INNOVATION IN GOVERNANCE Research Group

Challenging futures of biodiversity offsets and banking

Critical issues for robust forms of biodiversity conservation

A report based on an interactive, anticipatory assessment of the dynamics of governance instruments, 19 April 2013.

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By circulating these workshop results, we seek to contribute to a debate on biodiversity offsets and banking design with regard to constituting political reality in biodiversity conservation models.

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Summary

This report emerged from the workshop “Challenging futures of biodiversity offsets and banking”, held by the Innovation in Governance Research Group on April 19, 2013, at the Berlin-Brandenburg Academy of Sciences and Humanities in Berlin, Germany. The workshop was conceptualized and designed as a platform for a wide variety of actors who regularly deal with the design and implementation of biodiversity conservation, offset, and banking schemes in order to identify and discuss issues and challenges for the future development of governance approaches for biodiversity conservation. The workshop panel brought together diverse practitioners and scholars involved in the development of biodiversity offsets and credit trading as an innovation in governance. Their engagement with these policy instruments is connected to particular interests in the design and use of such new governance approaches: from scientific and methodological perspectives to political views that emphasize public responsibility in facing biodiversity loss and, finally, business interests in establishing market und service infrastructures. Even though they shared a common interest in dealing with biodiversity offsetting and banking schemes, the participants held different views of the ‘nature’ of nature and biodiversity, how to determine their value, and whether market-based approaches can be suitable for the governance of biodiversity conservation. Some of the views were more optimistic, others more critical as regards the prospects of biodiversity offsetting and banking. In bringing these distinct perspectives together in a focused process, the workshop stimulated a critical discussion and facilitated debates about the future and its challenges for the use and design of biodiversity offset and banking approaches.

Similar to approaches from Constructive Technology Assessment (CTA), the discussion on challenging futures of biodiversity offsets was triggered by scenarios depicting alternative pathways into the future. Prior to the workshop, we developed three scenarios in which the design and use of biodiversity offset and banking was dominated by one of three particular rationalities threading through recent policy discourses: the logic of commerce, politics and science (see appendix). Based on our research on the historical development processes and dynamics by which biodiversity offset and banking approaches took shape and stabilized as an innovation in governance, each of the scenarios portrays a set of hyperbolic speculations regarding the future design and use of

biodiversity offsets. By debating these scenarios we encouraged reflections on the innovation process, its ambivalences, conflicts and repercussions, as well as the different perspectives and capacities of actors to shape the future of biodiversity offsets.

One basic finding from the workshop was that while the design of biodiversity offset approaches and biodiversity valuation methods is often framed as functional-methodological issues, it is almost always linked with more fundamental and potentially antagonistic philosophies, worldviews and rationalities of how to see, use and value nature. The methodology, design and implementation of biodiversity offset and banking schemes is thus as much a political as a technical issue, a matter of concern and judgment, fact and functionality.

It therefore requires different forms for making decisions about the design and use of new governance approaches than expert debate and generation of scientific evidence. In order to support the social embeddedness and legitimacy of biodiversity conservation approaches, we suggest a cautious approach to ensure that design decisions concerning biodiversity offset, banking and credit trading schemes are debated more openly and negotiated with a more diverse set of concerned actors in regard to their broader societal and political implications. This is what, in our view, “responsible innovation” in governance would require: “a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society)” (von Schomberg 2011: 9).

When attempting to relate functional and methodological design issues and different philosophies and worldviews about the ‘essence’ of nature and biodiversity, markets and governance, there is also a general challenge of enhancing the robustness of innovation in governance. This is where attempts to establish standards for the valuation, measurement and trading of certain qualities of nature attain relevance as a political process in which certain ways of conceiving and interacting with nature become collectively binding. In this sense, the methods of biodiversity management and governance are inherently political. Biodiversity offsets’ main promise is to flexibilize and possibly replace

regulatory, command-and-control policies for nature conservation. However, a key challenge for the future of biodiversity offsets is not to automatically background alternative modes of biodiversity governance due to the strong lobbying of certain interest groups for a more widespread application. Another key challenge is to anticipate and reflect the cultural, social and political assumptions that are incorporated into biodiversity offset designs, but remain hitherto largely uncontested. Such broader impacts and repercussions should be anticipated and debated before certain designs become implemented and, because they push certain standards, irreversibly reconfigure diverse socio-ecological and cultural contexts.

The main part of this report summarizes the issues and challenges discussed by workshop participants in relation to the future development of biodiversity offsetting and banking. These issues cover a range of topics. The workshop participants discussed questions about the functions and suitability of biodiversity offset schemes for halting biodiversity loss, and the contribution of such tools to conservation strategies and land-use planning procedures. Participants debated the value of biodiversity and ecosystems, along with the need for more holistic and participatory valuation methods that go beyond simple measurements in physical and economic terms. These topics were related to basic questions about the desirability and long-term impacts of monetarizing and permitting the commodification of nature and biodiversity. Participants also brought up challenges of quality assurance as well as problems involved in the standardization of offset schemes.

Furthermore, institutional embeddedness, as well as other prerequisites for offsets, was debated in this regard, raising diverse questions: Will these tools function as promised when applied in different cultural, institutional and political contexts, and under different circumstances? How is it possible to find trade-offs between accounting for context particularities and establishing a level – potentially even global – playing field for business? Especially the latter question induces reflexive concerns with regard to the social dynamics of biodiversity offset design and the role of specific commercial and professional interests in the innovation process.

Most controversies that emerged in debates over biodiversity offset and banking design were related to different views of nature, the economy, and governance. These are highlighted in the issues section. For some participants, the commodification of nature was primarily a means for utilizing mechanisms within a green economy paradigm to halt biodiversity loss. For others, biodiversity offsets were an approach to raise environmental awareness and ensure quality control for landscape development, conservation and planning. This could be possible, it was argued, by making trade-off decisions more transparent and bolstering ineffective protection laws. Finding alternative ways to encounter biodiversity loss and expanding the set of governance approaches for nature conservation were seen as a main contribution of offset schemes. Others viewed them as the expansion of a dominant neoliberal governance paradigm that displaces alternative conservation practices. Some argued for the efficiency and equity of market-based governance approaches while others emphasized that such designs fail to account for cultural and political dimensions of nature degradation and are doomed to fail in diverse and complex socio-ecological settings. The issues were rarely debated separately; the participants frequently noted links and interdependencies between the individual topics.

As result of the workshop, it appears that a quick resolution of open issues and challenges in the design and use of biodiversity offset schemes may not be desirable, at least if it would imply closure in the debate by establishing ‘one best way’ of doing biodiversity conservation. The fundamental political nature of most controversies on how to conceptualize, organize and implement biodiversity offset schemes suggests that there is no objectively right or wrong design decision to be taken. Any decision will be a political decision in favor of one approach and against others. This should be made explicit to allow the concerned publics of such approaches, as well as a more general public, to judge and engage with them on their own terms.

A core challenge for the future of biodiversity offsets and banking is to provide for an innovation process which expresses the underlying rationalities and expectations of market-based approaches for biodiversity conservation, as well as their possible limits and consequences, in order to allow for public debate and contestation, and ultimately political decision, instead of shielding analysis

and design from broader engagement by positioning them as objective, technical questions that are the sole purview of experts.

We propose that critical reflection and articulation of the inherent ambivalences of biodiversity offset and credit trading schemes in particular situations can help find effective and robust approaches to biodiversity conservation. By making the innovation dynamics of biodiversity offset schemes visible, i.e. by bringing involved and affected actors with different perspectives to one table, we can create awareness for the various, and sometimes conflicting views concerning the design and use of these governance approaches and the various trade-offs and dilemmas that need to be faced. Continuing the debate among increasingly professionalized and commercially operating enactors of offset schemes with affected and critical actors can serve to probe the developmental trajectories and negotiate future pathways that are legitimate and effective in particular contexts.

We acknowledge that our focus on a single group of approaches for biodiversity conservation is problematic as well. However, it enables us to narrow the debate, give special attention to these rather than alternative approaches, and to some degree reify them as tools. Nonetheless, there are also good reasons behind this strategy. Biodiversity offsets, banking and credit trading schemes happens to be the center of attention of many policy debates at present; hence, we thought it would be productive to pursue a reflexive form of engagement. Because the design discourse on biodiversity offsets is still in flux, debate and reflection on this topic may aid in developing conservation approaches that are embedded in their respective implementation contexts. By circulating the identified issues in the form of an ‘extended innovation agenda’, we seek to cultivate debate and interactive reflexivity with regard to the making of political reality in governance designs for biodiversity conservation. We thus hope to contribute to the design of future governance systems in a way that ensures their alignment with the actual diversity of different ways of life rather than bluntly impacting upon them from the outside. This report may provide an orientation for reflexive design work on biodiversity governance.

1. Introduction: Challenging futures of biodiversity offsets and banking

The mainstreaming of the concepts of biodiversity and ecosystem services has resulted in a political and ethical paradigm shift over the past decades. Instead of conserving nature for its intrinsic and inherent value, the trend has shifted towards an emphasis of nature's anthropocentric and instrumental values, with a focus on its measurement in economic and physical terms (e.g. Jax et al. 2013; Costanza et al. 1997; 2014). As a result, various approaches have been articulated and implemented to remake the governance of biodiversity, employing neo-liberal conservation policies and methods for the commodification of nature (Scherr et al. 2004; Adger et al. 2003). Proponents argue that these new modes of governance are better equipped to deal with today's global ecological problems, reduce regulatory costs, mobilize private capital, harmonize regulatory frameworks, and increase awareness by enlisting a range of new actors in the policy process (e.g. Tommel and Verdun 2008; Mead 2008; Jordan et al. 2003, 2005; Haddas and Huigen 1997).

One of these new and promising governance approaches for confronting biodiversity loss and growing development pressure is biodiversity offsetting and banking. This approach operates under various labels, including 'habitat banking', 'mitigation banking' and 'conservation trading schemes' (TEEB 2008). At their core, offsetting and banking schemes allow ecological impacts occurring in one place to be compensated by conservation or restoration measures implemented in other locations provided that stricter mitigation measures – such as avoidance or reduction – are not feasible, thus employing a "mitigation hierarchy" (ten Kate et al. 2004). Compensation can happen on a case-by-case basis, by offsetting the impacts of specific development projects through additional protection measures at a different site. It may also take the form of standardized procedures of issuing generic 'biodiversity credits' for protection measures, which can be issued in advance and independently of concrete impacts, and later used to compensate biodiversity losses accruing from other projects. The latter form can be linked to regulations that provide for private "biobanks" to generate and offer credits on a commercial basis. Offsetting aims to achieve "no net loss" of biodiversity. It is based on standardized metrics for valuing biodiversity. This is to ensure consistent accounting for loss and gain at either end of the process.

