Background Paper

Streamlining biodiversity and climate policy for REDD+

Biodiversity monitoring and REDD+

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

This project is supported by the German Federal Agency for Nature Conservation (BfN) with funds from the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU).

BfN Federal Agency for Nature Conservation

BACKGROUND PAPER 1

Streamlining biodiversity and climate policy for REDD+

DINAH BENICK AND TILL PISTORIUS

1 Introduction

Many political processes and multilateral environmental agreements have evolved during the last decades. They aim at tackling different and increasing global environmental problems such as loss of biodiversity, mitigation of and adaptation to climate change or combating desertification. One characteristic of most multilateral environmental agreements is their rather narrow focus on one core objective which leads to enormous challenges regarding the development of effective and coherent policies for cross-cutting issues. Deforestation and forest degradation are an illustrative example, because forests provide numerous vital ecosystem goods and services which are at jeopardy due to the destruction of forest ecosystems. Accordingly, forests play a crucial role in many different environmental policy processes as their unsustainable use has severe short and long-term consequences for both, local stakeholders as well as the global community. Furthermore, the drivers and underlying causes of deforestation and degradation vary considerably and are often intricately linked to domestic national and sub-national development issues and related policies (GEIST & LAMBIN 2001).

Currently, much attention is paid to mitigating climate change by reducing emissions of greenhouse gases (GHG), which is predominantly dealt with under the United Nations Framework Convention on Climate Change (UNFCCC). Taking into account the UNFCCC principle of "common but differentiated responsibilities", non-Annex-I countries have no obligations to reduce their domestic emissions under the Kyoto Protocol, which expires by the end of 2012. Different responsibilities will also be taken into account in a post-Kyoto agreement, but since deforestation and forest degradation in (tropical) developing countries represent – with 12-20% of all anthropogenic emissions (VAN DER WERF *et al.* 2009, IPCC 2007, STERN 2007) – one of the major sources of GHG emissions, there is a consensus that there should be positive incentives for developing countries which succeed to reduce these emissions. This is further supported by the fact that such activities represent cost effective mitigation activities (ELIASCH 2008). However, international approaches have to be flexible regarding the specific regional circumstances and respect national sovereignty.

As a result, at the 11th conference of the parties (COP) in 2005, the UNFCCC mandated its Subsidiary Body for Scientific and Technological Advice (SBSTA) to assess the options for a mechanism for reducing emissions from deforestation. Subsequently, COP 13 in Bali decided to further negotiate the details for a REDD mechanism (Reducing Emissions from Deforestation and Forest Degradation in Developing Countries). Initially the idea was to have a simple mechanism, but during the process its requirements and ideas for the design and ways of implementation became increasingly complicated. Reasons are, for example, technical challenges regarding the monitoring, reporting and verification (MRV) of carbon stocks, concerns regarding the social and environmental integrity of the mechanism, as well as particular na-

tional interests regarding the scope and eligible activities (ANGELSEN 2008a). In the meantime, the scope of REDD has been widened to REDD+[1], further increasing the demand for sophisticated technical solutions to ensure the MRV of carbon stocks in forests and minimize negative side effects of the mechanism.

It is noteworthy that there is an enormous political will by both, donor and beneficiary countries to make REDD+ a success. Despite the complexity of the issue, the many questions that still need to be resolved and the overall failure of COP 15, REDD+ was the most advanced issue at the end of the negotiations in Copenhagen.

2 REDD+ and biodiversity – synergies and risks

One issue in the context of REDD+ that has recently received more attention than in earlier negotiations is its potential effects on biodiversity. Resulting from the focus of the mechanism on one ecosystem service (carbon storage) in multifunctional ecosystems, REDD+ bears different risks for biodiversity that should be avoided as far as possible.

At the beginning of the academic and political debate on REDD, it was assumed that the reduction of emissions from deforestation would generally be beneficial for biodiversity (e.g., SANTILLI *et al*. 2005). Accordingly, benefits for biodiversity and other ecosystem services were considered as "co-benefits". The original intention of avoiding deforestation through such a mechanism was to reduce emissions from deforestation which is often considered to be a no-regret strategy that yields many benefits, including contributions to the conservation of biodiversity.

In the meantime the inclusion of biodiversity safeguards into a political agreement has become an intensively discussed topic, especially fostered by the widening of the scope to REDD+. In the light of changing climatic conditions, forests should not just be considered as a powerful instrument to mitigate emissions, they are the fundamental basis for adaptation. Plantations may be effective regarding carbon sequestration, but they are more vulnerable to biotic pests and abiotic calamities (drought, fire, storm). Therefore, resilient and diverse ecosystems are more capable to reliably store carbon than plantations (LOUMANN et al. 2009, SCBD 2009).

Concluding, safeguards for biodiversity can be considered as a basis to generate synergies or so-called co-benefits. Adequate underlying definitions of a REDD+ mechanism are of crucial importance for biodiversity safeguards which aim at avoiding incentives for the conversion of natural and semi-natural forests into commercial tree plantations (SCHMIDT 2009, PISTORIUS 2009a). However, in contrast to "forest" or "afforestation / reforestation (A/R)", the terms

[1] In 2007, the Conference of the Parties to the UNFCCC decided to launch a comprehensive process to enable the implementation of the Convention through long-term cooperative action by addressing, inter alia, "[…] *enhanced national/international action on mitigation of climate change, including, inter alia, consideration of:* […] *Policy approaches and positive incentives on issues relating to reducing emissions from deforestation and degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries"* (Decision 1/CP.13).

"(semi-) natural forest" or "plantation" are not yet defined by previous UNFCCC decisions[2] and the existing UNFCCC forest definitions (Decision 11/CP.7)[3] bear the risk of establishing monocrop plantations (SASAKI & PUTZ 2009, LONG 2009). Therefore it is likely that definitions will play a significant role in the upcoming REDD+ negotiations.

Further risks for biodiversity are related to potential shifts of land-use change activities to non-carbon or low-carbon (forest) ecosystems such as savannahs or non-forest peatlands (KAPOS *et al.* 2007, MILES 2007, MILES & KAPOS 2008). A concretization of forest management concepts (see following Section), and a distinguishing of A/R activities from forest restoration can also be considered as safeguards (KAROUSAKIS 2009, PISTORIUS 2009a, HARVEY *et al.* 2010, von SCHELIHA *et al.* 2009, PHELBS *et al.* 2010). With regard to the design of the mechanism, it also appears crucial to ensure a broad participation in the mechanism to avoid displacement of deforestation activities and emissions ("leakage") as countries are in different stages of the forest transition curve (ANGELSEN 2008b). If REDD+ provides incentives only to countries with high historical deforestation rates, those developing countries with low historic deforestation rates could have an incentive to intensively use their forests before joining such a voluntary mechanism (PISTORIUS 2009a).

The international REDD+ framework can only provide the basic structure to guide the development of national and sub-national REDD+ strategies and ease cooperation between responsible institutions and organisations in the climate and biodiversity sector. However, an adequate design and implementation of REDD+ at the national level is of utmost importance for the sustainable delivery of environmental co-benefits (DICKSON *et al.* 2009). In this context it appears helpful to analyze multi-level and multi-actor governance for REDD+ (see Section 5).

3 SFM and other forest related definitions in the context of REDD+

In 2007, the Bali Action Plan widened the scope of the mechanism beyond reduction of emissions from deforestation and forest degradation to "conservation, sustainable management of forests (SMF) and enhancement of forest carbon stocks in developing countries" (Decision 1/CP.13). This was confirmed by the ongoing negotiations and the outcome of COP 15 in Copenhagen. In reaction to the reference to SFM and SMF in negotiating texts as well as in

[2] Many different definitions for forests exist; the FAO (2005) for example classifies different forest types, e.g. primary forest, modified natural forest, semi-natural forest, productive and protective plantations.

[3] (a) "Forest" is a minimum area of land of 0.05-1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10-30 per cent with trees with the potential to reach a minimum height of 2-5 metres at maturity *in situ*. A forest may consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground or open forest. Young natural stands and all plantations which have yet to reach a crown density of 10-30 per cent or tree height of 2-5 metres are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention such as harvesting or natural causes but which are expected to revert to forest;

(b) "Afforestation" is the direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed sources;

(c) "Reforestation" is the direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the human-induced promotion of natural seed sources, on land that was forested but that has been converted to non-forested land. For the first commitment period, reforestation activities will be limited to reforestation occurring on those lands that did not contain forest on 31 December 1989.

scientific and NGO publications, the Secretariat of the United Nations Forum on Forests (UNFF) submitted a brief reference document to the Secretariat of the UNFCCC (UNFF-09-L-MS-219, August 2009). This document emphasizes, that the concept of SFM has already been addressed at global as well as multilateral, national and regional level and that a specific language on SFM exists. However, Many NGOs consider SFM to be an unspecified and misleading term that allows for industrial scale logging; as the underlying concept has failed to initiate meaningful improvements regarding the management of forests, they argue to make no reference to SFM in a future REDD+ agreement (e.g., GLOBAL WITNESS 2009).

