Chapter 6
Conclusions

Coordinating lead authors: John A. Parrotta, Stephanie Mansourian and Christoph Wildburger
Lead authors: Toby Gardner, Valerie Kapos, Werner A. Kurz, Constance L. McDermott, Bernardo B.N. Strassburg, Ian D. Thompson and Bhaskar Vira

CONTENTS

6.1 REDD+: Opportunity and risk

Forests, especially those in tropical and sub-tropical regions, contain most of the world's terrestrial biodiversity and provide a broad range of ecosystem services. These services directly benefit people both globally and locally, in particular the hundreds of millions of people whose livelihoods depend, at least in part, on forests. One of these global services - carbon sequestration - is receiving international attention because of forests' important contribution to the global carbon cycle.

Deforestation, resulting mainly from ongoing conversion of forests to agricultural land, is the major cause of global biodiversity loss in terrestrial ecosystems. It is also the second largest anthropogenic source of carbon dioxide emissions to the atmosphere after fossil fuel emissions. Forest degradation (changes in forest condition that affect a forest's capacity to provide goods and services) is a major contributor to global anthropogenic CO_2 emissions, and an important driver of biodiversity loss.

The future of the global forest carbon sink – as well as the world's terrestrial biodiversity - is highly uncertain. On the one hand, ongoing threats from land-use and environmental change are significant, and on the other, there are potentially significant opportunities for positive change through efforts to reduce rates of deforestation and forest degradation. The Intergovernmental Panel on Climate Change (IPCC) has highlighted that reducing deforestation, especially in the tropics, can considerably reduce greenhouse gas emissions and increase CO_2 removals at low costs, and can be designed to create synergies with adaptation and sustainable development.

REDD+ activities aim to mitigate climate change by reducing the greenhouse gas emissions resulting from deforestation and forest degradation. A number of actions, including changes in land use and management practices (in both forested and non-forested land) can achieve REDD+ objectives while also conserving biodiversity and enhancing the provision of other forest ecosystem services. Selecting the most appropriate approaches for

implementing such actions is critical to ensuring the best outcomes for biodiversity, carbon, and other ecosystem service benefits, and for people. Importantly, given the complexities of forest ecosystems and their management, and their importance for biodiversity and human well-being, poorly designed and implemented REDD+ interventions could have serious adverse impacts on biodiversity and people.

For these reasons, a thorough understanding of the relationship between biodiversity, carbon and other services in the context of the ecology of forests and multiple-use landscapes, and of the impacts of human activities on these relationships, is essential to inform appropriate management actions. It is also of crucial importance that any intervention be considered within the governance context and related constraints of a given region.

In this report, we have synthesised and analysed current knowledge regarding: the relationships between forests, biodiversity and carbon, and other ecosystem services; how these complex relationships may be affected by deforestation, forest degradation, and the management activities implemented to achieve REDD+ objectives[1]; the potential synergies and trade-offs between and among environmental and socio-economic objectives, and; their relationship to governance at multiple scales.

6.2 Relationships between forest biodiversity, carbon and other ecosystem services

Biodiversity is of fundamental importance to forest productivity and other critical ecosystem processes and services. While some forest ecosystem services, such as erosion control, are only weakly related to biodiversity, losses of biological diversity can adversely affect the resilience of forest ecosystems to ongoing human impacts, environmental change, and the long-term provision of many ecosystem services, including carbon storage.

Together, deforestation and forest degradation are responsible for some of the greatest negative impacts on terrestrial biota with very extensive areas affected in both tropical and sub-tropical regions. Deforestation, essentially via conversion for pasture or intensive agriculture, substantially reduces ecosystem carbon stocks, prevents recovery of carbon stocks and results in an almost total loss of a site's original biodiversity, with reduced ecosystem function. Forest degradation resulting mainly from fragmentation, human-induced fires and unsustainable forest management, can also have severe adverse effects on biodiversity and may significantly reduce carbon stocks and the provision of ecosystem services. Further deforestation may ensue, as unsustainable forest management can increase access to previously remote areas, making the forest more susceptible to conversion for agricultural use or fires. The combined impacts of past and ongoing degradation on forest carbon and biodiversity may approach those of deforestation.

Ecological thresholds exist in ecosystems that, if crossed, can result in detrimental outcomes for ecosystem function and reduced provision of ecosystem services. To prevent the system from crossing these thresholds, forest management should strive to use goods and services at levels known to be sustainable for the ecosystem (i.e., within a 'safe operating space').

