REDD-plus and biodiversity: opportunities and challenges

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Action for reducing emissions from deforestation and forest degradation under the new global climate change agreement (REDD-plus) can also favour biodiversity conservation, but these additional benefits will depend on how REDD-plus is planned.

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Any new global agreement on climate change mitigation under the United Nations Framework Convention on Climate Change (UNFCCC) will include action on reducing emissions from deforestation and forest degradation, plus conservation and enhancement of forest carbon stocks and sustainable management of forest (REDD-plus). REDD-plus should make funding available for developing countries to support forest-related emission reductions and foster carbon sequestration within forests. The magnitude and scope of the funding and the responsibilities of participating developing countries will depend on the final form of the agreement.

While the main purpose of REDD-plus is to mitigate climate change, REDD-plus actions can yield additional benefits for people at local to global scales. The multiple benefits include ecosystem services such as biodiversity conservation, economic benefits such as fuelwood supply, and social benefits arising from the REDD-plus process itself (such as capacity building and improved governance). Benefits can include improvements over the present situation or avoided losses (for example, if more biodiversity is retained with a REDD-plus project or programme than without one). This article focuses on the factors influencing the outcomes for biodiversity conservation.

Globally, at least 50 percent of terrestrial species are found in forests, most of them in the tropics (Millennium Ecosystem Assessment, 2005). By mitigating global climate change, a successful REDD-plus mechanism would also benefit vulnerable biodiversity in ecosystems worldwide. There is some evidence that biodiverse forests are likely to be more resilient to climate change, thus underpinning the long-term success of REDD-plus (Thompson *et al.*, 2009).

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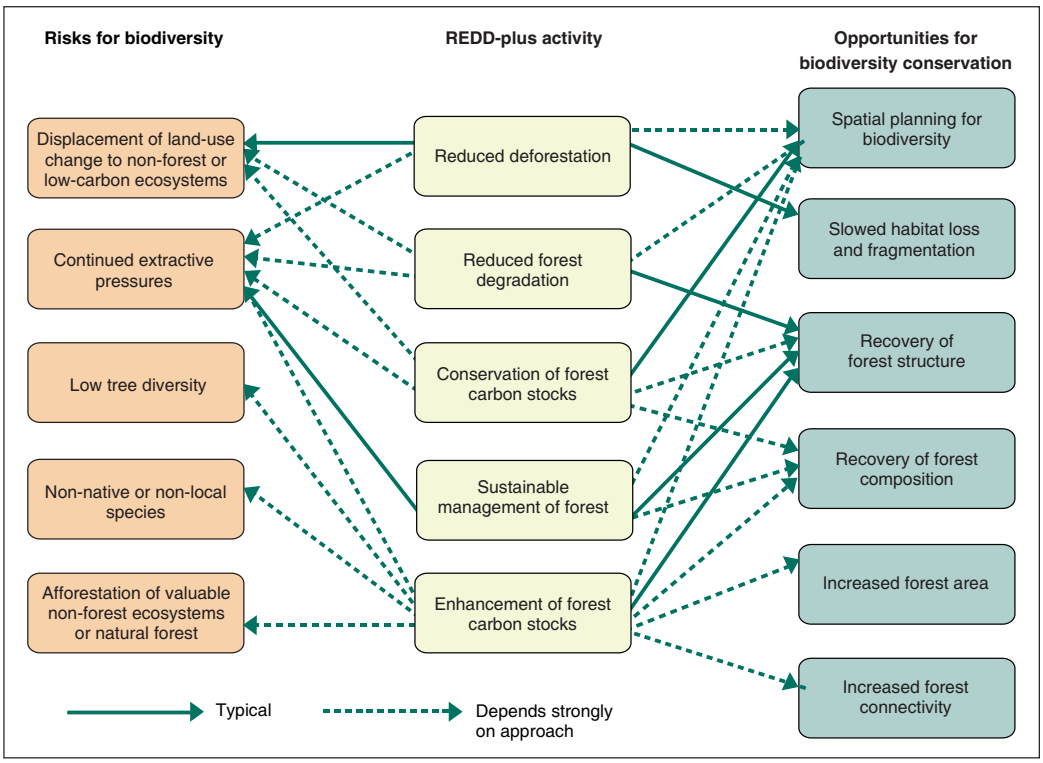
This farmer's reforestation efforts contribute to conserving the threatened fauna and flora of the Brazilian Atlantic

However, like any large-scale influence on land use, REDD-plus creates not only opportunities but also risks for biodiversity (Figure). Its impact on biodiversity will be affected by the type of activity, the location and the approach used. Multiple benefits can thus be considered at every stage of REDD-plus design and implementation, and at all scales – global, national and site.

