, research institutes, and financial institutions, which focuses on the question of compensation for impacts on biological diversity, in response to a growing interest in the field.

BBOP aims to mainstream the concept of “No Net Loss” of biodiversity into development projects through “conservation activities that will protect threatened habitat, contribute to national biodiversity strategies and address local communities’ livelihood priorities”. [40] During the first phase, which came to an end in summer 2009, the main objectives of BBOP have been to develop, test and disseminate guidance for designing and implementing Biodiversity Offsets. As part of this process, the BBOP Secretariat identified several pilot projects and has prepared a methodology toolkit. First drafts of a series of Biodiversity Offset handbooks have been posted for public review in an online consultation process, and revised documents taking into consideration the results of this consultation have been made publicly available in summer 2009.

Further information on the work of BBOP can be found on their website http://bbop.foresty-trends.org/index.php.
Criticism of Biodiversity Offsets

License to trash

The major points of critique on Biodiversity Offsets focus on their appropriateness (and thus questioning the concept of offsets itself) and the lacking application of the Mitigation Hierarchy. One problem lies in the fact that even though the Mitigation Hierarchy is applied as a theoretical principle, the practical implementation in some cases remains doubtful. When offsets replace the steps of avoidance and minimization this may lead to the approval of environmental harmful developments that would have been rejected without the offset. This is called „license to trash“.

[41] While usually the function of Biodiversity Offsets as a „last resort“ is formulated in many offsetting schemes, provisions for distinguishing between offsettable and not offsettable impacts are largely absent. [42] Thus, the issue of irreplaceability and the “No Go” option (non-implementation of a project due to its potential environmental impacts) are not considered sufficiently. This leads to the question for which kinds of biodiversity damage or loss an offset is admissible and effective. Building in particular on the value of biological diversity which is difficult to determine in all its facets and the complexity of interactions this results in a high degree of uncertainty. With regard to criteria such as replaceability and vulnerability it is in practice hard to anticipate e.g. the extinction of a species due to the implementation of a specific project and to prove a causal relationship between the impact and the loss of a species (and thus leading to a responsibility). Therefore, Biodiversity Offsets require the definition of thresholds for the kind and amount of biodiversity damage that can be counterbalanced by an offset.

Comparing apples and oranges

As noted before, the equivalence of impact and offset is crucial to maintain the same level of biodiversity. Therefore, critics fear that an adequate quantitative and qualitative relation (functional and spatial relation, compensation ratio) can hardly be achieved. This is due to difficulties in evaluating and balancing impact and offset. [43] The reasons are various: First, the value of biological diversity cannot be measured objectively as different people assign different values to it. [44] Second, even the best techniques will never be able to predict and to cover all impacts that may arise in the long term, especially with respect to indirect and cumulative effects. This becomes even more obvious when biodiversity data is incomplete and less detailed. [45] Last, the evaluation and balancing process consumes work, time and costs. As a result of these facts it will always be a compromise between the aim for an exact and detailed evaluation on the one hand and the need for pragmatism on the other hand.

Therefore, the necessary evaluation and balancing methods are diverse and built on different procedures and criteria. [46] For Germany alone more than 40 evaluation approaches can be distinguished [47] and BBOP assume more than hundred methods worldwide. [48] This existing multitude of evaluation and balancing methods is critical as it impedes to achieve comparability and transparency which are extremely important. [49] Furthermore, these methods face a number of deficiencies, e.g.

- Inappropriate use of simplified area balancing approaches using value points,
- Negligence of components of the natural balance, in particular the abiotic components soil, water, climate, air and the landscape scenery,
- Lacking cross-sectional evaluation and consideration of the natural balance and landscape as a complex,
- No consideration of cumulative effects and
- Lacking distinction between object-level and value-level. [50]

A lack of equivalence does not only concern the ecological situation but may also have socioeconomic effects, e.g. a development may cause disadvantages to the local population (e.g. restriction of recreational use of an area) which cannot be offset in the area, thus resulting in a social inequality. [51] [52]

**How long lasts perpetuity?**

Temporal aspects represent another important group of criteria, most notably the duration of impacts. There are impacts that last only a very short time and others that may endure many years or even centuries. Alongside these temporary impacts, other impacts may be permanent. In this respect the question of reversibility is important and the feasibility and costs of remediation. Furthermore, timing must be considered. Some effects may appear immediately, while others may only become visible after many years. The latter are difficult to address by appropriate measures as noted before. Furthermore, in the long term Biodiversity Offsets may fail when they are not or not properly implemented or do not fulfill all functions. Even though Biodiversity Offsets should last as long as the impairments persist, i.e. usually in perpetuity, in practice different time frames are applied (e.g. 20, 25, 30 years in German Impact Mitigation) which is of course seen critically. Thus, even more emphasis must be placed on the importance of monitoring, follow up and long-term environmental management plans in tackling the lack of mitigation and compensation measures implementation and in ensuring their long-term effectiveness.