Today, the scientific as well as political discourse on how to design and use offsetting systems, as well as questions of how to govern them is largely open, and many crucial issues still need to be addressed (cf. Fox and Nino-Murcia 2005; Wilcove and Lee 2004). One difficulty with biodiversity credit trading, when compared to emissions trading, is that measuring commensurable units for biodiversity seems to be far more complex and place-specific. Open issues in this regard are the measurement and evaluation of functional (in-kind/out-of-kind) or spatial (on-site/off-site) equivalence or, more generally, the question what can be counted as equivalent in terms of destroying versus conserving nature. As a result, an accepted and universal design for biodiversity offsetting schemes is not yet discernible.

Despite the general focus on seemingly functional methodological issues concerning how to set up and operate offset systems, more fundamental questions about their suitability and governance also still remain (see e.g. Sulivan 2013; Robertson 2006, 2004). There are doubts regarding the extent to which market- and business-oriented policy solutions and commercial 'banking' are fundamentally suited to deal with environmental degradation caused by the capitalist dynamics of economic development. Moreover, the capacity of governments to counterbalance and regulate economic dynamics and the power amassed in the process is also a matter of concern. This is particularly relevant from an international perspective with several different, more or less institutionalized forms of governance on national and sub-national levels, and in the absence of intergovernmental frameworks. Therefore, the appropriate role and degree of state interference and oversight are ambiguously discussed in the policy discourse. Moreover, a general lack of information about ecological, social, political, and cultural impacts and effects of offsetting schemes creates more uncertainty than certainty (e.g. Wilcove and Lee 2004). However, despite all these open issues related to biodiversity offsets, their popularity is rising, with governments and private companies all around the world increasingly seeking biodiversity offsetting policies to meet international commitments for tackling biodiversity loss (cf. Madsen et al. 2011).

For us, the vast innovation of biodiversity offsets and banking schemes and their promotion as a hopeful policy solution on the one hand, and the many unresolved issues of whether and how to design biodiversity offsets and banking as a new form of governance on the other, constitutes the motivation to engage with ongoing design discourses and to stimulate a critical debate about future challenges of these market-oriented approaches. We envision an open articulation of the risks and opportunities of offsetting schemes for the future of biodiversity conservation. We aspire to raise these issues for debate by a broader public that extends beyond concerned professionals, experts and agencies. We believe that decisions about such forms and use of governance modes must be matters of public concern. With this report, we endeavor to examine salient issues of the present technically framed design discourse that could arise if the forum of debate were extended and a more diverse set of perspectives were to engage with the future of biodiversity offsetting. This report seeks to foster 'responsible innovation' in governance by putting the market-based management of biodiversity and corresponding commodification of nature up for public debate. Together with the discussions which took place at the workshop, it aims to prevent the neglect and premature closure of fundamental questions of political organization guised as technical and functional issues.

With this orientation, we studied the historical and ongoing innovation processes of the development of offsetting schemes with regard to underlying dynamics, mechanisms of articulation and emerging tensions. We developed a set of scenarios for possible futures that highlight different challenges for designing offset processes and for society at large. And we organized a workshop that brought together various experts, regulators, and business makers, as well as users and affected societal actors, including skeptics and critics. We identified these actors in our study of this innovation case as spokespersons for different perspectives and concerns in relation to biodiversity conservation. Prompted by our question for issues that can be anticipated to become probable challenges for the future of biodiversity offsets and banking, they spent a day identifying, expounding on and discussing issues.

These issues ranged from specific technical quarrels to broader contexts, and extended all the way to fundamental philosophical assumptions and the overall purpose of such designs. Based on 25 issue descriptions done by participants ("issue briefs") and transcripts of recorded discussions, we identified a connected bundle of key issues which reflect main lines of debate and their interlinkages.

This report is structured as follows. Following the introduction, we offer an interpretative and constructionist perspective in section 2 that illustrates how the design of biodiversity offsets and banking approaches is part of a larger, transnational process of reconfiguring environmental governance through environmental markets. The construction of these designs and tools is de facto a political process of establishing collectively binding rationalities and technologies for humans to relate with nature. As the central part of the report, section 3 presents the issues and challenges for the future of biodiversity offsets that participants debated in the course of the workshop. As a conclusion, arguments to work towards the use of an extended innovation agenda and better embedding of biodiversity conservation schemes in their respective contexts are presented in section 4. Further information on the scenarios that stimulated the workshop debate as well as a list of the participants can be found in the appendices of this report.

2. Development of biodiversity offsets and banking: An ongoing innovation process

Our research group studies innovation in governance and the particular process, mechanisms and patterns of biodiversity offsetting approaches with regard to the work that goes into their construction. Such new governance approaches for biodiversity conservation result from manifold interactions of multiple actors within and across diverse sites such as research labs, think tanks, advocacy groups, grassroots movements, government departments, regulatory agencies, consultancies, professional associations, and the media. All these actors advance and shape the design and use of biodiversity offset schemes. While they come to engage with biodiversity offsets and banking from different origins, they also bring different perspectives, skills, resources and expectations to the table. Academic scholars, for example, may see the commodification of nature as a methodological challenge of how to compare and value ecological assets. Political decision-makers, in contrast, may regard market-based policy approaches in general and offset approaches in particular as a chance to ease conservation-development conflicts for their constituency or as a way to involve the private sector in biodiversity conservation attempts. For other actors, the creation of new markets for conservation products and services, and the profits that may be obtained, constitute an additional motivation for supporting such forms of biodiversity governance. Various more skeptical or critical actors may be concerned by the implied politics, power relations, equity issues and repercussions of market-oriented policies.

Like other innovations, the development of offset schemes may get “settled” on a certain path and increasingly become a matter of negotiation among in-group experts. Initially “open” interactions around various versions of biodiversity governance may gradually become more exclusive and come to center on one particular paradigm and its specific design elements. This may be linked with institutions that regulate access to specialists, infrastructures which support problem-solving, particularly for the given paradigm, and training of specific skills. Corresponding tools for measurement and evaluation are developed in line with this generally accepted pattern and thus reinforce the dominant design.

Such a stabilized socio-technical arrangement can produce a momentum, pushing for the installation of a particular form of governance in a growing number of places, diffusing across municipal, regional, national and international arenas of governance.

At the same time, the closure and expertization of the design process implies that the articulation and development of new forms of governance is decoupled from contexts of implementation, from interaction with situated social, political and ecological constellations. Innovation processes may thus become detached from ongoing changes in the broader world to which they claim to apply (Rip et al. 1995; Felt et al. 2007; Owen et al. 2013). Thus, a new policy "instrument" is born – and at this moment it becomes easy to forget its history of interactions, i.e. its construction by a closed set of experts and professionals with certain visions who developed their working models in interaction with a very particular and often highly reduced local setting, akin to a computer model, or a specific historical 'real world' governance context.

The development of biodiversity offset and banking schemes can be characterized as a process originating in local policy experiments and then expanding to other localities, regions and countries. The U.S. (since the 1980s) and Germany (since the 1990s) have been at the forefront in this regard. Both countries have, largely independently of each other and with different results, developed offsetting systems. While the U.S. scheme is a strongly market-based approach that encourages commercial third-party banking and trading, Germany's pooling approach is mainly run by the public sector. Among other effects, the market-based orientation has led to the emergence of a whole new private mitigation banking industry in the U.S., a sector that coordinates lobbying efforts and that has entered the political sphere as a player in its own right. As a result, a dominant coalition of experts advocates a market-based approach to compensatory mitigation, which has since served as a model for the development of similar statutory or voluntary biodiversity offsetting schemes worldwide, e.g. in Australia, Brazil, South Africa, and in other parts of Europe.

More recently, a transnational design discourse on compensatory mitigation has emerged that links up with, and is legitimated by, the more general trend toward market-based policy instruments. Pro-market governmental and non-governmental institutions, organizations, coalitions and initiatives, such as the OECD, the CBD, Forest Trends, IUCN, BBOP, IPBES, or TEEB, advocate market-based biodiversity protection. A critical aspect in this regard is the consideration that many actors who favor market-based approaches also possess more lobbying power, and greater capacities to enroll their own experts, than those in favor of alternative approaches.

As an effect, particular views of how to see and value nature become inscribed in governance designs and, in the course of their development, become taken for granted as the 'natural' way of doing conservation, while other, alternative views of what nature is and how to conserve it are backgrounded as less rational, practical, promising etc. Yet, different actors assign meaning to, use and value nature in different ways. Questions of valuing nature, defining which parts can adequately stand in for others, measuring worth and finding equivalency are judged in different ways depending on how actors relate and interact with nature. A fundamental underlying issue of biodiversity offsetting is that it promotes the installation of a general valuation and coding system which defines what nature is across different perspectives and different situations and localities. In this sense, designing or selecting specific formats for biodiversity conservation is a question of establishing a shared collective rationality. The design of compensation schemes is therefore inherently political.

It appears that market-oriented environmental policy instruments pose as an elegant resolution to the conflicting rationalities of ecology and economy. In reality, they merely shift the arena of conflict. This ideological struggle resurfaces in 'technical' design questions about partitioning and measuring different 'pieces' of nature. Ecological proponents are usually more concerned with issues of complexity, uniqueness and uncertainty for governance and management of nature and reluctant to draw up general scales. On the economic end, the focus tends to be on the efficiency of compensation trade-offs and the liquidity of markets, which leads to the promotion of simple and standardised methods of establishing equivalence between incremental units of nature.

In order to face such hidden politics in biodiversity offset and banking design we developed the “Challenging futures” format, which promotes and stimulates reflexivity on how meanings of nature, the measurement of its value and the role of market, scientific, cultural and political interests are negotiated for designing particular forms of biodiversity governance. The discussion aimed at exposing the diversity of positions, as well as issues of agreement and controversies. The following collection of critical issues serves to illustrate this diversity.

3. Towards an extended innovation agenda: Critical issues

We describe the themes, issues and challenges for the future of biodiversity offsets and banking schemes that were identified and discussed by workshop participants in the following section. Core statements and direct quotes are marked with reference to the workshop session and line number in our transcripts: OD = opening discussion; BL = briefing letter; Fin = final discussion; group work: yellow, blue, red, and green. The issues are not presented in any particular order; instead, they should be imagined as a "network" of issues. All issues mentioned are important in the current and future development process of biodiversity offsetting and banking schemes as they are likely to have strong impacts on their design, functions and implications. With this thematic network, we want to provide an impetus for reflecting, constructively acknowledging and debating the issues presented here, along with their implications, intentions, and debatable points. We propose these issues as part of an extended innovation agenda which does not focus on overcoming technical bottlenecks to achieve certain versions of biodiversity offsetting, but on the broader implications of these models and the desirability of a world that is produced by certain forms of governance. Clearly revealing different perspectives and rationales underlying biodiversity offset and banking schemes shall help increase the future societal embeddedness of biodiversity conservation approaches, and should therefore receive greater attention and debate.