Questions of equity apply not only to the direct financial benefits that may arise, but also to the multiple benefits



Major opportunities and risks for biodiversity conservation from the five REDD-plus activities proposed in the Ad Hoc Working Group on Long-term Cooperative Action (AWG-LCA) draft of December 2009

of REDD-plus. The location of the sites and approach to the activities concerned will also affect who benefits or loses from REDD-plus. In general, poorer people are more likely to be dependent on forest resources than the more well-off within the same rural communities, and women and men often rely on different resources for their subsistence and livelihoods (Ferraro, 2002; Campbell *et al*., 2008). Involving a wide range of stakeholders at the local scale in developing and implementing REDD-plus activities will help to make sure that these groups are not disadvantaged.

At this early stage for REDD-plus, some countries are launching demonstration projects to test approaches to reducing forest carbon emissions. Some of these projects can also be used to improve understanding of impacts on biodiversity. They could also offer opportunities to use monitoring data to evaluate adaptive management approaches for improved biodiversity outcomes.

POLICY CONTEXT: THE SCOPE OF REDD-PLUS

The UNFCCC negotiations on a post-Kyoto agreement have yet to result in a decision on the form that an international REDD-plus mechanism will take. For an effective mechanism to emerge, both a new international agreement under UNFCCC and a ready (in the sense of willing and prepared) set of REDD-eligible countries will be needed. Widespread readiness to engage in REDD-plus would make it possible for a large proportion of the world's tropical forest to be covered under the mechanism from the start, reducing opportunities for international displacement ("leakage") of emissions and improving the chance that REDD-plus will yield true benefits for the climate.

Major areas still to be agreed upon include the mode of international financing, which could be market based, fund based or a mixture of the two, and the method of deciding the reference levels for forest emissions against which success will be judged (e.g. negotiation, historical records or projections of business-as-usual trends). The scale of funding will do much to determine the area of forest covered, and thus the risk of land-use change displacement between countries.

The range of activities encompassed by any UNFCCC decision on REDD-plus will shape the opportunities and risks for biodiversity. The negotiating text presented at the meeting of the Ad Hoc Working Group on Long-Term Cooperative Action under the Convention (AWG-LCA) in Bonn, Germany in June 2010 proposes that the following range of activities be eligible under a REDD-plus scheme (UNFCCC, 2010):

- reducing emissions from deforestation;
- reducing emissions from forest degradation;
- conservation of forest carbon stocks;
- sustainable management of forest;
- enhancement of forest carbon stocks.

The AWG-LCA draft (UNFCCC, 2010) also includes a list of environmental and other "safeguards" to ensure the multiple benefits of REDD-plus. REDD activities should:

- be consistent with the conservation of natural forests and biological diversity (i.e. not involve the conversion of natural forests, incentivize the protection and conservation of natural forests and their ecosystem services and enhance other social and environmental benefits);
- complement or be consistent with national forest programmes (i.e. forest policy frameworks) and relevant international conventions and agreements;
- involve transparent and effective governance;
- respect the knowledge and rights of indigenous peoples and members of local communities;
- involve full and effective participation of these and other stakeholders;
- address the risk of reversals and reduce displacement (leakage) of emissions.

Nothing would prevent eligible countries, or donors funding the development of REDD-plus strategies, from setting conditions that are more detailed or stringent than those stipulated in the eventual UNFCCC guidance.

NATIONAL PREPARATION FOR REDD-PLUS

National-level decisions during the design and implementation of a REDD-plus programme will influence the outcomes for biodiversity (see Box). A major consideration is the effect of REDD-plus on land use, both through direct action to manage forest carbon stocks and through any displacement of land-use change from forests covered under REDD-plus to other ecosystems. Such potential displacement, such as development of new croplands in savannah rather than forest, can pose an additional threat to biodiversity (Miles and Kapos, 2008).