The present negotiating text (FCCC/AWGLCA/2009/ L.7/Add.6) includes "sustainable management of forests" ("Bali language") as an activity under REDD+. However, the meaning of this wording is still vague and will most likely not resolve the described concerns. Keeping in mind that COP7 (2004) of the Convention on Biological Diversity (CBD) noted "*that sustainable forest management can be considered as a means of applying the ecosystem approach to forests*" (Decision VII/11), further discussion about SMF / SFM under REDD+ seem to be necessary.

An option to achieve a maximum of benefits for long-term carbon storage and other ecosystem services could be to add a qualitative aspect to A/R within REDD+ instead of merely focusing on a short-term biomass production, e.g., by restoration of degraded (former) forests and natural habitats and enhancement of landscape connectivity (SCBD 2009, PISTORIUS 2009a,b). Referring to this, a definition of restoration as an activity aiming at re-establishing the original functions and characteristics of the ecosystem prior to its degradation for REDD+ could be discussed (BENAYAS *et al.* 2009, UNEP-WCMC 2009).

4 The link between REDD+ and forest biodiversity conservation under the CBD

The CBD and the UNFCCC are encouraging forest conservation and sustainable management from different perspectives. Nevertheless, there are numerous activities of both conventions on international and national level, which could possibly be linked in the spirit of streamlining political processes. The following sections briefly present an overview of the CBD work on forest biodiversity and results and recommendations of the CBD Ad Hoc Technical Expert Group in Biodiversity and Climate Change (AHTEG-BDCC) for consideration under REDD+.

4.1 The forest related programmes of work of the CBD

In 1998 the CBD has adopted its Programme of Work (PoW) on Forest Biological Diversity (Decision IV/7) which was renewed in 2002 by adopting the Enhanced PoW on Forest Biodiversity (Decision VI/22). The Enhanced PoW contains 3 elements, 12 goals, 27 sub-objectives and 130 activities. One of the objectives is to "protect, recover and restore forest biological diversity" (Goal 1.3) which includes

(a) restore forest biological diversity in degraded secondary forests and in forests established on former forestlands and other landscapes, including in plantations

(b) promote forest management practices that further the conservation of endemic and threatened species

(c) ensure adequate and effective protected area networks

One element of the strategy for achieving the 2010 biodiversity target[4] - with its sub-target to conserve at least 10% of each of the world´s ecological regions (Decision VII/30) - is the enhancement of status and effectiveness of forest protected areas. Therefore the CBD adopted in 2004 the PoW on Protected Areas (Decision VII/28). This target is also reflected by Decision VIII/15, Annex IV, that addresses the application of the 2010 goals and targets to the thematic programmes of work. In 2008, the 10% target was reconfirmed by CBD COP 9 as well as the relevance of the Ecosystem Approach (EA), which represents the primary framework for action under the convention[5], and the cooperation across different sectors. To strengthen the comprehensive structure of a protected area network, the "Life Web Initiative" was formed as an agent for pooling projects of member countries with possible investors.

With regard to REDD+, COP 9 requested the Executive Secretary of the CBD to collaborate with other members of the Collaborative Partnership on Forests (CPF) – in particular the Secretariat of the UNFCCC and the World Bank – in order to support the Parties' efforts to reduce emissions from deforestation and forest degradation in developing countries in the framework of the UNFCCC (Decision IX/5).

4.2 Link between biodiversity and climate change mitigation

In 2008, the CBD launched the AHTEG-BDCC to analyze the links between biodiversity and climate change adaptation and mitigation. The outcomes of this AHTEG have been highlighted in a report presented at a UNFCCC COP 15 side event (SCBD 2009). In its Annex IV, the report gives an overview of the activities within the scope of REDD+ and its possible positive and negative impacts on biodiversity (see Table 1).

The AHTEG-BDCC outcomes can possibly be used to support Parties and other stakeholders in UNFCCC negotiations regarding the development of "biodiversity friendly" approaches for a REDD+ mechanism and national REDD+ strategies. However, it is not clear in which way the results of the report that has yet just been "welcomed" by the Bureau of the COP to the CBD, can be used by Parties in the UNFCCC negotiations. Parts of the report were used as suggested recommendations, being discussed at SBSTTA 14 (UNEP/CBD/SBSTTA/14/6), for potentially being included in a decision adopted by the CBD COP.

[4] In decision VI/26, the Parties of the CBD committed themselves to a more effective and coherent implementation of the three objectives of the Convention, to achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on earth.

[5] At its Fifth Meeting, the Conference of the Parties endorsed the description of the Ecosystem Approach and operational guidance and recommended the application of the principles and other guidance on the Ecosystem Approach (COP 5, Decision V/6).

Regarding further development of REDD+ biodiversity safeguards and safeguards for the rights of indigenous and local communities (including options for MRV), at SBSTTA 14 a collaboration with the Secretariat of the UNFF, the World Bank, the Secretariat of the UNFCCC, and the other members of CPF will be discussed (UNEP/CBD/SBSTTA/14/14).

Table 1: Links between biodiversity and REDD+ activities (adapted from SCBD 2009, Annex IV).

Mitigation activity	Potential benefits	Potential risks	Possible actions
Reducing emissions from deforestation and forest degradation	Reduced forest loss and reduced forest degradation Reduced fragmentation	Leakage into areas of high biodiversity	At national level, prioritizing REDD actions in areas of high biodiversity Develop premiums within incentive measures for biodiversity co-benefits Improving forest governance Promote broad participation
Forest conservation	Conservation of intact forest habitat Reduced fragmentation Enhanced integrity of landscape		Prioritize high biodiversity forests Maintain landscape connectivity Conserve a high diversity of forest types
Sustainable management of forests	Reduced degradation of forests (relative to conventional logging)	Potential encroachment in intact forest, resulting in biodiversity loss	Prioritize sustainable management in areas with already intensive land-use Apply best practice guidelines
Afforestation and reforestation (A/R)	Habitat restoration of degraded landscapes (use of native species and diverse plantings) Enhancement of landscape connectivity	Introduction of invasive and alien species Replacement of native grasslands etc.	Apply best practices Prevent replacement of intact forests, grasslands Enhance landscape connectivity Develop premiums within incentive measures for biodiversity co-benefits

5 Multi actor and multi-level governance of REDD+

As REDD+ is moving from its "basic vision" to concrete implementation on national and sub-national level by development of REDD+ pilot activities and programmes (for a detailed overview of REDD+ pilot activities see Background paper 2), the question of supportive governance structures is currently gaining momentum in the REDD+ debate. So far, the aspect of potential synergies with the work and objectives of the CBD is seldom considered by the UNFCCC. However, comprehensive and feasible approaches for achieving good governance, including safeguards and benefits for biodiversity, will remain a key issue regarding implementation of the mechanism at different governance levels.

5.1 Governance as a term for new political structures

"Governance" is a term with many different definitions; in political science the empiric-analytical understanding of governance prevails in a wide and in a narrow form. Whereas the narrow concept focuses on new forms of political management and on the involvement of non-public actors, the wider governance concept refers to all forms of social order, including

markets, hierarchies and networks (WOLF 2009). Transferred to forest policies, forest governance is described as the mode of behaviour by which institutions exercise authority regarding the management of forest resources. Based on this definition, "good governance" includes open and informed policy making with a government accountable for its actions and a strong participation of civil society (FAO & ITTO 2010).

In discussions on REDD+, governance is often reduced to the implementation of governmental policies, including legal and regulatory frameworks, laws and land tenure (e.g., BOND et al. 2009). This "narrow" governance concept refers to national state authorities and government actors as the subjects for setting the policy framework through norms and rules. The horizontal level of governance with integration of various institutions and stakeholders into a policy dialogue is regarded as a supportive and necessary tool for designing REDD+ on national and sub-national level but not as an intrinsic part of the governance concept. However, governance in its wider scope – as described above – means the development of policies by governmental and non-governmental actors comprising organizations and institutions within various sectors and the implementation of these policies through diverse policy instruments. In this comprehensive view, governance of REDD+ can be described as "multi-level, multi-actor" governance that is defined as "the act or manner of governing… [that] allows stakeholders to negotiate, formulate and implement policies" (FORSYTH 2009).