3.1 Functions of biodiversity offsets: A matter of worldviews and philosophies?

At the outset of the workshop, several questions arose about the functions of offsetting systems: What is their actual purpose? What are the many purposes attached to them by different actors, both explicitly and implicitly? How might offsetting improve biodiversity governance and nature conservation? To which understandings of current situations and which problem definitions do expectations of "improvement" refer? What does offsetting add to the existing set of policy approaches; where does it shift priorities? How clearly are objectives defined and how are potentially detrimental side-effects accounted for in the definition of functions? These fundamental questions are by no means uncontroversial. A large part of the discussion was related to differences in the underlying orientations which actors apply to the issue of functions of biodiversity offsets.

A widely shared point of departure was, however, that present governance patterns, as they work in reality, are not effective in halting a continued loss of biodiversity, at least when viewed on a global scale. In many places, socio-ecological settings are transformed to pursue economic and industrial development in a way that undermines regenerative capacities, diminishes habitat for fauna and flora, and reduces biological diversity.

Voluntary offsets as a way to extend and enforce the conservation of biodiversity

On the promoters' side, offsets are seen as a way to extend and enforce the conservation of biodiversity. For example, voluntary offset schemes are said to play a role in contexts where no governmental regulations are in place and thus no concern for biodiversity protection is institutionalized. This allows governments or banks for example in many developing countries to promote protection levels by approving and certifying compensatory measures for the impact of development projects on nature. Here, voluntary offset schemes can be implemented by corporations or governments to demonstrate that they are addressing the environmental impacts of their development activities, and to provide them with an insurance against public accusations of ecological destruction.

In this vein, developers argued that biodiversity offsets are a good approach for the industry to "pay off its sins". Often, especially large developers have money but lack a publicly trusted channel to make it count in compensatory terms. Offsets can be seen as a reliable "severance mechanism" which gives the industry security – also with regard to contingencies in competitively negotiating compensation with governments [OD:682].

In addition, voluntary offset schemes provide a space for experiments with different offset mechanisms and standards [OD:152]. As such, useful lessons can be drawn from voluntary schemes as they can anticipate legal requirements. As a limiting factor, it was said that learning about costs is hardly possible in voluntary markets, as they are biased by self-selected samples, posing a problem for understanding how these instruments works. Their market potential is also rather low [OD:433].

Internalizing external costs

A related view was that offsets allow the internalization of costs of biodiversity conservation into the economic system. Behind this argument is the observation that markets produce external costs, e.g. the costs of dealing with air or water pollution or, relevant in this case, the loss of biodiversity. As an important feature, biodiversity offsets and banking assign values to these costs and thus help to internalize them by forwarding the bill to developers. As such, biodiversity offsets can be seen as a step towards assigning responsibility for 'unavoidable' impacts. Consequently, as one participant proposed, offsetting systems are much more about the "polluter pays" than about the "compensation" of impacts [OD:858]. The internalization of external costs of environmental damage using market-based mechanisms thus can be seen as a consistent and reasonable step that might even replace regulation in the future [Fin:423]. Internalization may remain a vision, i.e. "you never get there" [Fin:465]; however, as it was noted, in today's society we are already "making tradeoffs implicitly, but we have to make them explicit" [OD:858]. Offsetting could provide an explicit and coherent scheme for valuing and comparing the use of nature, making tradeoffs explicit and transparent, and enabling a professionalization of compensatory practice. Biodiversity offsetting schemes, banks and related organizations, so this argument goes, thus have the potential to make ubiquitous trade-offs efficient and effective [OD:902].

Raising public awareness of the value of biodiversity

Participants highlighted that biodiversity, similar to ecosystem services, is still not sufficiently valued by society and its value should thus be made more explicit. By assigning values to ecosystems, habitats and biodiversity, offsets and credit trading schemes have the potential to sensitize the public to the loss of biodiversity and its related costs, an argument in favor of offsetting approaches. Valuation systems would therefore also fulfill an informational and educational function: demonstrating the value of biodiversity [OD:910].

On the whole, as it was argued, the public needs to better understand and accept the cost of biodiversity protection, when for example the state determines a need to infringe on protected areas and therefore has to use taxpayer money to pay for professional compensation. As such, biodiversity offsets help to create a (market) demand for biodiversity development and protection services, e.g. in form of biobanks [OD:551; Fin:188]. They also foster commercial activities for biodiversity conservation in cases where the state reaches its limits. Other workshop participants viewed this aspect as less a market problem than an educational issue. Here, the public can be made more aware of biodiversity loss and its associated values, but by other means than offsetting systems [Red:452]. It was argued that the value of biodiversity cannot only be defined in monetary terms, but consists instead of a bundle of social, cultural, economic and ecological values. Challenges identified in this regard included the need to work towards more holistic valuation schemes that take multiple values into account [OD:480].

Enrolling private capital and initiative for nature protection

Regarding the additional value of biodiversity offsets, some participants highlighted that market-oriented offset approaches can help get the private sector on board with biodiversity conservation and, as an effect, add private land to the conservation system. However, it was also remarked that there is still no real biodiversity market of which to speak. Instead, credit trading is a hybrid, based on regulations where the state creates both the demand and supply and wildlife agencies are in charge of oversight [OD:5].

Expanding capitalism

Other participants regarded offsets as a neo-colonial tool that predominantly serves particular interests, i.e. developers and the economy, and is largely pushed by a market-oriented constituency that ignores the complexity of nature and the diversity of socio-ecological, cultural and institutional context conditions. In this view, market instruments are regarded as one result of a broader capitalist movement and an increased conflict of commons vs. capital. This standpoint was raised during the workshop debate and the question posed if it is at all possible to resolve biodiversity loss, as an ethical and political problem, by employing a market-based instrument like biodiversity offsetting. As one participant put it: “There is so much rhetoric around the table… why is biodiversity disappearing? … Because we do not have enough markets?” [OD:763]. If external costs are really seen as the problem, as it was argued, then the internalization solution should be taken more seriously. But if the logic of markets itself is the problem, it would be preferable to avoid using them as a solution. In this sense, the future of biodiversity offsets may also depend on a wider politicization of the conflict [OD:183].

3.2. Valuing biodiversity: How to trade off economic efficiency against socio-ecological complexity?

The value of biodiversity and related questions of how to define equivalents in terms of loss and take are issues that were controversially discussed. Generally, using biodiversity offset schemes implies finding trade-offs between the logic of nature and the logic of the market. There is an inherent tension between these two logics, i.e. acknowledging nature's complexity on the one side and searching for efficient ways to handle biological impacts on the other. Valuing biodiversity thus prompted a two-fold debate comprising the fundamental question of what an adequate view of nature might be and the apparently methodological and functional question of how to value and deal with nature in terms of adequacy and practicability.

A fundamental problem: Complexity of nature versus procedural pragmatism

The question of how to view nature and deal with various negative impacts, either from a holistic and complex standpoint or by adopting a reductionist and partitions approach, can hardly be reduced to methodological and functional design considerations. Worldviews and philosophical orientations about the intrinsic versus the instrumental functions of biodiversity and nature are often framed as mutually exclusive. At the outset of the workshop, some fundamental requirements for thinking about offsets were gathered. One participant commented that a basic attitude of "Yes, we want to compare nature here and there, we believe it is substitutable, if only for pragmatic reasons that we will not be able to save it anyway, and we think it can be done", [OD:628] is required to even begin thinking about offsets.

In parts of the debate, the trade-off between adequacy and practicality was understood in the sense that, on the one hand, sophisticated metrics are required to account for ecological differences and find ecological equivalents. On the other hand, simple metrics must be in place to ensure an economically efficient offsetting system to reduce transactional costs. Combining the logics of ecology and market poses a methodological dilemma: How is it possible to balance the need for ecological specificity with the coarse metrics favored by market practices? Can we argue that while current measurement systems are

imperfect, they are better than nothing? Is commitment to long-term monitoring and adaptive management a sufficient strategy to mitigate against the risks of incomplete or imprecise measurement systems?

In this context, one fundamental question that arose during the workshop was: Is it possible to resolve this dilemma with a methodological and functional approach? This question was challenged. A number of participants deemed sacrificing complexity in order to make nature tradable in practical and market terms inacceptable. With regard to methodological design considerations for offsetting and banking schemes, these participants raised doubts as to their usefulness for biodiversity protection and their capacity to achieve 'no net loss' objectives.

A methodological problem: finding suitable metrics

As reported at the workshop, several attempts have been made to solve this dilemma in methodological terms in the past decade. In Victoria, Australia, a frequently cited example at the workshop, complex, detailed metrics were developed to design more ecologically appropriate valuation systems. However, practical experience revealed that these metrics made it difficult to get a match between the offset required by a developer and an adequate credit. Often, no credits are available and developers need to find them on their own, a time-consuming, expensive process, which then becomes a political issue.

More commonly, participants in administration reported that they are working on simplifying the metrics to facilitate their application. Some were critical of their own activities, commenting that the "environmental movement hates this, but the developers are very pleased" [OD:1009]. Thus, how priorities are set in these cases becomes obvious. In the discussion on this matter, the business side replied that the members of their ranks have no real preferences as to the valuation technique itself. One proponent said that his company can accept every regulation as long as it applies for every company, therefore forming a level playing field for all as an important requirement for his company's own activities [BL].

Others said that the development of a suitable metric is difficult as there is still not enough information on this issue as a whole (see section 3.1 “Functions”). Overall, participants expressed a need for policy learning and a better integration of lessons learned. They also addressed the challenge of improved monitoring and enhanced data integration and provision for offset schemes. Extended monitoring over longer periods would help determine whether conservation goals are in fact met [Fin:106].

The problem of stacking

One topic that emerged during the methodological discussion about valuating biodiversity is “stacking”, i.e. the multi-functional use (and monetarization) of offset/protection projects or sites [Fin:940]. According to the participants, there are two ways of looking at stacking. The first is from a scientific perspective: Additional credits can only be sold if additional protection is in place. The second perspective is related to the policy objective of inducing conservation practices: Additional credits would increase incentives to set aside privately owned land for conservation. This is closely related to questions of additionality and legitimacy. Potentially, stacking can provide additional value if conditions for species preservation are also improved. If this is the case, current conservation sites may be upgraded [Fin:940]. Nonetheless, the legitimacy and possibility of stacking depends on how nature, ecosystems and biodiversity are perceived and the associated question of what should count as offsets. If offsets are understood as an ecosystem service then it is difficult to argue that additional types of credits (e.g. different species) can be produced by already protected areas [Fin:970]. But if offsets are regarded as the product of a site, stacking might be less problematic.