Policies that tackle the drivers of deforestation on a national scale could include changes to agricultural incentives, logging moratoria and payments to "suppliers" of carbon stocks. These are relatively unlikely to generate internal displacement of deforestation and forest degradation pressures from one area to another.

Other approaches will be implemented only in selected regions or sites (e.g. afforestation and targeted law enforcement). In this case, best practice involves a map-based priority-setting analysis to support zoning or land-use planning. In this way, the total set of potential sites is identified and the most valuable sites for carbon and additional benefits are tackled first. Priority-setting analysis can also offer a focus for community engagement with REDD-plus.

An analysis focused on maximizing REDD-plus success (i.e. maximizing carbon sinks or minimizing carbon losses) for minimum costs may miss the opportunity for substantial biodiversity benefits at little extra cost (Miles and Kapos, 2008; Grainger *et al.*, 2009). For a given carbon outcome, a strategy that conserves or creates a greater mix of different forest types over a wider area is likely to deliver greater conservation gains (Miles, 2007; Strassburg *et al.*, 2009; Venter *et al.*, 2009). However, there will often be trade-offs between cost, conservation and carbon outcomes. Some areas of biodiversity conservation concern are likely to be more costly to conserve than others – for example, biodiversity "hotspots" by definition hold a high number of endemic species but experience a high level of threat (Myers *et al.*, 2000).

Some spatial allocation decisions may need to be made before such an analysis is available, for example siting of demonstration projects. In this case, the following rules of thumb can be considered to favour biodiversity conservation (Harvey, Dickson and Kormos, 2010):

- Prioritizing the retention of threatened high-biodiversity forests over other activities such as reforestation or sustainable management of pro-

How countries can plan for biodiversity benefits in their REDD-plus preparations

- **Acquire and share data needed to understand the current and potential distribution of biodiversity and, where possible, its value for ecosystem service provision and beneficiaries.**
- **Assess likely biodiversity impacts as part of cross-sectoral policy analysis undertaken to identify workable solutions to forest carbon loss.**
- **Take biodiversity into account in the selection of REDD-plus locations, i.e. through a map-based priority-setting analysis.**
- **Take the likely impacts on biodiversity into account when selecting REDD-plus activities and approaches.**
- **Include stakeholders that depend on biodiversity and forest ecosystem services in REDD-plus decision-making.**
- **Define goals for biodiversity conservation in the REDD-plus strategy and, where feasible, at site scale.**
- **Identify institutional responsibilities for these goals, and build capacity to meet them as needed.**
- **Design cost-effective monitoring systems to allow assessment of progress towards the goals.**
- **Plan for adaptive management to address unwanted declines in biodiversity.**

duction forests will typically bring greater and more rapid gains for both biodiversity and carbon conservation.

- Where carbon stocks and ecosystems are similar between forest areas, prioritizing connectivity of forests will yield better results for biodiversity conservation.

REDD-PLUS ACTIVITIES AT SITE SCALE

At any site, the opportunities and risks for biodiversity will depend on the type of REDD-plus activity undertaken (see Figure) and the approach used to implement it, including specific management practices such as the extent to which biodiversity conservation is planned for, managed for and monitored. For example, physically excluding human access to a site previously used for extraction of timber or fuelwood is likely to benefit wildlife (Bowen-Jones and Pendry, 1999; Meijaard *et al.*, 2005). The long-term sustainability of such an approach is, however, doubtful (Bruner *et al.*, 2001). Reducing emissions from degradation through community forest management is likely to produce better results for carbon over the long term, while biodiversity outcomes will depend on the design and implementation of the chosen management regime.

Reducing emissions from deforestation

Reducing loss of natural forest will yield significant and multiple benefits, which include the retention of ecosystem services: moderating river discharge, erosion and sediment fluxes; protecting soil resources which contain essential nutrients for plant growth; purifying water; and providing a habitat for flora, fauna and microbial communities (Stickler *et al.*, 2009). Each of these ecosystem functions is valuable for biodiversity conservation as well as for human well-being.

Deforestation in UNFCCC language is defined as a change in land use, not only in vegetation cover. Land-use change is the primary cause of biodiversity loss worldwide (Wood, Stedman-Edwards and Mang, 2000). As the main cause of deforestation is conversion to agriculture, many approaches to reducing deforestation focus on the agriculture sector – for example, increasing the productivity of existing agricultural land to reduce the total area required, or increasing the long-term sustainability of techniques and thus the time that land remains productive. The effect on biodiversity within the agricultural landscape itself varies according to the technique.