If the parties to the UNFCCC succeed to conclude on a post-Kyoto agreement after the failure of Copenhagen – which appears to be a precondition for the REDD+ mechanism to become operational – it will mainly facilitate the financial transfer of incentives and provide the basic framework, including rules and modalities for MRV and general safeguards for other global environmental and development objectives. On the national level, implementation will gain momentum through the national REDD+ strategies which determine appropriate activities according to the national circumstances and priorities. Currently, several countries are developing those national strategies within pilot programmes as for example the World Bank's Forest Carbon Partnership Facility (FCPF) and the UN-REDD Programme. Whereas certain policies and measures directly address national governmental and non-governmental stakeholders and initiatives, much implementation will take place at the local / project level. The German "internationale Klimaschutzinitiative (IKI)" and the Life Web platform are just two examples for initiatives that fund REDD+ activities at the project level (Figure 1).

In order for REDD+ to become a success and guarantee its environmental integrity, it is necessary to ensure coherence between different policy levels and its institutions. Furthermore, enhancing cooperation between organizations will be a precondition for addressing biodiversity conservation within international REDD+ framework and national strategy design

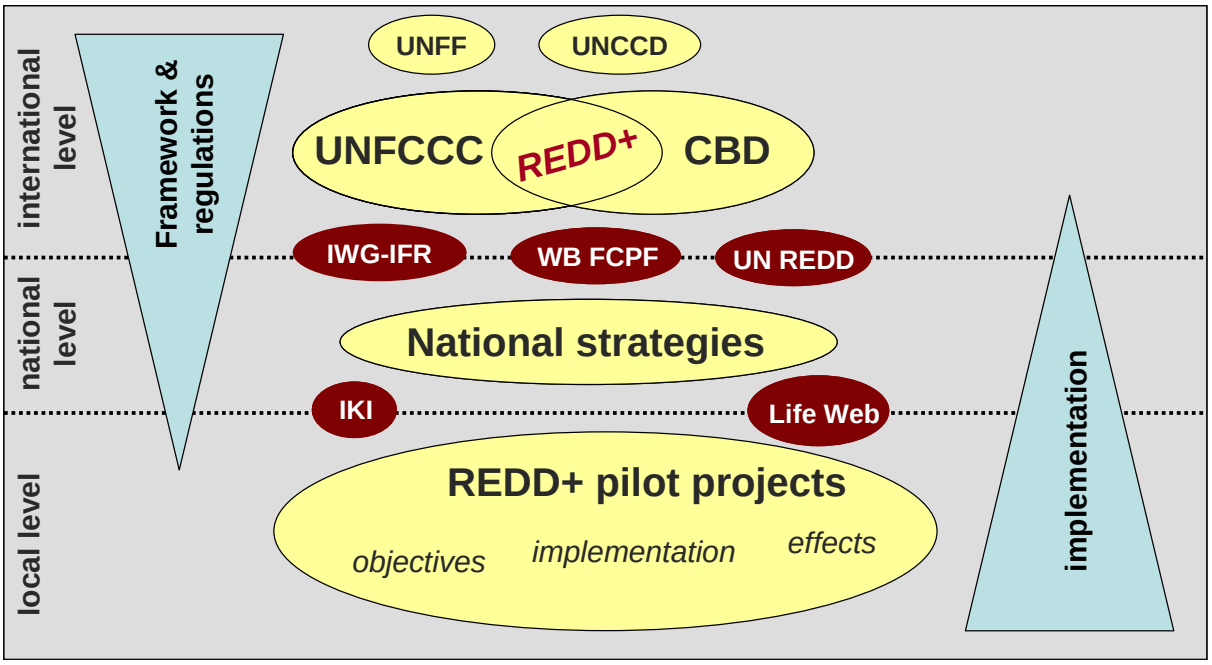

Figure 1: Organizations and institutions of climate and biodiversity related political processes.

5.2 Biodiversity conservation in international and national REDD+ design

The actors involved in the climate negotiations become increasingly aware of the link between the development of new mechanisms for climate change mitigation actions in the forest sector and their possible impact on biodiversity conservation (see Section 2). As a response to this development, efforts of the negotiators recently focused on the inclusion of biodiversity safeguards into the international REDD+ mechanism[6].

On national level, multilateral programs as FCPF and UN-REDD incorporate biodiversity safeguards and provisions for the enhancement of environmental co-benefits in different ways: Either by less strict tools as of information and guidance or by requirement of social and environmental impact assessments in national REDD+ strategies. Additionally, many NGOs are currently involved in the development of voluntary social and environmental standards for REDD+ projects[7]. These organizations often started by developing standards for forestry projects entering voluntary carbon markets, which have experienced a boom in the last decade (MERGER 2008). For a more detailed overview of the indicators used by these organizations, see Background paper 2.

With increasing awareness that REDD+ can also have negative impacts on biodiversity conservation as well as on indigenous peoples and local communities, the CCBA started an initia-

[6] AWG-LCA (FCCC/AWGLCA/2009/L.7/Add.6):"…*the following safeguards should be [promoted] [and] [supported]: (e) Actions that are consistent with the conservation of natural forests and biological diversity, ensuring that actions referred to in paragraph 3 below are not used for the conversion of natural forests, but are instead used to incentivize the protection and conservation of natural forests and their ecosystem services, and to enhance other social and environmental benefits"*

[7] The Climate, Community & Biodiversity Alliance (CCBA), CarbonFix Standard (CFS), Plan Vivo Systems and Standard, Voluntary Carbon Standard (VCS)

tive that aims to define and build support for a higher level of social and environmental performance of REDD+ programs. The standard is based on principles (frame and objectives), criteria (requirements for reaching the objectives) and indicators (quantitative or qualitative parameter that need to be fulfilled and confirmed with regard to one criterion. The last standards draft of the currently ongoing stakeholder consultation process suggests that the major focus will be on social impacts and participation issues as just one of the eight principles is related to biodiversity and ecosystem services (CCBA 2010).

6 Summary and remaining questions

Effective and environmentally integer governance of REDD+ includes the pursuit of collective interests, as for example the development of safeguards for biodiversity and their implementation on the ground. This requires coherence between the different objectives and the actors which are to 'deliver' governance, and is complicated due to the heterogeneous national and local circumstances. Accordingly, the different policy levels (international, national and local) face varying needs and challenges for the integration of biodiversity safeguards in their respective REDD+ policies and activities. Institutional and policy changes are required to integrate protected areas into comprehensive landscape-scale strategies and to provide an enabling environment for SFM.

Many questions yet need to be answered to work towards an integer REDD+ mechanism and its implementation on the ground, e.g.:

- What are the needs and challenges for establishing strong and effective biodiversity safeguards at the international level and within national REDD+ strategies?
- How can the concept of SFM be concretized in order to make it function as a biodiversity safeguard within REDD+ governance and for facilitating forest restoration?
- Which options do exist for complementing governance of REDD+ (e.g. work carried out by the CBD, CPF and other policy processes)?
- What are the options for streamlining different policy processes and institutions already involved in tackling deforestation and forest degradation?
- How can comprehensive governance structures support MRV?

7 References

ANGELSEN A (2008a): Moving ahead with REDD: Issues, options and implications. CIFOR, Bogor, Indonesia, 156 p.

ANGELSEN A (2008b): How do we set the reference levels for REDD payments? In: Angelsen A (ed) (2008): Moving ahead with REDD: Issues, options and implications. CIFOR, Bogor, Indonesia. pp. 53-63.

ANGELSEN A, BROCKHAUS M, KANNINEN M, SILLS E, SUNDERLIN WD AND WERTZ-KANOUNNIKOFF S (eds) (2009): Realising REDD+: National strategy and policy options. CIFOR, Bogor, Indonesia, 362 p.

BENAYAS JMR, NEWTON AC, DIAZ A, BULLOCK JM (2009): Enhancement of Biodiversity and Ecosystem Services by Ecological Restoration: A Meta-Analysis. In: SCIENCE, Vol. 325, pp. 1121–1124. URL: http://www.sciencemag.org.

BOND I, GRIEG-GRAN, M, WERTZ-KANOUNNIKOFF S, HAZLEWOOD P, WUNDER S, ANGELSEN A (2009): Incentives to sustain forest ecosystem services: A review and lessons for REDD. Natural Resource Issues No. 16. International Institute for Environment and Development, London, UK, with CIFOR, Bogor, Indonesia, and World Resources Institute, Washington D.C., USA, 47 p.

CCBA (2010): Draft REDD+ Social & Environmental Standards, Version 15 January 2010.

DICKSON B, DUNNING E, KILLEN S, MILES L, PETTORELLI N (2009): Carbon markets and forest conservation: A review of the environmental benefits of REDD mechanisms. UNEP World Conservation Monitoring Center.

ELIASCH J (2008): Climate Change: financing global forests. Earthscan, London, UK. 264 p.