In the U.S. there are layered, stacked regulations in different protection laws. These would need to be parsed out [Fin:1102], which is also problematic as it would mean consolidating different services within one agency. Stacking, from an administrative viewpoint, must also entail de-stacking of the regulatory, jurisdictional side of the equation. However, as mentioned by participants, regardless of whether stacking is scientifically or legally valid, if it is not publicly understood it will be rejected [Fin:1192].

Biodiversity – living wholes vs. tradable commodities

The debate on valuing biodiversity continually touched upon the challenge of dealing with the complexity of biodiversity and ecosystems. Participants viewed biodiversity as far more than a collection of separate elements; instead, it is a complex function of networked elements and manifold links to broader socio-ecological and cultural contexts [OD:352]. Moreover, these contexts themselves are dynamic. Climate change adds to these dynamics, provoking changes in natural conditions: Not the protection but the development – both natural and anthropogenic – of biodiversity and nature should therefore stand at the forefront of conservation efforts [OD:352; OD:782]. As a part of ecosystems, biodiversity should therefore not be conceptualized as static; it involves dynamic change over time with a changing environment, changing landscape and changing value systems. Biodiversity and its protection need to be seen from a long-term perspective. Participants suggested 50 to 100 years as a reference frame [OD:480; 828]. This poses a problem for implementing conservation measures on the ground over the long term with a changing environment and with changing values and demands [OD:931].

The pledge for holistic and participatory valuation methods

In summary, the question of valuation is tricky terrain. As a future challenge, it was held that the valuation of biodiversity and ecosystems cannot be established independently of the local or cultural-political communities that defines them. Biodiversity does not exist as an objective value across social, cultural, and political boundaries. Values are politically negotiated, depending on the context and who weighs in on relevant decisions [OD:480]. As a major future requirement formulated during the debate, a critical evaluation of the appropriateness of valuating nature, most predominantly in monetary terms, was viewed as essential. Trade-offs between practical needs for market-making and the intrinsic complexity of biodiversity will need to be made explicit and potentially re-negotiated in a more open and participatory way. Therefore, more sophisticated and place-specific valuation methods are needed to prevent biodiversity from being reduced to simple metrics such as monetary values and acres. Moreover, they cannot be imposed across all contexts but determined in a holistic and participatory manner, taking different kinds of context conditions and values into account.

3.3 Standardizing: Toward unified biodiversity offsetting procedures?

Closely related to the issue of biodiversity valuation is the issue of standardizing offset procedures and thus questions about the advantages and disadvantages of applying unified measurement and compensation methods. Should compensation schemes, both mandatory and voluntary, operate under a standardized procedure? Should compensation regulations and metrics be the same across different areas, jurisdictions and countries? Do standards help to ensure quality compensation, ease permit processes and increase control efficiency, thus making them a step towards 'good' offsetting practices? Or are they more of a technocratic burden that prevents adaptation and undermines socio-ecological context sensitivity? Workshop participants advanced different positions concerning this issue.

The debate on standards was dominated by an inherent tension between two logics: A logic of local (socio-ecological) optimization and a (global) rationality of pragmatic economics. These two logics must be dealt with by offset and credit trading schemes. Within the first logic, necessary local adaptations are seen as an essential prerequisite for offset design considerations in order to account for both ecosystem complexity and stakeholder needs, thus enabling smooth and effective operation. Thus, room for negotiations and adjustments must be incorporated in offset designs. The second logic deals with the complexity of nature based on a simplified – hence pragmatic – approach that enables market efficiency and requires more centralized policies and standardized procedures [OD:551]. Currently, the trend towards the privatization and commercialization of compensation systems is accompanied by increased attempts to standardize biodiversity offset regulations and procedures, as acknowledged by most participants.

Reasons for standards

One line of argumentation for the use of standards is their provision of certainty, an added value for the involved actors, i.e. providers, users and responsible authorities [Fin:547].

From an administrative perspective, standards are seen as statements or symbols of political will which the state uses to demonstrate that biodiversity conservation is high on its political agenda and to recognize its stewardship role. Standards send a clear signal for the need for quality compensation by defining clear processes and decision-making procedures which apply similarly in all contexts. Standards become independent of specific context conditions such as ecological, social, institutional and cultural particularities, as well as the development and compensation situation. These features are what makes a particular offset procedure transparent and replicable.

Moreover, standards are recognized by many users as a 'technique' that applies to all involved actors, hence providing security. As such, they offer guidance for agencies, providers and developers at the national level, and reduces discretionary power at a regional level [OD:1104]. In addition, standards might improve quality control, as was successfully proved in the context of wetland banking: Mitigation providers had to fulfill higher mitigation standards than other compensation providers, leading generally to more (ecologically) effective results.

Particularly in light of growing business opportunities on a worldwide scale, workshop participants noted that market actors need to have an easy, clear and reliable compensation procedure that guarantees a "level playing field" [BL] and fairness among all users. As one participant said: "If you want business to be part of the solution, you need to make it easy for business, give it certainty, clarity, move towards this severance and viability" [OD:682]. Without equivalent standards across different methods of mitigation, banking cannot work [OD:782]. In contrast, weak or non-binding standards may cause inefficient ecological outcomes, as it was also mentioned.

Difficulties with standards: Diverse contexts, purposes and functions

A contrasting line of argumentation relates to difficulties with standards with regard to diverse contexts. Many participants see problems with standardized offset approaches. Their simplicity goes against the complexity of ecosystems and societies. This critique can be expressed as philosophical differences concerning what nature and biodiversity is, what offsets are, and what markets should be and can accomplish [OD:512], as well as the priorities assigned.

Standards may ignore particular context conditions and situational particularities. They imply that one particular way of proceeding and reasoning, including its philosophical and functional underpinnings, can be implemented over a range of different contexts and alternatives.

However, as it was highlighted, society's values are highly plural, existing among different actors, contexts and cultures, and must be recognized in all nature and biodiversity-related regulations. Otherwise, compensation schemes can only come to bear, not by representing situational values of nature, but by imposing of a concept and an approach to valuing nature which has been designed at a distance and which forcefully asserts itself as a shared reality of nature. Effective implementation then implies that practices of engaging with nature also change to comply with the new regulatory concept, thus risking opposition and failure. Therefore, accounting for diversity is regarded as a necessary requirement for any institution in order to work towards embedded and accepted solutions that are supported by the concerned stakeholders' and that do not result in problems after implementation. While there is a need for practical compromises between general applicability and context sensitivity for policy design decisions, standards provide less room for contextual decisions compared to other options.

Furthermore, the issue of standards also bears a dynamic problem dimension: Like the world, societies and politics are changing. Understandings of biodiversity and its worth, too, are a matter of underlying dynamics and changes. Therefore, sustainability planning and management generally require dynamic governance patterns that pick up on these changes [OD:512]. To sum up, with regard to biodiversity conservations, agile and flexible approaches appear to be essential.

The challenge of quality assurance and a sufficient resource basis

If standards are adopted, the next critical question is how strict and binding they should be for establishing biodiversity offsets. Standards could provide quality assurance for offsetting practices, as they help counter arbitrariness and misuse. However, participants expressed worries that standards cause more problems after implementation because of their tendency to ignore context particularities and to impose a certain social order and set of values

that were negotiated by a closed group of experts. Among the workshop panel, preference was given to a strong regulative framework with 'minimal' standards that leave room for adapting to individual cases and for bargaining. This image can thus be interpreted a compromise on the standardization issue. As a necessary precondition for quality assurance it was emphasized that standards, when applied, need to be enforced and controlled. However, law enforcement, control and continuous monitoring depend on available resources, and resources are one of the limiting factors for efficient biodiversity conservation in general, and compensatory mitigation in particular. The need to ensure quality compensation in the long run, including sufficient resources, was identified as another challenge.

Politics and risks of standardization

At several junctures, critics of conservation trading systems circled back to the fundamental limits of market-oriented approaches for dealing with environmental problems like biodiversity loss. The extension and wide-ranging standardization of market-based governance systems amplifies their risks. One risk is the creation of perverse monetary incentives: Measures are undertaken to spend funds available through development projects rather than foregrounding their ecological effectiveness. Even though biodiversity credit trading is not (yet) a speculative market, it is a regulated market that poses certain risks [OD:433]. The potential of misuse caused by speculation dynamics was a further topic of discussion, as witnessed during the financial crisis or carbon credit trading [OD:183]. To aggravate matters, highly complex algorithms and expert discourse surrounding biodiversity offsetting, valuation and banking mechanisms end up hiding corruption from the public [Red:229]. Skepticism prevailed regarding the quality of compensatory conservation by private and commercial providers [OD:100], as well as the potential arbitrariness of trade-offs based on few expert opinions, merely serving to move corruption into the math. Risks of free riding were also mentioned [Fin:652].

3.4 Context: Is the working of biodiversity offsets depending on context conditions?

Running counter to the debate on standardization is the issue of how much the implementation and operation of offsetting schemes depends on particular context conditions. The workshop debate therefore touched upon the question of how much context sensitivity is required of biodiversity offset systems and what framework conditions are needed for context-sensitive functioning.

The importance of context for biodiversity offsetting

Most participants acknowledged that offset design and use has to be specific about the ecological, economic and socio-cultural context conditions that aid their function – and those that impede it. This applies for all types of policy instruments in order to understand the particular situations in which instruments can work and to develop a suitable policy mix [OD:321; Fin:820] for desired policy outcomes [Fin:862]. Several challenges were discussed in this regard.

Beginning the debate on this issue, similar to previous issues, many participants highlighted the importance and relevance of contexts. Two basic camps emerged: Some actors argued that the reality of diverse, locally specific and relationally networked ecosystems, as well as diverse social perspectives and practices of engaging with nature, requires a participatory, case-by-case approach to appraising compensation options. Other participants focused on more general key conditions they viewed as necessary operating prerequisites for offset schemes, particularly with regard to flexibility to account for particular context conditions.

The necessity of strong regulatory frameworks and governments

State guidance and oversight is a necessary precondition for biodiversity offsets, as conservation targets need to be defined, set and enforced by governments [OD:604]. In this vein, many participants assumed that making offsets work (i.e. to fulfill conservation targets) is a question of designing ‘good’ regulation for a quasi-market system – i.e. “the better the regulation the better the market” [OD:433].

They maintained that, if done correctly, biodiversity offset and banking approaches could deliver their promised advantages, i.e. add private lands for nature and species conservation more efficiently, effectively and consistently than other alternatives. By the same token, this view holds that the added value of offsets lies in fostering compromises between conservation and development, and making such compromises or trade-offs transparent and explicit [OD:902]. It was suggested that offsets and banking as new biodiversity conservation instruments can help institutionalize long-term efforts and promote better administration in this regard [OD:480]. In terms of forces that could hinder administrative innovation, some participants stated that there is currently little responsibility for high-quality offsetting on the part of state officials and thus a lack of political will.