Other approaches focus on protecting forests, for example through incentives or enforcement of land-use regulations, which have the advantage of directly addressing the goal of reducing deforestation. The main risk of these approaches is that the driver of land-use change may not be affected, causing leakage of the problem to another area. Ecosystems and countries that are not involved in the REDD-plus mechanism are particularly likely to be at risk (Miles and Kapos, 2008).

In both cases (agriculture and protection), spatial priority-setting would assist in targeting the forests of greatest conservation concern.

Reducing emissions from forest degradation

Reducing degradation of forest carbon stocks can in many cases lead to a recovery of forest structure, with consequent positive results for biodiversity as niches are restored and resource availability increases. Common causes of forest carbon loss include logging, fire, forest wetland drainage and extreme weather events such as hurricane damage or drought. These causes can be linked to one another, with logging, drought and drainage increasing the susceptibility of forest to fire (Nepstad *et al.*, 2008). Only anthropogenic causes of degradation are strictly relevant to REDD-plus under UNFCCC.

Improvements in governance and law enforcement related to timber extraction may take a number of forms. For example, a successful logging moratorium would yield carbon and biodiversity benefits, at the cost of timber production.

Other improvements in forest governance will promote reduced emissions where logging continues. For example, reduced-impact logging has far lower

Reducing degradation of forest carbon stocks – for example losses caused by fire – can often lead to a recovery of forest structure, with consequent positive results for biodiversity

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climate impacts than conventional logging (Putz *et al*., 2008). Regulated and/or certified logging concessions that require these practices can protect some biodiversity and carbon values while realizing some timber values (Chomitz *et al*., 2006; van Kuijk, Putz and Zagt, 2009).

Better management of fire use in agricultural practices should help reduce another cause of forest degradation (Aragao and Shimabukuro, 2010). In most forest landscapes, control of fire benefits biodiversity and related ecosystem services. However, some plant and animal species in fire-adapted ecosystems (e.g. tropical woodlands and savannahs) depend on periodic burning (Stickler *et al*., 2009).

In swamp forest areas subject to drainage, restoration of the water table will slow carbon emissions from peat decomposition and reduce the likelihood of underground fire, as well as being a first step towards restoring forest ecosystems (Parish *et al*., 2008).

Conservation of forest carbon stocks

The approaches used in carbon conservation can build on those used in biodiversity conservation even if the primary aims are different. These approaches include increasing the number or enhancing the management of protected areas, community conserved areas (CCAs) and forest reserves (including some production forests) and supporting community-based natural resource management. Moreover, systematic conservation planning tools are among the most widely used spatial priority-setting tools (e.g. Game and Grantham, 2008).

Financial support for conservation of carbon stocks in intact forests could support REDD-eligible countries with high forest carbon stocks and low current deforestation rate. If forest conservation initiatives are not undertaken here, the risk of international leakage to these countries would threaten the global success of REDD-plus. Other countries may also choose to include forest carbon conservation in their REDD-plus approaches.

Action on protected areas, CCAs and forest reserves would help to protect primary forest biodiversity adequately. While strict protection may reduce access to forest resources for local people, community conserved areas may enhance and preserve forest access (Coad *et al*., 2008). Protected areas are demonstrably able to withstand agricultural expansion and logging pressures, especially when sufficiently funded and managed with the consent of local communities (Clark, Bolt and Campbell, 2008). However, they can only form part of a REDD-plus strategy, as they do little to address the drivers of deforestation; displacement of these pressures is still a risk.

Sustainable management of forest

The term "sustainable management of forests" is used in the draft AWG-LCA text on REDD-plus without definition. By inference, in this context the term appears to refer to the sustainable management of forest for timber production (i.e. carried out in such a way as to maintain constant levels of carbon stocks over multiple logging cycles). This is the meaning referred to in the following discussion. Approaches to sustainable management of forest for timber include reduced-impact logging, ecoforestry, enhanced regulation of logging and application of certification standards.