FAO (2005): Global Forest Resources Assessment 2005 – Progress towards sustainable forest management, FAO Forestry Paper 147, Food and Agriculture Organization of the United Nations, Rome, 2005.

FAO & ITTO (2010): Forest governance and climate-change mitigation. A policy brief prepared by ITTO and FAO.

FORSYTH T (2009): Multilevel, multiactor governance in REDD+ - participation, integration and coordination, In: Angelsen A ,Brockhaus M., Kanninen M., Sills e., Sunderlin W.D. and Wertz-Kanounnikoff S. (eds) (2009): Realising REDD+: National strategy and policy options. CIFOR, Bogor, Indonesia.

GEIST HJ & LAMBIN EF (2001): What drives tropical deforestation? A meta-analysis of proximate and underlying causes of deforestation based on subnational case study evidence. LUCC Report Series No. 4, LUCC International Project Office, Louvain-la-Neuve, Belgium. 136 p.

GLOBAL WITNESS (2009): Trick or Treat? REDD, Development and Sustainable forest Management, Global Wittness, September 2009.

HARVEY CA, DICKSON B, KORMOS C, (2010): Opportunities for achieving biodiversity conservation through REDD. In: Conservation Letters 3 (2010), p. 53–61.

IPCC (2007): Climate Change 2007: The Physical Science Basis. Summary for Policymakers. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 18 p.

KAPOS V, MILES L, HERKENRATH P (2007): Reducing Emissions from Deforestation: A Key Opportunity for Attaining Multiple Benefits. UNEP.

KAROUSAKIS K (2009): Promoting Biodiversity Co-Benefits in REDD, OECD Environment Working Papers, No. 11, OECD Publishing, © OECD, doi:10.1787/220188577008.

LONG A (2009): Taking Adaptation Value Seriously: Designing REDD to Protect Biodiversity. In: CCLR, Jg. 3, S. 314–323. URL: http://ssrn.com/abstract=1476046.

LOUMANN B, FISCHLIN F, GLÜCK P, INNES J, LUCIER A, PAROTTA J, SANTOSO H, THOMPSON I, WREFORD A (2009) Forest Ecosystem Services: A Cornerstone for Human Well-Being, in: Seppälä R, Buck A, Katila P (eds.). (2009):Adaptation of Forests and People to Climate Change. A Global Assessment Report. IUFRO World Series Volume 22. Helsinki. 224 p.

MERGER E (2008): Forestry Carbon Standards 2008 - A Comparison of the leading Standards in the Voluntary Carbon Market and the State of Climate Forestation Projects, published by Carbon Positive, November 2008, 71 p.

MILES L (2007): Reducing Emissions from Deforestation: global mechanisms, conservation and livelihoods. UNEP; WCMC.

MILES L, KAPOS V (2008): Reducing Greenhouse Gas Emissions from Deforestation and Forest Degradation: Global Land-Use Implications. In: SCIENCE, Vol. 320.

PHELBS J, GUERRERO MC, DALABAJAN DA, YOUNG B, WEBB EL (2010): What makes a 'REDD' country? Global Environmental Change (2010), doi:10.1016/j.gloenvcha.2010.01.002.

PISTORIUS T (2009a): REDD from the conservation perspective. Pitfalls and opportunities for mutually addressing climate change and biodiversity conservation. Institute of Forest and Environmental Policy, Albert-Ludwigs-University Freiburg.

PISTORIUS T (2009b): "Co-benefits" on the paper vs. multiple benefits on the ground – Implications and tools for REDD pilot projects with a high value of biodiversity. ETFRN newletter Nr. 50, pp. 11-19

SANTILLI M, MOUTINHO P, SCHWARTZMANN S, NEPSTAD D, CURRAN L, NOBRE C (2005): Tropical deforestation and the Kyoto-Protocol: An Editorial Essay, Climatic Change (2005) 71:267-276.

SASAKI N, PUTZ FE (2009): Critical Need for New Definitions of "Forest" and "Forest Degradation" in Global Climate Change Agreements. Conservation Letters 2, 226-232.

SCBD (2009): Connecting Biodiversity and Climate Change Mitigation and Adaptation: Report of the Second Ad Hoc Technical Expert Group on Biodiversity and Climate Change. Montreal, Technical Series No. 41, 126 p.

VAN DER WERF GR, MORTON DC, DEFRIES RS, OLIVIER JGJ, KASIBHATLA PS, JACKSON RB, COLLATZ GJ, RANDERSON JT (2009): CO2 emissions from forest loss. Nature Geoscience 2, pp. 727-738.

VON SCHELIAH S, HECHT B, CHRISTOPHERSEN T (2009): Biodiversity and Livlihoods: REDD benefits. Forest Governance. GTZ; CBD. Eschborn.

SCHMIDT L (2009): REDD from an integrated perspective. Considering overall climate change mitigation, biodiversity conservation and equity issues. Deutsches Institut für Entwicklungspolitik. Bonn.

STERN N (2007): The Economics of Climate Change – The Stern Review. Cambridge University Press, New York, USA, 712p.

UNEP-WCMC (2009): URL: http://www.unep-wcmc.org/forest/restoration/fris/concepts.aspx

WOLF S (2009): Governance in der internationalen Zusammenarbeit (IZ) – viele Akteure und ein Ziel? URL: http://www.fize.de/veranstaltungen.risse.zusammenfassung.htm (08.03.10).

BACKGROUND PAPER 2

Biodioversity monitoring and REDD+

STEFFEN ENTENMANN AND CHRISTINE SCHMITT

1 Introduction

There is general agreement among the scientific community that greenhouse gas emissions from land-use changes in forest areas have to be reduced in order to keep the increase of the global temperature regime as low as possible (IPCC 2007). As a reaction, a mechanism of Reducing Emissions from Deforestation and Forest Degradation in developing countries (REDD+) is currently negotiated under the United Nations Framework Convention on Climate Change (UNFCCC).

While the central focus of REDD+ is on carbon storage in forests, biodiversity conservation and enhanced socioeconomic development of local communities are perceived to be – at least – "co-benefits" of REDD+. These effects are to be ensured through "biodiversity safeguards", i.e., elements of the mechanism that secure the ecological long-term viability and the political resiliency of REDD+ (DICKSON *et al.* 2009; see also background paper 1). Consequently, it appears reasonable to develop provisions for a standardized monitoring of the ecological and socioeconomic impacts induced by REDD+ (UN-REDD 2008). This paper has its focus on biodiversity aspects. Whereas there are currently strong efforts to establish systems for "Monitoring, Reporting and Verification" (MRV) of the carbon dynamics within REDD+ (IPCC 2006; UNFCCC 2009), there are not even methodologies for MRV systems that use a widely accepted and globally available set of measures to assess the impacts on forest biodiversity (SCHOLES *et al.* 2008).

The ability to describe and assess changes of biodiversity in developing countries is severely restricted. This is due to the stunning complexity inherent to the concept of biodiversity, the related requirements for biological and technical expertise and the financial investments necessary in order to employ trained staff and to set up biodiversity monitoring systems (LACHER 1998; DANIELSEN *et al.* 2000). A huge number of species need to be described to get a starting point consecutive monitoring can be based on, including a considerable share of species that lack description in scientific literature. Furthermore, besides this compositorial aspect of biodiversity, structural and functional aspects also need to be described if the goal is to capture biodiversity in its complexity (NOSS 1990).

Experiences made in forest biodiversity conservation over the last decades are very valuable for developing schemes for monitoring biodiversity in the context of the REDD+ demonstration activities[1] – or pilot projects – that are currently being established. Whereas

[1] Wertz-Kanounnikoff & Kongphan-apirak (2009) use the term demonstration activities to refer to activities which have carbon storage as explicit objective. In this paper, we use the term pilot projects for such activities.

such pilot projects have a clear focus on maintaining and / or increasing forest carbon stocks in the respective project area, they differ in how far biodiversity aspects are considered.

The present paper aims at outlining existing initiatives and approaches that can provide practical experience and guidelines for the monitoring of biodiversity in pilot projects. The paper has its focus on the field of application and is complementary to background paper 1, which concentrates on the international policy arena related to REDD+.

2 Initiatives for the monitoring of biodiversity

As climate change mitigation is the central aim of REDD+, most actors involved in this process are primarily concerned with carbon storage in forests. However, if projects focus too narrowly on the enhancement of carbon stocks, biodiversity and socioeconomic issues might be neglected (SCHUYT 2005; MILES & KAPOS 2008; HARVEY *et al.* 2009).

Initiatives were established as a response to the REDD+ negotiations that highlight biodiversity issues by promoting positive environmental effects – including the monitoring of biodiversity impacts. They can draw on experience from approaches for biodiversity measurement and evaluation developed by different institutions and scientific organizations independently from the current REDD+ discussions. Expertise and scientific advice from the latter approaches is becoming very useful for answering biodiversity-related questions emanating from the REDD+ process. An overview of initiatives that are directly or indirectly related to REDD+ is provided in Appendix 1.