Many participants said that for the efficient operation of offset systems, it is important to have a strong regulative framework [Fin:86, Fin:220, OD:828]. However, in terms of limiting factors, strong regulatory frameworks do not exist in all countries [OD:735]. There are major differences in governance capacity, in particular between developed and developing countries. Here, feasibility varies widely [OD:152]. Particularly in developing countries, ineffective compensation deals are made due to corruption and power imbalances. Participants with experience in these contexts further explained that payments for nature conservation often disappear. Private armies are required to save protected areas from illegal logging, poaching, etc. Governments do not guarantee the full protection of compensation areas, e.g. they retain sub-surface rights like mining, oil, gas. Therefore, it is very risky to invest in compensation schemes in developing countries, because severance and liability is not guaranteed [Fin:1164]. In most countries, therefore, applying offsets is not an option for biodiversity conservation on a large, i.e. institutionalized scale, as the definition of conservation policy and objectives and their enforcement is often lacking or weak due to the specific political situation [OD:403].

There were also advocates of softer regulation, who viewed stakeholder negotiations in voluntary schemes, for example, as an appropriate mechanism of governance, in particular in country contexts where appropriate policy frameworks are absent [Fin:139].

The existence of defined (government) protection targets

The existence of publicly defined protection targets was viewed as a necessary precondition for installing offsets and credit trading schemes. These types of targets need to be integrated in protected areas regulation and/or national conservation targets and policy.

Similar to the discussion on standards, the targets express a government commitment to nature conservation and hence to securing biological assets. Many participants viewed the existence of an institutional framework and defined biodiversity protection targets as a starting point for thinking about the usefulness of biodiversity offset schemes. Only then is it possible to ask whether offsets are an attractive and feasible instrument [OD:403]. Offsets do not work unless government-defined conservation targets are in place [OD:604]. Related to this point, governments can also install a limit to offsetting, i.e. defining where biodiversity offsets are not an option to compensate for development of any kind in a specific area, as witnessed in New Zealand [OD:604].

Interaction of offset schemes and other instruments

Biodiversity offsets and credit trading schemes are seldom used as a sole policy for biodiversity conservation. Commonly, offsets are one tool among many others in the realm of biodiversity conservation and nature protection. Therefore, one should not overemphasize the distinction between the market and legislation as distinct alternatives as it was stressed by workshop participants. Both types of instruments can interact [OD:828]. Many participants found that, ideally, instruments should be mutually supportive.

In light of these considerations, a sound institutional interplay was identified as an important element for generally increasing the institutional effectiveness of biodiversity conservation and the resilience of social-ecological systems. Problems of interplay can occur when institutions have not considered their impacts on related institutions and their performance over time. The interplay between institutions can also be seen as a result of their functional interdependencies in terms of social or ecological relations, or as interdependencies formed by political design for strategic purposes.

Because offsetting and banking emerged spontaneously [OD:971], one future challenge identified in this regard is that a sound interplay with existing institutions must be purposefully created. It was argued that a close cooperation between responsible actors, in particular oversight agencies and judiciary bodies, is highly important. In this context, it was remarked that emissions trading could provide an instructive example for offsets, e.g. with regard to the problem of finding a baseline [OD:858].

The need for complementary conservation instruments

As it became clear in the debate on fostering framework conditions, biodiversity offsetting is particularly effective in combination with other instruments. Useful complementary instruments for offset and banking discussed at the workshop were strict offset regulations. Here, it was emphasized that the regulation of offsetting does not necessarily refer to market regulation, but can also take the form of case-by-case regulation schemes [Fin:87].

Additionally, besides the existence of defined (and traceable) conservation targets, mapping tools were considered helpful to guide where conservation happens and/or where it makes sense in the future (e.g. California wildlife connectivity map). Participants argued that mapping tools with GIS help assess suitable compensation sites for banks. They may also be used, for example, to connect existing conservation areas as corridors or to protect ecologically valuable areas where no conservation measures have been applied so far [Fin:886]. It was found that, ideally, offsets and banks should be integrated in land-use planning systems at the local jurisdiction level [Fin:820], and thus become linked to the existing protected area systems and conservation planning at the landscape level [Fin:652] by means of strict enforcement or a rigid mitigation hierarchy.

However, similar to the absence of conservation regulations and targets, most countries do not have landscape and regional planning approaches or the systematic application of mapping tools in place. In addition, the logics for establishing offsetting schemes and banks, as it was noted, are not just guided by ecological and institutional concerns but also by economic interests of the private sector [OD:5].

The need for long-term financing

Participants stressed that the operation of biodiversity offsetting schemes requires sufficient funding. This not only concerns planning and permitting on the part of agencies, but also their management and monitoring in the long run. Providing sustainable funding is therefore a key issue. In this context, some promising solutions existing in other countries were discussed, e.g. in the Brazilian system where 0.5% of funding for each project is allocated to a central fund to invest in protected areas [Fin:605]. Also offsets can be financed by a dedicated fund for site maintenance and management. Some argued that the fund would ideally be kept separate, under independent regulation and outside of the country where the banks operate; however, this would be expensive [Fin:1140]. Further funding alternatives include taxes (what effectively underlies and feeds the fund) [Fin:622]) – although taxes include an overly simplified metric and, as such, might be even less preferable than offsets [Fin:652] – or fee-based systems [Fin:532].

Uncertainty and lack of experience

One of the main challenges formulated by workshop participants pertained to the sizable amount of uncertainty about biodiversity offset systems design, operation and impacts. Regardless of what function is implied, the question of whether biodiversity offsets are relatively better or a worthwhile complement to policy alternatives cannot be answered because experiences with offsetting systems are still recent, and information incomplete and scattered. There is insufficient knowledge about offset approaches and its impacts, and no baseline scenario exists for measuring their effectiveness and efficiency. Consequently, markets cannot be compared with alternative instruments, such as nature reserves [OD:321]. More pointedly: There is simply no information about what would happen in terms of biodiversity protection with or without offsetting [OD:858]. The careful evaluation and comparison of policy outcomes resulting from offsets and alternative approaches should thus be conducted to determine whether the main promises are fulfilled and to learn about policy impacts. Hence, ecological as well as social expertise needs to be developed and put in place to evaluate the issues of implementation adequately. In addition, the full range of policy options should remain debatable without either edging out or promoting certain approaches due to their popularity.

3.5 Legitimacy: Do compensatory valuation schemes fit local and cultural needs?

The legitimacy of biodiversity offsets and valuation schemes came up as an issue in the workshop debate and with it the question of whether compensatory valuation is in line with the needs of local and/or broader populations for dealing with and conserving biodiversity. Legitimacy issues touch on ethical concerns, for example that compensation schemes provide a permit for destruction, or a "license to trash" [OD:100]. This begs the important question: Do biodiversity offsets make it possible for developers to continue with their projects in any case?

Critics emphasize this risk. Workshop participants who fell into this category argued that offsetting schemes create loop-holes for industry to evade publicly legitimated environmental policy and regulations regarding infringements on natural habitat. Offsets may be used to "greenwash" highly destructive projects. Generally, the offsetting approach prioritizes economic development and efficiency goals at the expense of existing nature protection regulations [BL: 824].

On a functional and practical level, a contrasting position was brought up in the debate related to the strict application of the mitigation hierarchy. The mitigation hierarchy was developed hand in hand with the offsetting idea. Its use is meant to ensure that offsetting always remains the last option after other mitigation steps – such as avoiding or minimizing impacts – are not practicable. In this perspective, offsetting is more of an exception than a common practice. In addition, as previously mentioned, there is a need for strong regulative frameworks and strict agency oversight to ensure that "no go options" do exist. Designing an institutional framework and regulating offset practices is therefore an important requirement for preventing misuse [OD:682]. However, both the mitigation hierarchy and agency oversight include subjective and hence political judgments of which development or mitigation strategy is regarded as acceptable and which is not. In sum, the mere existence of these instruments is no guarantee that offsets will not be used as a blueprint for developments, but at least they exist.

On a general level, for some participants, a lack of legitimacy exists on the side of the public, since it does not see the need and the costs associated with high-quality biodiversity conservation. Because the public is not willing to pay for biodiversity conservation in other forms, e.g. through higher taxes, so the argument goes, offsets are one of the remaining solutions to get the private sector on board with meeting conservation demands. As such, this problem of legitimacy also boils down to an educational problem: The public needs to understand why biodiversity conservation is important, along with the related costs. At this juncture, a link was established with environmental justice [BL]. It was also argued that costs are not the only value of biodiversity, but that value, even from an anthropocentric perspective, amounts to more than a common, reductionist expression in monetary terms.

Therefore, it was argued, the value of biodiversity and the legitimacy of conservation practices can only be determined and justified within particular contexts, which are determined by cultures, ecosystems, politics and concerns. The public needs to gain a better grasp of these topics, otherwise corruption will be shifted into the math [Red:229].

Holistic conservation and compensation mechanisms as future challenges

In functional terms, a further key challenge for biodiversity offsets in the future is not to lose or water down the mitigation hierarchy, as well as to counteract stacking, as both may threaten the legitimacy of offsetting [Fin:188]. It is a “constant battle to strengthen the mitigation hierarchy” as one participant stated [OD:1104]. Having clear criteria or cornerstones for offsets is also an advantage for industry and developers, as they need a reliable severance mechanism [OD:710]. Moreover, it was mentioned that one should not only argue in terms of costs as the main source of legitimacy for biodiversity conservation. The development of compensation mechanisms should not be restricted to monetary terms; instead, it needs a procedure, including a valuation system, that generates legitimation by showing the value range of loss and that compensates for all types of damage [OD:480]. An accepted and holistic mechanism and metric will constitute an important future challenge.

3.6 Social life: What drives and shapes the innovation of biodiversity offsets and banking

In addition to questions of how context conditions, development and conservation needs shape the future design of biodiversity offsets and banking approaches, the innovation process itself creates momentum and introduces social dynamics into the design process. These social dynamics of innovation in biodiversity governance emerge from the distributed activities and interactions of actors who engage with questions of offsetting schemes. As part of a reflexive approach to innovations in biodiversity conservation, these types of dynamics can be monitored, anticipated, and perhaps modulated, if not planned and steered. In this sense, reflecting on innovation dynamics and the various influences and strategies by which actors engage, or are likely to engage, with further developments forms another critical issue for the future of biodiversity offsets.

Non-intentional innovation processes

In explaining the dynamics of offsetting, one reason mentioned by participants can be found in its beginnings, in how the idea emerged. The concept of offsetting and banking did not result from the careful design of an alternative instrument for biodiversity protection, but can be better described as a historical 'accident': It emerged as an idea in practice that seemed to work in a particular conservation context. As one participant remembered: "It emerged as a workaround, has fallen upon us, carrying different meanings with different actors" (cf. in the U.S., these practices started in public banks and have then moved to the commercial sector) [OD:5]. As such, some participants felt that the concept of conservation credit trading has not fully matured, and potential alternatives, like a fee-based banking program, need to be created from scratch.