**Shift of responsibility**

There is a risk that Biodiversity Offsets replace conservation and other obligations of governmental bodies. Therefore, central question is what the (physical and financial) compensation measures are used for. Negative uses include cases where monetary compensation measures are merely used for the management and maintenance of existing protected areas, as this would not generate an additional Net Gain to counterbalance the loss, undermining the No Net Loss principle. It must be ensured that Biodiversity Offsets are not merely financing tools for general nature conservation duties.

**Potentials of Biodiversity Offsets**

**Trading up**

Despite the preference for “in kind” offsetting, functionally and spatially disconnected compensation measures or compensation payments are becoming more acceptable or may even be preferable, as long as they can generate a greater environmental benefit (like-for-better). In the scientific discussion this is designated as “Trading up”. [53] Thereby, a less valuable asset is substituted by an asset that is more valuable in terms of either its quality or quantity. [54] Thus,
Biodiversity Offsets offer the potential to implement measures with a higher ecological value (that would not have been otherwise carried out due to the high costs).

**Landscape Level Planning and Green Networks**

An important issue to consider is the scale of the offset, i.e. that “small sites can require a disproportionate effort of management in order to maintain their ecological interest and mitigation costs for separate developments can also be higher where administration and management are replicated both spatially and over time in separate commissions for the same target habitat or species”. [55] Therefore, the potentials or advantages of aggregated offsets and banking have to be highlighted. Thus, conservation pools and mitigation banks are effective instruments to implement Biodiversity Offsets with a minimum of land consumption, bureaucracy and costs (for the acquisition of land and the maintenance of measures and a maximum of nature conservation value.

From an ecological point of view landscape and habitat pattern may play an important role in ensuring efficient and adequate compensation measures (Core sites, Green Corridors and Ecological Networks). [56] [57] Through bundling and matching of measures and their concerted management compensation pools can contribute to the creation of an extensive network of protected areas with sound natural dynamics and larger and functionally more effective habitat networks, which is at the same time more cost-efficient due to reduced administrative effort. Thus, the Ecosystem Approach “taking into account available information on the full range of biological, social and cultural values of biodiversity” [58] is being widely supported, i.e. Biodiversity Offsets can be integrated into the overall planning concept at landscape level (Landscape Level Planning), e.g. building on the provisions of landscape plans and other planning instruments. Thereby compensation pools are increasingly assuming a development function and compensation measures can be used even to enhance poor landscapes. Furthermore, in the context of the implementation of measures, the time lag between impact and offset can be reduced significantly, as the offset is already in place when the impact occurs.

These issues namely were on the agenda of the 7th annual meeting of the Business and Biodiversity Offset Program (BBOP 7) in Paris in June 2009. Specifically a workshop on “Conservation Banking and Aggregated Offsets” was held. Experts from various countries worldwide discussed the role of pool and banking models. The result was the consensus that it is one of the core tasks to analyze the role and the chances of pool and banking models for the future development of impact mitigation and compensation mechanisms.

**Conclusion**

The discussion about Biodiversity Offsets is both complex and controversial. Nevertheless and despite the fact that some nature conservation organizations are strictly against Biodiversity Offsets and claim the prohibition of any habitat changes, these are commonly accepted and applied in practice, as the existing mitigation and offsetting schemes (e.g. German Impact Mitigation, US Wetland Mitigation) prove. Instead of the question whether or not the concept of Biodiversity Offsets is feasible and reliable, technical issues with regard to the “Where?”, “When?” and “How?” arise and need to be solved. [59]
As has been shown above Biodiversity Offsets also include some risks which need to be taken into consideration seriously, while benefiting of the advantages and potentials.

A large potential that has not been sufficiently discovered, yet, lies in Voluntary Biodiversity Offsets. Little is known about the conditions under which these arise, which steering mechanisms they enable and how they can contribute to nature conservation and halting biodiversity loss.

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