2.1 Initiatives that evolved directly from the REDD+ process

The UN-REDD programme, the World Bank Forest Investment Program (FIP) and the Forest Carbon Partnership Facility (FCPF) provide financial support for the creation of biodiversity monitoring systems for REDD+ pilot projects and national strategies of tropical countries on all continents. They request the provision of clear proposals for monitoring plans from the applicant countries and usually support the development of systems and methodologies to monitor deforestation, ecological zoning and the development of information and communication systems by providing scientific assistance. Regional initiatives, as the Amazon Fund or the Congo Forest Fund, focus more on countries within or adjacent to forest areas in a specific region. The requirements of these international and regional initiatives for monitoring impacts on biodiversity are generally non-binding, do not include minimum standards and are not defined in detail (DICKSON *et al.* 2009).

The REDD+ Social and Environmental Standards are currently developed to be used by governments and NGOs to design and implement national REDD+ strategies and programs. In the latest draft (CCBA 2010) an open framework for the development of indicators is provided. According to these standards countries should adjust their REDD+ activities to the existing National Biodiversity Strategy and Action Plans (NBSAP) that member countries of the Convention on Biological Diversity (CBD) are supposed to develop.

Standards that are relevant for the access of individual REDD+ projects to the voluntary carbon market, e.g., the Climate, Community and Biodiversity (CCB) Standard and the Plan Vivo Standard, have comparatively specific provisions for how to measure biodiversity in the projects and monitor the impacts of REDD+ (Appendix 1). The CCB Standard document (CCBA 2008) includes a comprehensive list of methods for biodiversity monitoring, including aspects of threatened species, invasive species, the use of Geographical Information Systems (GIS) and indicators. Central aspects of the standard include the description of species and ecosystems diversity in the project region before the start of the project and the subsequent monitoring of the impacts the REDD+ activities have on biodiversity. Most standards are developed with the involvement of environmental non-governmental organizations (NGOs).

2.2 Other initiatives that promote biodiversity monitoring

The Convention on Biological Diversity (CBD) established thematic Programmes of Work (PoW) for particular ecosystems and works on cross-cutting issues related to biodiversity, including the improvement of biodiversity monitoring by developing methods and indicators. These PoW include, among others, the *PoW on Forest Biodiversity* and the *PoW on Protected Areas*; work on cross-cutting issues includes, e.g., *Climate Change and Biodiversity* and *Identification, Monitoring, Indicators and Assessment*. Appendix 1 highlights some of the project relevant CBD guidelines, while the CBD's role on the international stage is treated in more detail in background paper 1.

The Global Environmental Facility (GEF) is the international funding mechanism of the "Rio conventions". It provides grants to developing countries and countries with economies in transition for projects related to biodiversity. GEF supports the improvement of existing forest certification standards. This includes the support of research for indicators and "[…] criteria used in certification systems with regards to measuring the components of biodiversity in forests […]" (GEF 2007). With the establishment of the Tropical Forest Account (TFA), the GEF received an organ that is designed to support sustainable forestry within REDD+ and to support preparation and implementation of FCPF and UN-REDD work.

An important organization that has influence on the design of monitoring schemes related to REDD+ is the International Union for Conservation of Nature (IUCN), since the IUCN Red List of Threatened Species (IUCN 2001) is an often applied indicator for assessing the state of biodiversity within the borders of pilot projects.

The Forest Stewardship Council (FSC) is an independent and non-profit orientated NGO. The FSC created a certification system that takes into account environmental issues and is becoming also relevant for REDD+ (FSC 2008). The FSC developed the High Conservation Values (HCV) concept, which was further developed by the High Conservation Value Resource Network. It provides guidelines for the collection of biodiversity data necessary for the monitoring of ecological conditions and changes in forests (FSC 2009).

Environmental NGOs like Conservation International (CI), the World Wide Wildlife Fund (WWF) or the Rainforest Alliance have been active for decades in the conservation sector.

They are now also directly involved in the REDD+ process and are central stakeholders in a number of REDD+ pilot projects. They assess, e.g., biodiversity baseline conditions and contribute to the development of project standards (e.g., CI 2010).

The following section gives some examples of how the guidelines for biodiversity monitoring developed by these organizations are recognized in specific REDD+ pilot projects.

3 Biodiversity in REDD+ pilot projects

A review of existing REDD+ pilot projects is presented by WERTZ-KANOUNNIKOFF & KONGPHAN-APIRAK (2009). In addition, summarizing overviews (CERBU *et al.* 2009; WERTZ-KANOUNNIKOFF & KONGPHAN-APIRAK 2009) as well as regional overviews, e.g. on Latin America (CENAMO *et al.* 2009), have been published. Based on these publications, and complemented by an own internet-based research, a total of 41 REDD+ pilot-projects were identified (Figure 1). This overview should be regarded as a snapshot of the evolving REDD landscape, rather than a complete inventory.

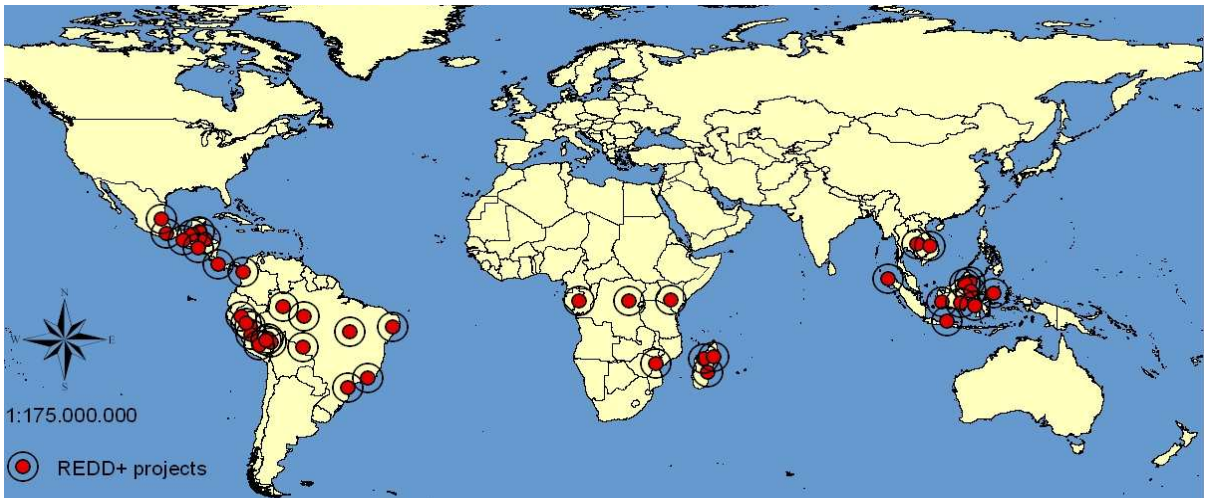

Figure 1: Snapshot of currently evolving REDD+ projects.

A central process in the creation of a climate project is to write a Project Design Document (PDD). In the beginning the PDD format was designed for projects under the UNFCCC Clean Development Mechanisms (CDM) but it is now also used for REDD+ pilot projects. PDDs of some projects that have been certified by the CCB Standard, or are currently undergoing an evaluation process, are publicly available at the CCBA website (http://www.climate-standards.org/projects/index.html). The PDDs of pilot projects that have a reference to REDD+ in their titles were reviewed regarding the indicators, criteria and methods used to describe the state of biodiversity in the project areas and the impacts of REDD+ activities in the project area (Appendix 2).

3.1 Determination of pre-project condition of biodiversity

Assessment of the pre-project condition of biodiversity on the project sites is the basis for all following monitoring activities. The analyzed projects mostly described the state of biodiversity by species richness, but area of forest cover, share of forest cover in the total area and forest structure (e.g., degree of forest fragmentation) were also important indicators (Appendix 2). Species belonging to the charismatic megafauna and species on the IUCN Red List were often used as indicators for biodiversity. Furthermore the HCV concept (e.g., JENNINS *et al.* 2003; FSC 2009) was often consulted to select indicators. Studies were frequently carried out in collaboration with local universities or NGOs.

3.2 Monitoring of project impacts

The projects used a number of different methods for the monitoring of biodiversity. The approach used in the Oddar Meanchey Project, Cambodia, encompasses the quantification of wildlife populations by "Fixed Point Photography", analyses of "Field diaries" or "Line transect" methods. It also includes the application of "Focus Group Discussions", where community monitoring groups report on the developments in resource use, species populations, and conditions of the environment. Another participatory monitoring approach, aiming to create awareness and improve the training of community members, is applied in the Juma project, Brazil (Biodiversity and Natural Resource Use Monitoring Program in State Protected Areas of Amazonas, see MARINELLI *et al.* (2007), Appendix 2).