As it became clear throughout the workshop, biodiversity offsets are not shaped by single actors or actor groups (as suggested by the scenarios in the appendix), but through the interaction of many different actors and interests. These interactions involve different perspectives on biodiversity offsets as their common object of engagement, different expectations about its future, and different values to assess the success of its application.

The future of biodiversity offsets is thus the result of distributed and heterogeneous agency among, inter alia, ecologists, economists and landscape planners, administrative officials, business entrepreneurs, land owners and so on. This diversity of actors, interests, ideas and conceptual underpinnings should be reflected, along with the various direct and indirect linkages and influences they bring, particularly with regard to the ability of single actors to intentionally steer the logics involved in the design process [OD:20; Fin:352].

Supply push and marketing by offsetting experts and professionals

Another cause discussed for the rapid growth of offsets and banking on an international level is the business and industry sector emerging around these instruments. Business lobbies for simple methods, universal coverage, and cheap credits.

For a pragmatic approach to impact mitigation, developers, service providers and overseeing agencies require simplicity and stability. As a result, complex algorithms in the U.S. were converted to compute acreage in the 1980s [OD:5]. Again, the dominance of a neo-liberal imperative has led to the question of how to render ecological complexity in a form that is as abstract and transportable as a commodity. In the words of one participant, studies must be “designed so that the output from the ecological models can be used as an input for economic models”. Participants also acknowledged that this hierarchy will rankle some ecologists [OD:5].

However, lobbying power and developers’ needs not only result in simplified metrics, they also influence the positioning of banks: “We have a big market-driven enterprise coming in that is very powerful and those interests are driving where banking is going in our state” [OD:971]. Deals often permit the destruction of nature for monetary compensation (e.g. pipeline, oil and gas field development). Then money is available and involved actors seek out ways to spend it to legitimize the economic development [OD:100].

Additional drivers for offsets and banking approaches in the future will include their tendency to require specialization, scienticization, and technization. Designing, applying and monitoring offset schemes requires professionalization in terms of consulting and infrastructure.

The concept of offsets is old; what is new is that it “now involves a specific sort of technical economic discussion” [Fin:634] and dedicated experts dealing with them as previously highlighted. Currently, the expert side is still emerging and has not yet stabilized. There is no dedicated journal on this topic, and more research is needed to answer basic questions [Fin:722]. At present, at least. But these elements will come.

In this regard, many participants felt that innovation in governance should not be an end in itself, but must be oriented towards long-term improvement [OD:512]. From this perspective, it is debatable whether future developments will lead to an extended and widely applied common system for international offsets and credit trading (e.g. for migratory birds [Fin:106] or whether critical reflections will prevail and alternative conservation policies feature prominently on the political agenda.

4. Towards responsible governance innovation processes

The objective of the “Challenging futures of biodiversity offsets and banking” workshop was to identify challenges for the future of biodiversity offsets and banking and to initiate an anticipatory and reflexive discussion of their wider implications and possible repercussions. All issues that are reported on in this document originate from the workshop but were of course also subject to our interpretation. With this report, we would like to disseminate workshop results and feed them back into the community, along with our interpretations, in order to continue a societal debate about the future of biodiversity offset design and use.

During the workshop, controversies arose as to whether and how biodiversity offset and banking schemes should be designed, used, and governed – today and in the future. Acknowledging diversity and contextual differences influences perceptions about the usefulness of offsets and about questions of the value of biodiversity and nature. Setting offset standards for quality assurance, fostering legitimacy and a level playing field conflicts with beliefs that biodiversity conservation needs to stay open to situational contexts, and be subject to participatory decisions. Moreover, questions about the influence of the state versus the power of the market led participant to formulate different framework requirements for offsets to work. From our perspective, these controversies are rooted in fundamental differences – i.e. different philosophies and worldviews – that largely follow an ecological/intrinsic or an economic/anthropocentric rationality. Markets need exchangeable units shaped by forces of demand and supply; they require a simplification of nature and its functions. This presents a sharp contrast to ideas of complex, diverse and dynamic ecologies and ecosystems that bear multiple, i.e. social, political, cultural, and intrinsic values, extending beyond market logics and their basic conceptual capacities.

These tensions seem to be fundamentally opposed, even though proponents of market-based solutions continually suggest that they are not. As a matter of social reality, these worldviews often appear to be taken for granted by individual actors and, within the reality provided by these views, actors make themselves believe that they are pursuing an ‘objective problem-solving’ approach.

They then come to different design principles for biodiversity governance and to different perspectives on suitable solutions, leading them to favor one or the other configuration as more rational, practical, or promising and to assess certain questions as fundamentally resolvable, or not. As an effect, because their perception of policy problems and solutions also differs fundamentally, proponents of one or the other worldview tend to get separated on different 'tracks' in the design process for biodiversity governance approaches. In the workshop, these differences came together in the debate as the established design discourse was challenged by fundamental critics of market-oriented approaches in nature conservation. We are aware of the fact that no one dogmatically follows one single worldview, but that we all bring many different, even mutually conflicting logics to any situation. Our general approach is to rethink the issues identified in the workshop debate in the light of this perspective.

In the course of the debate, technical issues turned out to be political issues: Questions about the value of biodiversity, the nature of the biodiversity loss problem and suitable solutions were controversially discussed by a plurality of actors with different positions, perspectives and interests, with different views of the world and expectations as to how it can be shaped. This diversity is at the heart of politics, it is the multiplicity of values, aspirations, views of the common good, biodiversity, etc., which has to be negotiated and balanced politically in continuing processes of pragmatic decision-making and contestation. Nonetheless, all of these issues and points cannot be resolved in a neutral and objective way. Instead, it is a question of negotiating heterogeneous perspectives on reality, rather than objectively solving existing problems. Hence, biodiversity offsets are not neutral but they are political. It is important to have in mind that deciding for market-oriented conservation approaches and offset and valuation schemes is a political process involving subjective decisions about how to deal with biodiversity in the long term.

We aim to relate positions on technical design questions with general questions of worldviews and values, as a stepping stone for a constructive and future-oriented discussion. One main challenge we see for the future of biodiversity offsets and banking is that decisions and underlying rationales need to be made transparent and that a larger set of concerned societal perspectives must be included in the debate: Which logics drive arguments for and against

installing biodiversity offsets? How can the value of nature determined – can it be determined at all? Who should be consulted and involved when making decisions about these kinds of tools?

We believe that a critical reflection about the chances, risks and limits of offsetting schemes and an open discussion of the preconditions and ambiguities related to design questions can help improve biodiversity policy design. An open debate enhances our understanding of the expected impacts of biodiversity policies, increases their context sensitivity, improves the quality of their outcomes, and helps us become more aware of the dynamics involved in policy innovation. By reflecting the needs and visions of involved actors, designs can be continuously improved and adapted to changing conditions and requirements. At times actors may also find that a certain design does not work at all and should be abandoned. Singular interests and power structures, intrinsic or extrinsic to biodiversity offsets, should be faced and debated. In times where the discourse on the suitability and design of biodiversity offsets is still open, these debates and reflections may help to increase the societal embedding of biodiversity conservation approaches.

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Appendix A: Scenarios for biodiversity offsets and banking

Against the conceptual backdrop of innovation dynamics in governance, especially related to the increasing institutionalization and closure of design discourses, and in view of current developments in biodiversity offsets and banking, which we diagnose as being on the verge of a transition towards stabilization into global models, we have identified a series of diverging future developments paths. We describe these paths in three scenarios to invite actors to explore the issues that are at stake for the future design and use of biodiversity offsets and banking.

In these scenarios, we integrate patterns and storylines that have been developing in biodiversity offsets and banking over the past forty-odd years. We especially pick up on basic tensions that shape the dynamics of innovation and singled out three broad orientations that are active in the making of biodiversity offsets and banking. The first involves a business orientation in which the development of biodiversity offsets and banking offers opportunities to market special products and services. The second is a cultural-political orientation in which the development of biodiversity offsets and banking is a quest to implement certain forms of social order involving specific local power struggles related with it. The third orientation is scientific in nature: biodiversity offsets and banking provide a field for developing and asserting theoretical knowledge of the world. The chosen emphases were each isolate to create scenarios in which one of the three orientations was dominant, i.e. how would the innovation journey of biodiversity offsets and banking unfold over the next twenty years, if business, politics or sciences comes to dominate its development?

The results can be found in three different scenarios which are not meant to represent the most plausible, nor most likely, let alone desirable futures of biodiversity offsets and banking. But the scenarios provide a provocative point of departure, stimulating questions, thoughts, embellishment, amendments, objections, rectification, and debate about what are the challenges and issues when thinking about the future of biodiversity offsets and banking.

Scenario 1: Towards interlinked biodiversity markets

Abstract

This scenario presents a pathway of future developments in biodiversity offsets and banking in which we see the emergence of gradually interlinked biodiversity markets. A globally active biodiversity and ecosystem services industry success-fully links up with international policy initiatives and pushes for the use of market-based policy options for biodiversity protection. Providing support to decision makers, established players such as Ecosystem Marketplace and *BBOP become global experts for policy design and implementation. The newly established International Biodiversity Association, a network of powerful service providers, regulatory bodies, and leading scientists, finally paves the way for a unified understanding of the problem of biodiversity loss. The network also helps link various bio-diversity markets around the globe.*

The immediate future

In the aftermath of the *Rio+20 United Nations Conference on Sustainable Development*, it becomes painfully clear that not enough has been done to stop biodiversity loss. Negotiated targets have not been met and there is an increasing awareness that biodiversity loss is an environmental problem of the same caliber as climate change. The general sentiment is that something needs to be done, soon.

A new international agreement is forged among *CBD* members. The idea is to commit to a radical reduction of biodiversity loss by 2050. The biggest question is, of course, how this can be achieved. As shown by the past, simply setting up targets has not proven to be a viable strategy. Concrete policy options need to be on the table. A new *CBD* working group on policy approaches to biodiversity protection begins to compare and evaluate the existing set of policies. The challenge is to provide a systematic overview of the available options. A general finding is that several instruments already exist and have been put to work in different policy-making contexts with mixed results. Now, the only question is which of these tools promises the best results for future use.

Advocating the business case for biodiversity protection

The current interest in working on the "toolbox" for biodiversity protection, which is also present in academic circles, provides a window of opportunity for those who have advocated the business case for biodiversity protection in the past. Businesses that have become active in the provision of banking and certification services in the U.S. and Australian mitigation banking systems join forces with pro-market think tanks and initiatives like *Forest Trends* or *BBOP*. They start to advocate market-based policy options for biodiversity protection more aggressively than ever before.