Different forest types and ages are highly variable in species richness and their capacity to store carbon, with for example primary forests storing more carbon and growing (secondary) forests sequestering carbon more rapidly. Accordingly, land use planning processes need to take these differences into account when addressing both biodiversity and carbon objectives.

Experimental results indicate that increases in tree species richness in planted forests can increase biomass carbon stocks, although at high levels of diversity in forests, the relationship between changes in species richness and carbon stock changes remains poorly understood. Given the inherent difficulties in quantifying the functional importance of all species, management of forest ecosystems should take a precautionary approach to safeguarding biodiversity.

In (sub-) tropical forests that are allowed to naturally regrow or recover from disturbance and degradation, carbon and biodiversity can both increase over time. However, the rate at which they recover diminishes over time, and recovery of biodiversity can be slower than that of carbon. Secondary forests are of significant value to conservation of both carbon and biodiversity but there is uncertainty with respect to the extent to which 'novel' forest ecosystems will be able to provide expected ecosystem goods and services.

Due to the large number of endemic species, endangered species, and unique species assemblages in (sub-) tropical forests, spatial planning for biodiversity conservation objectives needs to be more area-specific than is necessary for carbon management.

6.3 Impacts of management actions

Implementation of REDD+ activities is achieved through management actions in both forest and non-forest land. Individual actions often address more than one REDD+ activity.

Overall, REDD+ actions are likely to bring positive impacts for both carbon and biodiversity. Actions that seek to maintain existing carbon and biodiversity through effectively reducing deforestation and forest degradation are more likely to have the greatest and most immediate

[1] The activities considered in this report relate to those specified in the UNFCCC's Cancún decision on REDD+ (Decision 1/CP.16 paragraph 70) that encourages developing country Parties to contribute to mitigation actions in the forest sector by undertaking activities to: reduce emissions from deforestation and forest degradation; reduce emissions from forest degradation; conserve forest carbon stocks; sustainably manage forests; and enhance forest carbon stocks.

benefits for both carbon and biodiversity compared to actions that seek to restore them. However, securing positive outcomes for both will depend on several factors such as location, scale of implementation, initial conditions, historical impacts, forest type and the wider landscape context. The timing of benefits is also likely to differ: actions to avoid deforestation and degradation can yield immediate carbon and biodiversity benefits, while those that seek to restore forests yield biodiversity benefits more slowly than carbon benefits. A consideration of this context dependency is essential in planning REDD+ actions across different sites and into the future.

Importantly, poorly designed and implemented REDD+ actions may fail to deliver biodiversity benefits and in some cases may also cause negative impacts. For example, plantations of introduced species may provide large and rapid carbon benefits while contributing little to local biodiversity, or depending on factors such as their management and prior land uses, may actually have detrimental impacts on biodiversity. Trade-offs between carbon and biodiversity outcomes can occur both locally and at wider spatial scales and are an important consideration to be addressed in REDD+ planning and implementation.

It is not easy to anticipate or measure all impacts of management actions on carbon and biodiversity, particularly as impacts can occur outside the area of management or in the future, and they can also evolve over time. Impacts of REDD+ interventions are also likely to vary significantly across different forest types and landscape conditions. Therefore, caution is needed when extrapolating management recommendations across different ecosystems, and the development of regionally-tailored strategies for REDD+ remains a major priority for future research.

Data on spatial patterns of biodiversity, expected trends in forest cover and condition, and on the effectiveness of existing management actions are needed to provide a better understanding of the full range of impacts of different REDD+ actions and guide decisions. Opportunities exist for using data obtained from the measurement, reporting and verification of carbon outcomes to derive landscape-scale proxies for changes in biodiversity (e.g. changes in the spatial extent and fragmentation of different forest types), but these are not sufficient for a full assessment of biodiversity impacts and trends. While the primary objective of REDD+ remains climate change mitigation, assessments of the impacts on biodiversity, ecosystem services and benefits to people as well as the governance factors that may affect implementation should be integrated into REDD+ decision-making.

6.4 Socio-economic and environmental trade-offs and synergies

The way in which REDD+ is implemented will determine its social and economic impacts on people, and a consideration of these impacts should be included early on in REDD+ implementation. REDD+ may generate substantial positive impacts but it may also lead to changes in resource management and access that will disproportionately affect the poor and those that are most vulnerable.

Evidence suggests that pursuing social objectives alongside REDD+ will not only make the process more equitable but will also increase the likelihood of achieving carbon and biodiversity goals. For instance, increasing agricultural productivity can in some cases lead to reduced deforestation, and be a very powerful poverty-reduction tool. A real commitment to social and economic outcomes within REDD+ is essential, including considerations of governance and institutional arrangements, local engagement and participation, finance and markets, and timeframe.