If the sustainable management of forests for timber includes activities that reduce depletion of carbon stocks and enhance forest resilience, it could benefit biodiversity if it is implemented in forests that currently have unsustainable rates of harvest. Introducing logging (even at sustainable levels) in old-growth forest areas can, however, harm biodiversity (Putz and Redford, 2009; Harvey, Dickson and Kormos, 2010).

Reduced-impact logging, ecoforestry and other techniques for sustainably managing timber production forests require better training for forest managers and workers, but deliver substantially greater ecosystem and biodiversity benefits than conventional logging techniques. REDD-plus funds could provide an opportunity to transform the forestry sector to meet the goals of sustainable management.

Reduced-impact logging techniques deliver substantially greater ecosystem and biodiversity benefits than conventional logging

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Enhancement of forest carbon stocks

The REDD-plus activity that has given rise to the greatest concerns about possible harm to biodiversity is forest carbon stock enhancement. This activity could involve restoring carbon stocks in degraded forests or creating forests where none currently exist. The approaches used and the locations where forests are created or restored will determine the effects on biodiversity.

There is some uncertainty over whether "enhancement of forest carbon stocks" as mentioned in the AWG-LCA draft decision (UNFCCC, 2010) actually includes afforestation and reforestation (IUCN, 2009; RECOFTC, 2009) or only refers to enhancement of stocks within existing forest (Angelsen, 2009). Here, it is assumed that afforestation and reforestation activities are included. The main international funds for REDD-plus readiness also make this assumption (Miles, 2010).

The development of plantation forests may lead to the loss of biodiversity that was formerly present. In general, it may do less harm, or even create benefits, if plantations are composed of diverse, native species (Harvey, Dickson and Kormos, 2010) matched to the site, and are more akin to restored ecosystems than to monoculture landscapes (Brockerhoff *et al.*, 2008).

Concerns have been expressed about the possibility that the REDD-plus mechanism will incentivize the replacement of natural forests with plantation forests. The draft includes a safeguard to address this concern, stating that REDD-plus activities should not lead to the direct conversion of natural forests.

Relative to more intensively managed forests, forest restoration and rehabilitation of degraded natural forests involve a greater emphasis on healthy ecosystem functioning together with an eventual increase in carbon stored (Sajwaj, Harley and Parker, 2008). Biodiversity and water quality are particularly likely to improve with more natural forest structure and composition. The trade-off is the speed of carbon accumulation, which may be slower than in areas newly afforested or reforested.

In selecting locations for new forest areas, giving greater weight to areas close to existing forest can help to meet conservation objectives by increasing connectivity between forest patches, providing some resources for wildlife resident in natural forest and providing buffers around natural forest to lessen human impact there (e.g. Bali, Kumar and Krishnaswamy, 2007). Even plantations of non-native species can offer some support to biodiversity conservation in this way.

CONCLUSIONS

Different approaches to REDD-plus planning and implementation have different implications for forest biodiversity and the people and ecosystem services that depend on it. Planning at an early stage for positive outcomes for biodiversity and other multiple benefits can avoid inadvertent commitment to a suboptimal or actively harmful course of action. Making use of appropriate tools and putting policies in place to safeguard and enhance biodiversity can increase the benefits from REDD-plus, sometimes at little additional cost. The identity, magnitude and receivers of the biodiversity benefits and harm associated with REDD-plus will depend on the scope, location and type of REDD-plus activities, as well as on the approaches used to address specific biodiversity issues. Consultation, engagement and buy-in of stakeholders, from national government to local communities, is critical both for the overall success of REDD-plus and to ensure that different biodiversity values are understood.

At the national level, it is useful to identify the potential value of biodiversity and the groups that place value on it, so as to maximize its value to the nation and its forest-dependent communities, to demonstrate added value to funders and sometimes to facilitate complementary conservation finance. However, in a future scenario where REDD-plus funds are successful in conserving forests, the best use of limited biodiversity conservation funds may be to protect low-carbon and non-forest ecosystems from the displacement of land-use change pressures (Miles and Kapos, 2008), rather than to support REDD-plus.

REDD-plus needs to move forward swiftly if it is to achieve useful climate change mitigation results, despite major gaps in knowledge about tropical biodiversity and its response to environmental change. Monitoring and adaptive management to reduce any negative impacts observed will be of particular help in ensuring biodiversity benefits from REDD-plus. ◆

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