Forest Trends, in cooperation with key authors of the *TEEB* study, finances "*Two More Inconvenient Truths*", a documentary film which not only tries to educate the broader public about biodiversity loss ("Truth No. 1"), but also to argue that the only viable solution to this problem is harnessing the business sector and the power of markets ("Truth No. 2"). The movie is screened in major cinemas around the world and becomes one of the best-selling and most watched documentary movies ever.

In the debates about the best policy approach to biodiversity loss, the market-based camp has three significant advantages. First of all, this group is much better organized than advocates of alternative approaches, since it has worked to build a lobby for quite a few years. Second, it can point to the U.S. and Australian mitigation market schemes as working models. Third, it can easily affiliate itself with the more general trend toward market-based policy instruments, arguing that in the field of biodiversity protection, market-based instruments make even more sense than in other areas, since much of the land that could be used for protection measures is privately owned, and can therefore hardly be "harnessed" through regulatory approaches.

The third point is important also because, on the international level, key institutions such as the *OECD*, *UNEP*, and the *CBD* have already shown great interest in market-based solutions in the past. With Europe meanwhile implementing its *Natura 2015 Habitat Banking Scheme*, it seems that the market-based approach to biodiversity protection is on the rise as a dominant policy model.

Global experts for policy design

More and more countries that previously did not have any biodiversity protection measures in place now start planning and implementing their own policies. Many of them turn to experts in the pro-market constituency for help. The promise to support economic growth while still achieving conservation targets convinces various political decision makers, both in national administrations and on the international level. In this context, *Ecosystem Marketplace*, *BBOP*, and a number of other think tanks successfully develop into global experts for policy design and implementation. The "*State of Biodiversity Markets*" reports, published annually by *Ecosystem Marketplace* and, since 2015, in cooperation with the *World Bank*, become widely consulted as the most up-to-date information on the development of biodiversity offset and banking schemes around the world.

Alternative approaches to biodiversity protection increasingly take a back seat in national and international policy discourses. This happens despite the fact that critical NGOs and ecologists organize protests in various countries and at international meetings. Even a number of scandals and fraud cases, such as the creation and sale of "empty credits", do not result in major shifts in the general pro-market political mood. On the contrary, these scandals as well as the work of NGOs to reveal them ultimately contribute to the iterative improvement of market schemes and the establishment of stricter rules for generating credits.

Pioneering the development of biodiversity markets since 2004, *BBOP* becomes widely recognized as the leading expert for biodiversity offsets and banking standards. The organization has comprehensive technical expertise on how to set up markets, credits, etc., and acts as a key resource for the international policy world. In reaction to recent scandals and increasing NGO activism, *BBOP* organizes participatory workshops that include the concerns and suggestions of critics to create better policy guidelines.

Working towards a transnational biodiversity market?

The *International Biodiversity Association (IBA*) is founded in 2020. Its members include biodiversity service providers (banks, certifiers, etc.) and

regulatory bodies from all major biodiversity market schemes around the world, as well as nationally or internationally active think tanks. Despite their widely varying interests and backgrounds, all actors within the *IBA* are committed to developing a unified understanding of the problem of biodiversity loss. They advocate the power of market-based approaches for efficient biodiversity and habitat protection and – last but not least – the expansion of business opportunities.

Based on these developments, in conjunction with the operation of more and more biodiversity markets around the world, the idea of linking different markets, and the potential that it might hold, becomes a new topic of debate. Especially the larger service providers (e.g. *Green Inc.*, a consortium of biodiversity banks already active in different national schemes) envision new business opportunities in a network of interlinked markets.

The major damper to the proposed interlinking of market is the problem of the equivalence of biodiversity losses and gains. Until this point, credits can only be traded on a local level, even within national systems. Only a few newer systems, such as that in Korea, permit a broader trading of credits. While such "national equivalence" schemes are embraced by many on the biodiversity business front – and viewed as models for interconnected credit trading – the majority of ecologists see them rather critically, arguing that "giant pandas and snow leopards are hardly interchangeable".

At the end of the decade, biodiversity markets have become the ultimate policy solution to the problem of biodiversity loss. It becomes increasingly difficult for policy makers in charge of biodiversity protection to argue against the implementation of market schemes. Through *IBA*, the internationally organized biodiversity market constituency gains lobbying power and develops into a powerful political actor, pushing for the expansion of "their" instrument. Even though the potential linking of markets remains an open-ended debate with a variety of pros and cons, as a high-ranking spokesman summarizes at the end of the *COP 20* meeting: "The *CBD* is the first international convention to ever have had 'teeth' and really achieve the institutionalization of a policy for the provision of global public goods!"

Scenario 2: Unique political natures

Abstract

This scenario portrays a development in which basic assumptions about eco-systems, and with them concepts of ecosystem management, become politicized in public debates. Practices of defining and delimiting ecosystems as well as their functions become understood as inextricably linked to cultural framings and predispositions – and thus an issue affecting plural perspectives that need to be taken into account in order to make legitimate decisions about what nature is and what it is worth. International negotiations are torn by different understandings of biodiversity, both around the world and among decision makers. International market-oriented initiatives for a standardized framework of ecosystem measurement and assessment only take hold in a few countries. However, the actual diversity of biodiversity protection schemes is not easily eradicated. Protests against the "commercialization of nature" and cases of market failure prevent the large-scale application of biodiversity markets. Instead, biodiversity protection becomes a toolkit from which stakeholders pick and assemble concepts, elements, and tools as policy solutions for specific local projects.

The immediate future

In 2013, a broad range of cultural framings of nature, different concepts and methods of ecosystem analysis, and a slew of policy measures are applied in nature conservation and biodiversity protection. In addition to regulatory, cooperative, and voluntary protection schemes, the establishment of environmental markets for ecosystem services and biodiversity credit trading are intensely debated. However, the discourse is as fragmented as the practices in use.

Some transnational initiatives led by networks of pro-market governmental and non-governmental organizations push for marked-based biodiversity protection. Other governments, civil groups, and environmentalists resist attempts at unification and pledge their commitment to a more diverse and context-based framing of political problems and potential environmental protection strategies.

They argue, theoretically as well as in practice, for the active involvement of local stakeholders in specific local and regional governance schemes. The global managers of biodiversity at *CBD* and *IPBES*, and the *European Commission* struggle for more integrated, and preferably market-based, solutions to combat biodiversity loss. This is the context in which they see the most potential for effective policy innovations.

Protests against the commercialization of nature

Many environmental groups and indigenous people oppose the globalization of conservation and the marketization of biodiversity protection. They criticize biodiversity credit trading as a measure that disrespects the actual cultural and ecological complexity of "ecosystem functions" and for the perverse incentives it sets. These groups call for deliberation by concerned citizens and local political processes to establish governance arrangements that are a good match for specific contexts.

Many scientists, especially ecologists, highlight the risks of market solutions. Their central message is that ecosystems are too diverse to become commodified and treated as equivalents by over-simplifying measurement schemes, especially when these comparisons involve very different and geographically distant habitats. Instead, they claim that regional consultation and participation processes are needed to ascertain specific ecological, social, and economic needs. Their main message is that context-sensitive solutions should be sought out and global plans of action avoided.

Many of the protesters are bolstered in their opinions by recent examples of market failure. In 2015, the European carbon trading market, afflicted by various scandals in past years, finally breaks down due to all its flaws. Other negative events occur in specific instances of biodiversity credit trading. A German Newspaper reports about *Green Inc.,* one of the largest biodiversity credit traders and the market leader in the U.S. mitigation banking. The corporation comes under public scrutiny due to its hostile takeover of nature reserves in developing countries while it simultaneously blocks sustainable use by local inhabitants.

Additionally, *CIMB*, an influential Malaysian bank, becomes involved in a scandal over the sale of biodiversity derivatives for non-existing bio gains. Similar problems occur in carbon credit trading, and the risks of environmental markets start to become painfully evident.

No standardized biodiversity protection scheme in the EU

In response to the breakdown of the carbon trading market, the European Commission withdraws its plan to establish an EU-wide biodiversity offset system, including standards on the metrics, certification, and accreditation of biodiversity credits. Respective attempts to amend the *Environmental Impact Assessment (EIA)* and *Strategic Environmental Assessment (SEA)* framework for standardizing mitigation/compensation for development impacts are put on ice.

Instead, *the European Commission* returns to its initial strategy of simply setting up targets for reducing biodiversity loss. But even here, increased flexibility is allowed for certain nations, and also regional populations that immediately interact with and inhabit protected and other areas, to develop their own conservation philosophies, goals, and measures.

The “no net loss” rhetoric becomes problematic with increasing recognition of the actual diversity of ascertained values – and thus losses – of nature. Responsibility for environmental protection is left to the member states, while according some special rights to local minorities and concerned groups. Viable approaches are seen as those which are based on specific socio-political, institutional, and biophysical conditions. Environmental protection becomes part of an ongoing political debate on collective values and identity. Offsets and banking sometimes appear as elements in locally negotiated conservation strategies. However, as a pragmatic basis, implicit agreements on the “nature of nature” do not provide the required reliability for large-scale commercial investments.

Conservation and biodiversity protection measures range from self-organized cultivation and protection methods in local communities, to contractual conservation management agreements, agro-environmental schemes, and the designation of protected areas.

Pooling systems for impact compensation are also established, most managed with strict public oversight. Whereas market-based approaches that seek to commercialize nature are still discussed in national and international policy discourses, they have lost much of their initial momentum. Meanwhile, several other options are on the table. While some countries pursue commercial banking schemes, others opt for pooling systems, strict regulations, or community-based and participatory biodiversity governance approaches.

Reactions from the business community

In this climate, it becomes clear for many pro-market biodiversity and ecosystem service providers that designs and consulting in these areas need a political bent, with the impetus coming from stakeholders. As a reaction, they specialize in certain approaches, species, habitats, and regions for offering a plethora of biodiversity-related products, since the demand for standardized market-based conservation services mostly remains low. Continuing to forge a path towards standardized biodiversity offset regulation and a standardized market for biodiversity credit trading is mainly possible in contexts where a compensatory mitigation banking approach is already in place, e.g. in the U.S. and Australia.

In most other countries, local conflicts and specific issues raised by local stakeholders, especially indigenous communities and local inhabitants, define the negotiation of biodiversity protection measures. The importance of context is widely recognized, and it is common sense that every particular situation needs a particular approach that is sensitive to specific biophysical conditions, as well as local practices and cultures of defining and appraising them.

Prevalence of flexible systems

By 2025, several national and regional schemes establish the sites where flexible biodiversity protection is permitted based on individual political and biophysical situations. A few new biodiversity markets emerged in Latin America, in addition to more established counterparts. In this region, a high rate of return attracts numerous venture capitalists to a variety of “ecological hotspots.”

Nevertheless, the majority of biodiversity protection policies are negotiated in contexts where local actors and stakeholders work on locally accepted and embedded solutions. Depending on the actors' interests and conditions, policy designs differ from site to site, and from case to case.