Evidence shows that security of tenure, and associated authority for local decision-making, support better environmental management and the realisation of livelihood benefits. Inadequate recognition of such rights excludes the rural poor from decision making, and denies them access to potential benefits from market-based interventions, such as payments for ecosystem services. Weak tenure security also facilitates 'land grabbing' and other irregularities related to land ownership and transfer, which typically result in expropriation of lands from the most vulnerable groups. For REDD+ implementation to be effective and sustainable, tenure and property rights, including rights of access, use and ownership, need to be clear.

In many instances, true 'win-win-win' outcomes that are beneficial to biodiversity, carbon and people are not always available and there are sometimes difficult trade-offs. In these situations, a careful and inclusive evaluation should explicitly consider the following possible courses of action: (a) acknowledge the negative social/economic consequences, but do nothing about them, with subsequent repercussions for stakeholders; (b) compensate the losers, but acknowledge and accept social losses and disruption; (c) compensate the losers, and invest in secure, alternative livelihoods to attempt to offset some social losses; or (d) abandon the projects because of identified high human costs. Participatory and inclusive decision making may help identify the most appropriate choices in particular contexts, and avoid adverse consequences for the most vulnerable groups, including indigenous communities and women.

Socio-economic safeguards will help to avoid the most negative social and economic consequences, but for safeguards to be effective, social impacts need to be monitored carefully, especially access, authority and distributional issues. If REDD+ hopes to address the social and economic mechanisms that produce inequitable outcomes for vulnerable populations, it would need to go beyond the protective approach of safeguards and give greater parity to social objectives.

The landscape level provides a good scale to address and reconcile environmental, social and economic considerations relevant to REDD+. An integrated landscape management approach provides a framework to assess land use scenarios with REDD+ actions, their likely impacts on stakeholders and helps to define resulting trade-offs. Careful and inclusive spatial planning can positively

influence the distribution of winners and losers across the landscape so that REDD+ acts in the interests of the most vulnerable groups.

6.5 REDD+ and governance

REDD+ emerged within the UNFCCC but intersects with a wide array of other institutions involving different actors and priorities. Within this broader governance landscape, a diverse institutional complex has coalesced around REDD+ to govern an equally diverse array of REDD+ activities.

At the international level, three key sources of authority can be identified within this REDD+ complex: (inter-)governmental, fund-based and market-based. Each source offers different opportunities and constraints. (Inter-)governmental bodies have achieved few significant binding commitments regarding sustainable management of forests and biodiversity conservation. Fund-based institutions have been constrained by the quantity of funds available. At the same time REDD+ countries have limited capacity to meet the diverse operational requirements of REDD+ funders and absorb whatever finance is available. Market-based approaches are limited by the small size of the voluntary market.

REDD+ governance has also been shaped by autonomous national and local-level action. National governments play a critical role in establishing legal frameworks and tenure arrangements that can enable or constrain international efforts such as REDD+ as well as strengthen or undermine local authority. Without sufficient emphasis on local participation, there is a risk that REDD+ could recentralise government decision-making through policies and measures- for example, national targets to expand protected areas or increased regulatory enforcement- that undermine community-based forest governance.

The source of authority and scale of decision-making interact to shape the relative influence of intergovernmental processes, public and private donors, markets, national and sub-national governments and local populations on land use and management of forests. They also affect the means by which monitoring and reporting are incorporated into REDD+ projects. All of these factors in turn shape how the procedural and distributive benefits of REDD+ are shared among global to local actors.

Given the trade-offs involved in balancing power among different actors and institutions at different scales, the governance of forest management and biodiversity within and outside of REDD+ will continue to be pluralistic, involving multiple and competing forms of international to local rule-making. As observed in the previous GFEP report on forest governance[2], the most effective way forward may be to better understand, embrace and engage with this complexity rather than attempt to impose singular solutions.

In some cases, governance and policies independent of the REDD+ mechanism may be as, or more, important than REDD+ in achieving carbon, forest management, biodiversity and social objectives. Hence REDD+ interventions should take care not to undermine initiatives and governance arrangements that are already working. Instead, REDD+ should aim to balance conflicting demands for international standardisation, national sovereignty, decentralisation and the empowerment of local communities.

6.6 Knowledge gaps

In the process of synthesising and analysing existing scientific knowledge on the various aspects of REDD+, a number of important knowledge gaps emerged which should be addressed as a matter of priority for effective implementation of REDD+ and related forest management interventions. These knowledge gaps are highlighted below.