REDD+ projects expressed biodiversity impacts often by quantifying the population-dynamics of certain species. Frequently, the number of sightings of certain species during the monitoring period was put into relation to pre-project sightings (e.g., the Kasigau Corridor Project, Kenya). The development of alternative livelihood-strategies for local people is considered to be a biodiversity benefit, as is the substitutions of non-native with native, non-genetically modified plants in the project area (Madre de Dios Amazon REDD Project, Peru). Effects on the structure of the forest habitat are also described.

In some PDDs it is explained how the additional financial means that are expected to be generated by REDD+ can improve the performance of the projects' monitoring schemes. The Kakamega Forest Project in Kenya, for example, aims at increasing the number of staff members that are needed for patrolling and furthermore wants to establish a GIS center.

4 Methods and challenges in the development of monitoring schemes

REDD+ has the potential to improve the performance of biodiversity monitoring systems in development countries, and several methods and approaches have been applied in the REDD+ projects (see previous section and Appendix 2). They can be divided into different categories, such as participative and more externally driven approaches. Furthermore, some approaches are based primarily on ground observations, whereas others apply methods of remote data collection. Although there is usually a gradient and between the approaches and no sharp distinction can be made between them, some characteristics are discussed in the following paragraphs.

Participatory monitoring approaches that have been developed for the specific ecological and economical conditions in the tropics (DANIELSEN *et al.* 2000), are predominantly based on observations made in the field. They can to some extend be designed and managed by local people and are generally low in cost. In contrast, the costs of externally-led monitoring performed by professionals and scientists are usually higher when compared to participative methods. However, such professional monitoring is capable of detecting trends faster. By comparing participatory methods with methods conducted by scientists, DANIELSEN *et al.* (2007) found that combined approaches, i.e., when monitoring schemes are applied that combine scientific with participatory methods, are most effective in monitoring changes in biodiversity and to obtain data for management decisions. However, further testing of the accuracy of participatory methods is critically needed (RODRÍGUEZ 2003).

Predominantly externally driven techniques of biodiversity monitoring in the tropics include the application of GIS. Remote sensing, the detection of electromagnetic signals reflected by the surface of the earth or the vegetation by air- or spaceborne sensors, also offers an increasing number of possibilities to monitor trends in the state of biodiversity. Those techniques have been tested and further developed for over a decade now (see SAVITSKY & LACHER 1998) and include direct as well as more indirect approaches (TURNER *et al.* 2003).

Indirect approaches to survey aspects of biodiversity by using remote sensing focus on the sensing of elements of habitat structure or features of topography. For example, species losses as a result of deforestation and associated habitat loss can be calculated with the species-area relationship, provided that relationship is known (BROOKS *et al.* 1997). Thus a reduction of biodiversity in terms of species richness can be extrapolated from monitoring the changes in forest cover. Furthermore, structural patterns of forest landscape and their impacts on species can be observed by remote sensing (e.g., JRC 2009). Forest fragmentation produces edge effects, which influence habitat parameters like humidity, light and temperature and can be detected many kilometers inside of the remaining forest. This causes, among other effects, higher tree mortality and shift in the species composition (FERRAZ *et al.* 2007). Abiotic edge effects can be measured by spaceborne sensors like Landsat Enhanced Thematic Mapper plus (ETM+), the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) or the Airborne Topographic Mapper (ATM). Images from these systems generally have a rather low resolution and are available at low or no cost. Their quality and utility is often strongly reduced due to cloud formation, especially in tropical regions.

Direct remote sensing methods, using sensors like Ikonos or Quickbird, allow for more detailed observation of processes. At the same time, they are more costly. Especially the development of hyperspectral remote sensing methods made it possible to detect signatures that can be assigned to certain plant species and ecosystems (TURNER *et al.* 2003). Monitoring of biodiversity with remote sensing on species level was described by CLARK *et al.* (2005).

Costs for hardware, software and data have continued to decline during the last decade. Especially the new techniques of remote sensing could be used to monitor species composition and also changes in vegetation dynamics in REDD+ projects. Notwithstanding declining cost, a debate remains concerning the overall feasibility and cost-benefit ratio of remote sensing approaches.

5 Summary and open questions

The efforts and expertise that have already been invested into biodiversity conservation under REDD+ underline that the integration of biodiversity into the mechanism is desired by many initiatives involved in REDD+. However, besides some guidelines for describing and monitoring of biodiversity provided by carbon standards, as the CCB Standard, there are only few generally accepted guidelines on how biodiversity should be monitored. In order to approach this issue, some the key questions are to be adressed by working group 2 at the "Greening REDD+" Workshop.

Questions relevant for the monitoring of biodiversity on the project level:

- Within most monitoring schemes, biodiversity is restricted to the aspects that are measurable by certain methodologies and means available at a given time. Often species richness and the existence of threatened species are the main indicators for biodiversity. What are the implications of this simplified concept of biodiversity?
- Which criteria and methods for monitoring forest biodiversity do currently exist and which indicators should be measured to describe biodiversity in a more complex way?
- How can participative methods be combined with externally driven, expert-based methods?
- What are the advantages of a clearly defined and sophisticated set of methodologies/criteria for the monitoring of biodiversity, when one could argue that the conservation of primary forest or restoration of degraded forests as a result of activities to maintain carbon stock is conservation of biodiversity *per se*?
- How can the existing knowledge and expertise be synthesized and made available for project managers and local project managers?

Questions relevant for the embedding of local monitoring schemes into (sub-) national REDD+ strategies.

- How could systems for the MRV of forest biodiversity be designed in order to facilitate data exchange and flow of information between projects, (sub-) national governments and other stakeholders, such as NGOs?
- Would it be an option to introduce globally comparable MRV systems for biodiversity, similar to the standardized system of MRV of carbon stocks?

Since REDD projects should be integrated into the respective national REDD+ strategies, and also in an internationally recognized REDD+ framework, these questions constitute a link to the discussions and open questions in background paper 1.

6 References

BROOKS TM, PIMM SL, COLLAR NJ (1997): Deforestation Predicts the Number of Threatened Birds in Insular Southeast Asia. Conservation Biology 11, 382-394.

CCBA (2008): Community & biodiversity project design standards, second edition. Climate, Community and Biodiversity, Arlington, VA., USA. 50 pp.

CCBA (2010): REDD+ Social and Environmental Standards. Version 15 January 2010. 11 pp.

CENAMO MC, PAVAN MN, CAMPOS MT, BARROS AC, CARVALHO F (2009): Casebook of REDD projects in Latin America. IDESAM & The Nature Conservancy, Manaus, Brazil. 87 pp.

CERBU G, MINANG PA, MEADU V (2009): Global survey of REDD projects: what implications for global climate objectives? ASB Partnership for the Tropical Forest Margins, Nairobi. 4 pp.

CI (2010): Biodiversity survey network (https://learning.conservation.org/biosurvey/Pages/default.aspx, last accessed: 2010.03.27).

CLARK ML, ROBERTS DA, CLARK DB (2005): Hyperspectral discrimination of tropical rain forest tree species at leaf to crown scales. Remote Sensing of Environment 96, 375-398.

DANIELSEN F, BALETE DS, POULSEN MK, ENGHOFF M, NOZAWA CM, JENSEN AE (2000): A simple system for monitoring biodiversity in protected areas of a developing country. Biodiversity and Conservation 9, 1671-1705.

DANIELSEN F, MENDOZA MM, TAGTAG A, ALVIOLA PA, BALETE DS, JENSEN AE, ENGHOFF M, POULSEN MK (2007): Increasing conservation management action by involving local people in natural resource monitoring. AMBIO: A Journal of the Human Environment 36, 566-570.

DICKSON B, DUNNING E, KILLEN S, MILES L, PETTORELLI N (2009): Carbon markets and forest conservation: a review of the environmental benefits of REDD mechanisms. UNEP World Conservation Monitoring Centre, Cambridge, UK. 54 pp.

FERRAZ G, NICHOLS JD, HINES JE, STOUFFER PC, BIERREGAARD RO, JR., LOVEJOY TE (2007): A large-scale deforestation experiment: effects of patch area and isolation on Amazon birds. Science 315, 238-241.

FSC (2008): FSC statement: forests and climate change (http://www.fsc.org/fileadmin/web-data/public/document_center/publications/statements/FSCstatement-forests_climatechange.PDF, last accessed: 2001.03.15).

FSC (2009): FSC Step-by-step guide: good practice guide to meeting FSC certification requirements for biodiversity and high conservation value forests in small and low intensity managed forests'. Bonn, Germany. 38 pp.