Thus, most biodiversity businesses remain small, too small to attract well-heeled investors on the lookout for lucrative business opportunities.

At the close of this decade, biodiversity protection measures predominantly exist as context-sensitive solutions. It seems that marketization trends and the establishment of biodiversity markets with credit trading schemes will only have a future in narrowly defined contexts. The international bio business community is split in numerous advisory and business groups that are active on the national and regional levels and in a variety of political arenas. The market chances rise and fall with local political situations. Instead of standardized approaches and markets, biodiversity protection has turned into a toolkit, or rather a floating repertoire of concepts, elements, and tools from which stakeholders can pick and assemble for specific local projects.

Scenario 3: The game changer: GenCalc technology

Abstract

This scenario highlights the role of science in the future development of biodiversity offsets and banking. The starting point is a lack of unity in the international scientific community. Controversial discussions especially center on questions such as how to quantify biodiversity and related issues of technical feasibility. These conceptual battles continue until a group of ecologists develops the groundbreaking technology "GenCalc". This scientific breakthrough is the game changer in this scenario, as the new calculation method offers the opportunity to initiate transnational biodiversity compensation and credit trading – for the first time without neglecting the complexity of ecosystems and biodiversity. In prac-tical terms, a few technical issues still need to be ironed out; nonetheless, the scenario ends as the first steps towards the establishment of a transnational biodiversity market are being taken.

The immediate future

The close of 2013 is marked by prevailing skepticism towards the actual potential of international political negotiations to stop biodiversity loss. While preparing the *12th meeting of the Conference of the Parties (COP)* in Korea, for example, suggestions for concretizing biodiversity markets and biodiversity credit trading within the *Green Development Mechanism (GDM)* are postponed. Substantial uncertainty remains as to the positive and negative effects of these markets on the economy, as well as on biodiversity. The only common ground among conference participants is need for comprehensive, well-substantiated scientific data to develop a legitimate, binding system for biodiversity offsets.

As a result, the international research initiative *"BIOFUTURE"* is launched by the *United Nations General Assembly* as an incentive for the scientific community to help achieve the *Aichi Biodiversity Targets 2011-2020*. The initiative includes various different "epistemic cultures" working on a range of questions related to biodiversity markets. Ecologists study the possibility of comparing impacts on biodiversity across different ecosystems. Economists try

to evaluate the allocational efficiency biodiversity markets. Landscape planners test various procedural models of environmental decision-making.

Despite these important contributions, the trickiest problem faced by biodiversity markets remains the lack of a quantitative model to measure biodiversity loss and gain. This would imply a system with various impacts falling into the categories of debits and credits. The ultimate goal is to facilitate market transactions – without underestimating the complexity of ecosystems. This topic still remains the subject of heated controversies. So far, only a few scattered biodiversity compensation and banking schemes exist, and credits can only be traded on a local level, even within national systems. This is, once again, due to a lack of universal quantification methods for habitat values and biodiversity losses and gains.

At this point in time, quantification approaches are characterized by a wide range of tools and units of measurement used in different regions on a case-by-case basis. In some regions, approaches are guided by ecosystem analysis and monitoring to quantify the value of biodiversity. In others, species credits operate on the basis of acres of habitat as a currency for mitigation. Lastly, verbal deliberations are used to derive the scope of compensation. The comparative effects remain largely unknown.

The question of how to measure biodiversity and what can be seen as proper equivalents boils down to a political, context-specific question. As one manager at a government-run wildlife agency emphasizes: “In the end, it’s basically a decision by the responsible agency!” This situation motivates scientists to work on better tools to measure and compare ecosystem indicators.

Technological development unifies biodiversity measurements

Working within the *“BIOFUTURE”* research framework, American ecologists from the *Massachusetts Institute of Technology (MIT)* develop a new technology that permits the quantitative comparison of ecosystems, thus creating – at least theoretically – the conditions for the transnational trade of habitat and species credits. Marking this international breakthrough in scientific circles, an article in the journal *Nature* from January 2017, is widely cited and regarded as the official announcement of this breakthrough.

Using complex genetic analysis, the authors propose a generic conversion algorithm for the calculation and comparison of biodiversity resources. It is also sensitive to a number of crucial habitat indicators. The new technology becomes known as "*GenCalc"*. Objective calculations of biological diversity, as well as balancing impacts and offsets, finally seem possible. At this point, these developments are confined to the laboratory; the algorithm still needs meaningful, i.e. broad-based testing in practice.

Pilot projects for transnational biodiversity credit trade

Soon, a number of countries that have already established biodiversity offset and banking systems declare their readiness to serve as testing regions for the new tool. The goal is to determine whether it can, in fact, be used to link heretofore "distinct", and thus incomparable, biodiversity markets.

In 2018, New South Wales and Victoria, where commercial biodiversity banking schemes have been in place since the mid-1990s, as well as New Zealand, start to implement the new technology from *MIT* and create a test network of banks under the supervision of *Business and Biodiversity Offsets Programme* (*BBOP)* partners.

In Australia, development pressures are high due to a huge global demand for carbon and iron ore, and several mining companies like *Rio Tinto* urgently need offset options, which they find in New Zealand. These companies have the funds to buy up any and all necessary credits and a flourishing business develops. The new software enables the trade of valuable species credits throughout Oceania. Careful ecological monitoring takes place in parallel to stop operations if a decline in species is registered.

But this was not an issue, at least not until the end of 2018. Literally overnight, Great Barrier Reef corals start to die off en masse as an unintended side effect of coastal development activities. Due to unlikely circumstances, the monitoring system alarm is sent too late for this ecosystem to be saved. The aquatic flora and fauna of the Great Reef are lost forever. In the wake of this disaster, blame is attributed to a software failure.

An improved scheme for second implementation

Learning from this failure, the United States and Canada launch a second transnational bio trading experiment in 2020. In contrast to the Oceanian pilot, U.S. scientists from the *Environmental Protection Agency (EPA)* and the *U.S. Fish and Wildlife Service (USFWS)* have enhanced the technological basis for international species credit transactions and want to give the idea another go. One of their main objectives is to develop software that permits the calculation of comparable species credits in order to set up large-scale biodiversity markets.

In 2022, they succeed in developing this software and a species database prototype that contains monitoring data. This technology is quickly made available for use around the world. And this time the experiment is a success. To compensate for excessive oil sands production in Canada, huge investments are made in U.S. biodiversity certificates. The results are extremely positive: in Canada, close monitoring prevents the extinction of impacted species and in the USA, *FWS* ecologists even register an improvement in the status of relevant ecosystems. “An ecological breakthrough!” is the cover story in *THE ECONOMIST*. This success is the result of a further technological refinement as well as an early warning system for calculating credits based on the *“Global Biodiversity Inventory”,* a new online database to map and calculate global biodiversity assets managed by a newly founded *CBD* working group.

In 2030, several countries are connected to the transnational biodiversity market. Nevertheless, no measures are in place in the majority of countries across the globe, i.e. neither a biodiversity offset nor a market-based approach to compensatory mitigation – yet.

Appendix B: Workshop agenda

Time	Subject	Content
April 19, 2013	Venue: Berlin-Brandenburg Academy of Sciences and Humanities (BBAW)	
	Introduction	
9:00-9:10	**Welcome and overview**	➤ Introduction to workshop objectives & expected outcomes ➤ Overview of the agenda
9:10-9:30	**Why this workshop?**	➤ "Challenging futures" in relation to dynamics of innovation in governance
	Session 1: Challenging futures of biodiversity offsets and banking	
9:30-11:00	**Opening plenary discussion**	➤ Table round: What characterizes the present situation of biodiversity offset development? ➤ Open group discussion
11:00-11:30	*Coffee break*	
	Session 2: Identifying and articulating future issues for biodiversity offsets and banking	
11:30-13:00	**Group work: discussion of future developments and identification of issues**	➤ Identifying specific issues that require further attention and/or debate in the future development of biodiversity offsets and banking
13:00-14:00	*In-house lunch break*	
	Session 3: Compiling issues, discussing challenges	
14:00-14:30	**Strolling the "wall of issues"**	➤ Participants read and discuss issue briefs produced by working groups
14:30-16:15	**Discussion of selected issues and challenges in plenary**	➤ Selection and presentation of issue, and issue clusters ➤ Discussion on selected issue/clusters
16:15- 17:00	**Concluding discussion in plenary**	➤ Wrap-up of discussion of issues in plenary ➤ Identify open questions and missed points ➤ Outlook on further procedure
17:00	**End of workshop**	

Appendix C: List of participants

NO.	Name	Organization
1	Absher, James	U.S. Forest Service (FS)
2	Bishop, Joshua	World Wide Fund For Nature (WWF) Australia
3	Böttcher, Marita	Federal Agency for the Nature Conservation, Germany
4	Bruns, Elke	Institut für Nachhaltige Energie- und Ressourcen-nutzung (Institute for Sustainable Use of Energy and Ressources)
5	Carroll, Nathaniel	Ecosystem Marketplace
6	Cornwall, Amanda	Department of Sustainability, Victoria/Australia
7	Darbi, Marianne	Leibniz Institute of Ecological Urban and Regional Development
8	Dickie, Ian	Economics for the Environment Consultancy (EFTEC)
9	Ekstrom, Jonathan	The Biodiversity Consultancy
10	Hough, Palmer	US Environmental Protection Agency (EPA)
11	Johnson, Brenda	California Department of Fish and Wildlife
12	Kapila, Sachin	Shell
13	Karousakis, Katia	Organisation of Economic Co-operation and Development (OECD)
14	Korn, Horst	Federal Agency for the Nature Conservation, Germany / Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES)
15	Lohmann, Larry	The Cornerhouse
16	Mead, Deborah L.	U.S. Fish and Wildlife Service (USFWS)
17	Rempel, Ron	U.S. Geological Survey (USGS)
18	Robertson, Morgan	Department of Geography, University of Wisconsin-Madison

19	Spash, Clive L.	Department of Socio-Economics, WU Vienna University of Economics and Business
20	Stewart, John W. Fraser	Global Environment Coordination Unit, The World Bank
21	Suntken, Suleika	Deutsche Umwelthilfe (German Environmental Aid)
22	Szaramowicz, Martin	Flächenagentur Brandenburg (Brandenburg Pooling Association)
23	Wätzold, Frank	Chair of Environmental Economics, Brandenburg University of Technology Cottbus
24	Wilgis, Randy	National Mitigation Banking Assoc.

The moderation team

25	Rip, Arie (workshop chair, group blue)	University of Twente, Department of Science, Technology and Policy Studies
26	Mann, Carsten (group yellow)	Technische Universität (TU) Berlin, Department of Sociology
27	Simons, Arno (group green)	Technische Universität (TU) Berlin, Department of Sociology
28	Voß, Jan-Peter (group red)	Technische Universität (TU) Berlin, Department of Sociology