Significant gaps exist in our understanding of the relationships between biodiversity and ecosystem functioning and provision of forest ecosystem services, including carbon sequestration, and how these relationships are affected by forest condition. Further work is needed to better understand:

- Relationships between plant species richness, functional diversity and biomass accumulation in diverse tropical forest systems;
- Relationships between species richness and ecosystem resistance (to disturbance);
- How the loss of forest biodiversity affects ecosystem processes;
- Long-term effects of forest ecosystem degradation on rates of recovery of forest ecosystems;
- Degradation/disturbance thresholds or tipping points beyond which recovery of ecosystem functions and provision of services may be severely constrained;
- The magnitude and dynamics of below-ground carbon stocks and fluxes in different forest types, as well as the time scales and the factors influencing the rates of recovery of biodiversity and carbon in disturbed, degraded, and secondary forests;
- The levels of ecosystem service provision from secondary forests, including increasingly widespread 'novel' forest ecosystems.

As regards management interventions under REDD+, existing knowledge is incomplete, particularly with respect to the:

- Differences in biodiversity impacts of REDD+ actions in different forest types;
- Impacts of management actions in relation to forest product extraction; impacts on tropical dry and swamp forests seem to be particularly poorly studied;
- Indirect effects of management interventions on forest and non-forest ecosystems at landscape and larger scales;

[2] Rayner, J., Buck, A. and Katila, P., 2011. *Embracing complexity: Meeting the challenges of international forest governance.* Vienna: International Union of Forest Research Organizations.

- Scaling up of existing knowledge and spatial data to guide management recommendations across different forest types, and develop regionally-tailored strategies for REDD+;
- Design of monitoring and assessment protocols that can provide cost-effective data on the performance of REDD+ initiatives for conserving both carbon and biodiversity.

Significant knowledge gaps remain in a number of areas that are important for understanding the social and economic consequences of REDD+ and biodiversity strategies. This is in part because of the complexity of the interactions between people, biodiversity and ecosystem services. Further research would be particularly needed related to:

- Decision-making methods and tools that help to assess social and economic impacts and consider and incorporate the interests of diverse stakeholders involved in or impacted by ecosystem-based interventions;
- Impacts of deforestation and degradation on the livelihoods of the poor;
- The relationship between agricultural intensification and employment, and the specific policy approaches that could mitigate or reverse job losses in this context;
- Systematic studies that draw lessons from project level REDD+ pilots to build evidence about governance and institutional issues;
- Evidence of how behaviour might change when PES-like strategies are implemented at a large scale on state or communal land;
- Assessment of how incentives within a payment-based REDD+ might function in conjunction with, for instance, either state or community-led protected area management;
- Greater understanding of what local stakeholders consider to be fair and beneficial outcomes from forest and landscape interventions.

In order to generate widespread policy learning and buy in, research on REDD+ should draw on a mix of methodologies, from systematic, large-scale comparative studies, to in-depth ethnographic field-work, to community-driven monitoring and evaluation. As concerns governance arrangements, research is needed in the following areas:

Assessments of the equity (e.g. balance of decision-making power), the economic efficiency and the on-the-ground effectiveness of different forms of REDD+ governance, across institutions and scales, and as relevant to multiple objectives. This includes research addressing the following sub-questions:

- How do different institutions and sources of authority interact with each other, and with what consequences?
- How can different sources of authority be combined to achieve results, and what are the trade-offs involved?
- Does the sharing of benefits from REDD+ translate into more effective biodiversity conservation, forest management and poverty alleviation?

Furthermore, given limited information concerning the funding of research related to REDD+, there is a clear need to design and implement a survey targeting national and international research organisations, donors, the scientific community and other relevant stakeholders that could be used to collect, synthesise and evaluate data on REDD+ research funding in a systematic and comprehensive manner - a task that the Collaborative Partnership on Forests (CPF) might consider facilitating.

6.7 Moving forward with REDD+

Reducing the rates of global forest loss and degradation may yield unprecedented gains for both climate change mitigation and biodiversity conservation. It could also achieve significant social and economic gains. The degree to which these goals are achieved through a mechanism such as REDD+ will depend on whether and how REDD+ is translated into specific policies and practices that also contribute to biodiversity conservation and people's well-being. Should these two additional dimensions not be suitably addressed, there is a substantial risk that REDD+ may fail to deliver on all fronts.

Upland rice cultivation in the Western Ghats of India (Chikmagalur District, Karnataka).
Photo © John A. Parrotta