GEF (2007): Sustainable forest managment: strategic programming for GEF-4. Global Environmental Facility, 10 pp.

HARVEY CA, DICKSON B, KORMOS C (2009): Opportunities for achieving biodiversity conservation through REDD. Conservation Letters 9999.

IPCC (2006): Guidelines for national greenhouse gasinventories vol. 4 - agriculture, forestry and other land use. Intergovernmental Panel on Climate Change, Hayama, Japan. pp.

IPCC (2007): Climate change 2007: climate change impacts, adaptation and vulnerability. Intergovernmental Panel on Climate Change, 23 pp.

IUCN (2001): IUCN Red List categories andcriteria: version 3.1. IUCN Species Survival Commission, Gland, Switzerland and Cambridge, UK. 35 pp.

JENNINS S, NUSSBAUM R, JUDD N, EVANS, T (2003): Defining high conservation values at a national level: a practical guide. ProForest, Oxford, UK. 72 pp.

JRC (2009): Forest spatial pattern - linking and harmonizing the forests spatial pattern analyses at European, national and regional scales for a better characterization of the forests vulnerability and resilience. Final Report Document. 166 pp.

LACHER TE (1998): The spatial nature of conservation and development In: GIS methodologies for developing conservation strategies (LACHER TE, SAVITSKY BG (ed.)). columbia University Press, New York. pp. 1-3.

MARINELLI CE, CARLOS HSA, BATISTA RF, ROHE F, WALDEZ F, KASECKER TP, ENDO W, GODOY RF (2007): O programa de monitoramento da biodiversidade e do uso de recursos naturail em unidades de conservacao estudais do Amazonas. 60-64 pp.

MILES L, KAPOS V (2008): Reducing Greenhouse Gas Emissions from Deforestation and Forest Degradation: Global Land-Use Implications. Science 320, 1454-1455.

NOSS RF (1990): Indicators for monitoring biodiversity: a hierarchical approach. Conservation Biology 4, 355-364.

RODRÍGUEZ JP (2003): Challenges and opportunities for surveying and monitoring tropical biodiversity - a response to Danielsen et al. Oryx 37, 411-411.

SAVITSKY BG, LACHER TE (1998): GIS methodologies for developing conservation strategies. Columbia University Press, New York. 218 pp.

SCHOLES RJ, MACE GM, TURNER W, GELLER GN, JÜRGENS N, LARIGAUDERIE A, MUCHONEY D, WALTHER BA, MOONEY HA (2008): Toward a global biodiversity observing system. Science 321, 1044-1045.

SCHUYT K (2005): Perverse policy incentives In: Forest restoration in landscapes - beyond planting trees (MANSOURIAN S, VALLAURI D, DUDLEY N (ed.)). Springer, WWF, New York, USA. pp. 78-83.

TURNER W, SPECTOR S, GARDINER N, FLADELAND M, STERLING E, STEININGER M (2003): Remote sensing for biodiversity science and conservation. Trends in Ecology & Evolution 18, 306-314.

UN-REDD (2008): Role of satellite remote sensing in REDD. UN-REDD, Gland, Switzerland. 9 pp.

UNFCCC (2009): Reducing emissions from deforestation in developing countries: approaches to stimulate action, FCCC/SBSTA/2009/L.19.Add.1. 3 pp.

WERTZ-KANOUNNIKOFF S, KONGPHAN-APIRAK M (2009): Emerging REDD+ - a preliminary survey of demonstration and readiness activities. CIFOR, Bogor, Indonesia. 44 pp.

Appendix 1: International initiatives that address biodiversity issues related to the REDD+ process (adapted and further developed according to DICKSON *et al.* (2009)). Initiatives are broadly separated into (1) those that were established in order to support the implementation of REDD+ projects and programs, and (2) those that developed guidelines for the monitoring of biodiversity independent of the REDD+ process.

(1) Initiatives / facilities / programmes established to support the implementation of REDD+ projects and programs	
World Bank Forest Investment Program (FIP)[1]	The program aims to mobilize increased investment in REDD. Participants must use "participatory and independent approaches to monitoring and evaluation", including biodiversity and ecosystem benefits.
Forest Carbon Partnership Facility (FCPF)[2]	Mechanism to assist developing countries in their efforts to reduce emissions from deforestation and forest degradation. Selection criteria focus on "innovative and/or advanced concepts of monitoring, reporting and remote sensing of forest degradation, biodiversity protection and social benefits" (FCPF, 2008: 16). The inclusion of indicators for biodiversity depends on national priorities.
UN-REDD Programme[3]	Assists developing countries in 'getting ready' for participation in the REDD mechanism and supports development of guidance and standardized approaches. Member countries have to assess key environmental issues. Tools and methods for MRV (including MRV of environmental co-benefits) are developed and published in a regularly updated internet platform[4].
REDD+ Social and Environmental Standards[5]	Are currently being developed to ensure that REDD+ programmes and funding mechanisms respect the rights of indigenous peoples and local communities and generate significant social and biodiversity co-benefits. Development of the standards is facilitated by CCBA and CARE international. One of eight principles of the standards concerns biodiversity and provides a framework for indicators, Indicators refer to the National Biodiversity Strategy and Action Plans that countries are to prepare – or already have prepared - for the CBD.
(2) Initiatives / facilities / programmes that developed guidelines for the monitoring of biodiversity independently of the REDD+ process	
Climate, Community and Biodiversity Alliance (CCBA)[6]	The CCBA established a set of standards to promote multiple-benefit land-based carbon projects that contribute to forest conservation, restoration and agroforestry. The CCB Standards were initially developed for voluntary carbon markets, and are now also widely applied to REDD projects. Projects must meet the following criteria. Net benefits for Biodiversity: Use appropriate methodologies to estimate changes in biodiversity; demonstrate that no High Conservation Values (HCV) will be negatively affected by the project; identify all species to be used by the project and show that no known invasive species will and that the population of any invasive species will not increase as a result of the project; justify any use of non-native species over native species; guarantee that no genetically modified organisms (GMOs) will be used to generate emissions reductions. Offsite Biodiversity impacts: Identify potential negative offsite biodiversity impacts that the project is likely to cause; document how the project plans to mitigate these negative offsite biodiversity impacts; evaluate likely unmitigated negative offsite biodiversity impacts against the biodiversity benefits of the project within the project boundaries; justify and demonstrate that the net effect of the project on biodiversity is positive. Biodiversity Impact Monitoring: Develop an initial plan for selecting biodiversity variables to be monitored and the frequency of monitoring and reporting to ensure that monitoring variables are directly linked to the project's biodiversity objectives and to anticipated impacts; develop an initial plan for assessing the effectiveness of measures used to maintain or enhance HCV in the project zone; commit to developing a full monitoring plan within six months of the project start date or within twelve months of validation against the Standards.
Plan Vivo Standard[7]	A system for developing community-based payments for ecosystem services (PES) projects and programmes, with an emphasis on building capacity, long-term carbon benefits, diversifying livelihoods and protecting biodiversity. The use of native species is mandatory for the certification. Projects must submit annual reports including field assessments, monitoring and qualitative data. Staff awareness of conservation aspects and priorities is a indicator for validation of the project Wider ecological impacts must be identified and considered including impacts on local and regional biodiversity and impacts on watersheds.

[1] http://www.climatefundsupdate.org/listing/forest-investment-program
[2] http://www.forestcarbonpartnership.org/fcp/
[3] http://www.un-redd.org/
[4] http://redd.wetpaint.com
[5] http://www.climate-standards.org/REDD+/index.html
[6] http://www.climate-standards.org/
[7] www.planvivo.org

Convention on Biological Diversity (CBD)	The Programme of Work on Protected Areas includes elements for "direct actions for planning, selecting, establishing, strengthening and managing protected area systems and sites" and "standards, assessment and monitoring".[1] Programme Element 3 of the Forest Biodiversity Programme ("Knowledge, Assessment and Monitoring") includes the sub-goals "improve knowledge on and methods for the assessment of the status and trends of forest biological diversity, based on available information" and "improve the infrastructure for data and information management for accurate assessment and monitoring of global forest biological diversity".[2] Other CBD work relevant for the REDD+ process includes, e.g., the cross-cutting issues Climate Change and Biodiversity[3] and Identification, Monitoring, Indicators and Assessments[4]
Global Environment Facility (GEF)[5], especially the Tropical Forest Account (TFA)	The TFA is part of GEF's Sustainable Forest Management (SFM) Programme. It provides funding for countries with large forests areas to establish projects and programs with a focus on biodiversity. Provisional indicators include: Forest ecosystem coverage in national protected area systems; protected area management effectiveness as measured by individual protected area scorecards; total revenue and diversification in revenue streams generated by forest protected areas.
High Conservation Value (HCV) Resource Network[6]	The HCV Resource Network has been established by a group of organizations that use the HCV approach, including environmental and social NGOs, international development agencies, timber and forest product certifiers, suppliers and buyers, and forest managers.
Forest Stewardship Council (FSC)[7]	An independent, not-for-profit NGO responding to concerns over global deforestation. FSC developed the concept of "High Conservation Value (HCV) Forests". These are defined by six Categories (FSC 2009), including areas that have a high concentration of biodiversity values (protected areas; rare or threatened species; endemic species; and seasonal concentrations of species), large landscape-level forests, areas that provide critical ecosystem services (for local communities or on the a higher level) or are important for the cultural identity. National toolkits for the identification of HCV forests have been developed. Provisions for monitoring, based on the HCV concept, include changes in flora and fauna, environmental impacts of harvesting and other operations.
International Union for Conservation of Nature (IUCN)[8]	The IUCN Red List of Threatened Species[9] is an important and often used tool for describing the biodiversity status of project sites and monitoring the impacts of the REDD+ activities.
International Tropical Timber Organization (ITTO)[10]	The ITTO Thematic Program on Reducing Deforestation and Forest Degradation and Enhancing Environmental Services in Tropical Forests (REDDES) aims to help build the capacity of member countries in order to maintain and enhance their forest environmental services. ITTO supports the quantification, valuation, monitoring and verification of environmental services. This activity may include development of nationally applicable manuals and other training materials as well as organization of training events.
Conservation international (CI)[11]	CI has created a REDD training and education program; worked with tools of engagement and benefit sharing to ensure that REDD can benefit vulnerable communities and set up pilot forest carbon projects around the world. CI is also a leading proponent of the CCBA, which has developed voluntary standards to maximize the many benefits of projects that reduce deforestation.[12]
World Wildlife Fund For Nature (WWF)[13]	WWF has initiated REDD+ pilot projects in key regions of the world.

1 http://www.cbd.int/protected/objectives.shtml
2 http://www.cbd.int/forest/PE3.shtml
3 http://www.cbd.int/climate/intro.shtml
4 http://www.cbd.int/indicators/
5 http://www.undp.org/gef/
6 http://www.hcvnetwork.org/
7 http://www.fsc.org/climatechange.html
8 http://www.iucn.org/
9 http://www.iucnredlist.org/
10 http://www.itto.int/
11 http://www.conservation.org/learn/climate/pages/climate_redd.aspx
12 http://www.conservation.org/learn/climate/pages/climate_redd.aspx
13 http://www.worldwildlife.org/what/globalmarkets/forests/item3577.html

Appendix 2: Methods and targets for measuring biodiversity in REDD+ pilot projects (besides reduction of deforestation) according to their Project Design Document (PPD). This information was extracted from the PDDs of projects that have been certified by the CCB Standard, or are currently undergoing an evaluation process, and are publicly available on the CCBA website. Projects were selected for review if they had a reference to REDD+ in their project title.

Name and country of project	Positive biodiversity impacts	Description of biodiversity	Monitoring criteria and methods used
Oddar Meanchey REDD Project, Cambodia[1]	Ensuring the conservation of key habitat for threatened flora and fauna Predominant use of native species Guarantee that no GMOs will be used No High Conservation Value (HCV) sites will be affected Mitigation strategies will be developed to compensate for loss of income due to project-related restrictions Protection of IUCN endangered species	Number and families of species Examples of charismatic megafauna and birds (including IUCN endangered species)	Proportion of villagers that heard about project conservation activities Ha of degraded forest Area of forests burned previous year Sightings of key indicator species Methods according to (DANIELSEN *et al.* 2000): Field Diary, Photo Documentation, Transect Walk method, Focus Group Discussion
Kasigau Corridor REDD Project, Kenya[2]	Protection of IUCN endangered species Plantation of indigenous species No GMOs are used Ensure that non-native species have no invasive character Reduction of "bushmeat-consumption"	Description of vegetation of the project Species list (from wildlife sightings) Description of HCV	Wildlife monitoring on a daily basis Species populations extrapolated from sighting logs Evidence of illegal activity damaging to biodiversity (felled trees for construction, poached animals, poaching arrests, illegal grazing with number of head of cattle) Instances of wildlife-human conflict, e.g. elephant crop raiding or live-stock predation Database of wildlife sightings Elephant counts
Madre de Dios Amazon REDD Project, Peru[3]	Protection of HCV sites, key critical areas for fauna (e.g. collpas), prohibition of hunting Use of native plants	Identifications of HCV and IUCN endangered species	"Without project"-biodiversity scenario by comparison with neighbouring plots: Identification of species/fauna groups that reflect changes in fauna (like cattle grazing)
Forest Again Kakamega forest, Kenya[4]	Reduce forest fragmentation and degradation by connecting forest fragments Edge effects decrease Protection of IUCN endangered species, medicinal plants Lower species extinction due to forest fragmentation	General description of flora and fauna including numbers of identified species Forest is 3rd highest ranked forest in Kenya for conservation by the IUCN Fragmentation analysis Evaluation, if project zone includes HCV	Monitoring of key species (e.g. Blue Monkey that is restricted to large tracts of primary forest, birds) Detailed monitoring plan is not available yet Fragmentation studies, landscape metric analyses, habitat analyses
The Juma Sustainable Development Reserve Project: Reducing Greenhouse Gas Emissions from Deforestation in the State of Amazonas, Brazil[5]	Reduce threat of deforestation due to building of roads, illegal logging, mining, land grabbing Damage due to agriculture and cattle ranching, and overfishing will decrease Loss of 65% of forest cover is projected – project reduces loss to 10% Decreasing forest fragmentation and edge effects REDD+ will provide the resources necessary to overcome the great deficiencies of the State's ability to	High importance due to its rich aquatic flora and fauna and primate biodiversity; frequent finding of new species Aripuana River is an important boundary for fauna creates unique habitats Description of birds, mammals, aquatic mammals, fish, chelonians, crocodilians, flora. Including IUCN Red List threatened	Monitor Plan according to PRoBUC (monitoring of species richness of animals, plants (MARINELLI *et al.* 2007) Program aims to create awareness and improve training of community members Monitoring includes: species used by local communities, such as synergistic fauna (mammals, birds, and turtles), commercial fish species and timber and non-timber species; charismatic species, "special interest" species, (critically) endangered species,

	monitor such areas Enhancement of soil and water quality by reducing deforestation	species	"conflict species" (man vs. animal); land use and changes in vegetation cover and boat traffic
Reducing Greenhouse Gas Emissions from Deforestation and Degradation in the State of Tocantins, Brazil[6]	Project aims at increasing the size of an existing protected area mosaic and the connectivity between forest fragments Increase the refuge area for animals. Reduction of forest fire by improved management	Detailed description of vegetation and different sub-ecosystems in the Savannah Endemic species are quantified Species were defined by direct and indirect observation (droppings, feathers, tracks, nests, holes) IUCN threatened species	The monitoring will be conducted analytically and comparatively Between benchmark zero from the Social Carbon Methodology and subsequent benchmarks, tracking indicators exclusively formatted to monitor biodiversity and natural resources on an individual basis and integrated with the other elements of the project Indicators (Evaluation method): natural communities (Field survey); use of biodiversity (Interviews with local inhabitants); species of conservation interest (Interviews with local inhabitants & field survey)
Reducing Carbon Emissions from Deforestation in the Ulu Masen Ecosystem, Aceh, Indonesia[7]	Threats due to high-pricing tropical hardwood species Project aims at avoiding habitat loss and degradation	Surveys of megafauna (e.g., elephants, tigers) and their key food species	Monitoring includes: deforestation rates Use of remote sensing images, camera trapping programs Measurement of water quality

[1] http://www.climate-standards.org/projects/files/cambodia/CCB_PDD_Oddar_Meanchey_NORMAL_RES.pdf
[2] http://www.climate-standards.org/projects/files/taita_taveta_kenya/Rukinga_CCB_PDD_Ver_2_0.pdf
[3] http://www.climate-standards.org/projects/files/madre_peru/Madre_de_Dios_Amazon_REDD_Project_REVISED.pdf
[4] http://www.climate-standards.org/projects/files/kenya0409/Forest_Again_PDD.pdf
[5] http://www.climate-standards.org/projects/files/juma/PDD_Juma_Reserve_RED_Project_v5_0.pdf
[6] http://www.climate-standards.org/projects/files/tocantins/ccba_pdd_tocantins_redd_v_1.pdf
[7] http://www.climate-standards.org/projects/files/Final_Ulu_Masen_CCBA_project_design_note_Dec29.pdf