Biodiversity and Livelihoods:

REDD benefits

forest governance

gtz IWP International Forest Policy

On behalf of Federal Ministry for Economic Cooperation and Development

Convention on Biological Diversity

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1. Introduction

The importance of biodiversity and livelihood aspects within the design of REDD has been recognized at many levels. Achieving these multiple benefits will require new levels of collaboration among different actors at national and international levels.

This brochure demonstrates how measures and policies can be shaped to simultaneously address climate change, biodiversity loss and poverty. It identifies opportunities for synergies and mutual enhancement of the objectives of international agreements, particularly the United Nations Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD) as well as decisions taken by the UN General Assembly following the recommendations of the UN Forum on Forests (UNFF).

Since climate change is ongoing and has direct impacts on the existence and vitality of species and ecosystems, resilient forests are needed to ensure the permanence of REDD measures. Resilience depends on the availability of a large pool of options for reacting and adapting to environmental changes such as climate change. This pool of future options depends on biodiversity.

Forest ecosystems that have the ability to adapt to climate change can provide for the livelihoods of forest-dependent people and communities who are partners in safeguarding forests and supporting the mitigation of climate change. To sustain this partnership, these people should actively participate in decision-making, and financial compensation for their efforts is needed.

This brochure also provides background information on the linkages between ecosystem-based adaptation and mitigation measures. It aims to introduce experts, in particular those from the field of climate change, to the basic concepts of 'forest biodiversity' and 'ecosystem-based adaptation', which are important to the connection between mitigation and adaptation. It also shows how forest biodiversity can remedy forest degradation.

Beyond this basic introduction, the brochure describes concrete measures to achieve long-term success and the multiple benefits of mitigation and adaptation measures. These include participatory approaches and pro-poor-policies; improving the adaptation capacity of forests to climate change; maintaining species migration routes; and avoiding self-enforcing negative impacts of climate change.

The integration of biodiversity and livelihood aspects into REDD will fail most likely if there are no financial rewards. The brochure shows that no matter which mechanism is chosen under the UNFCCC framework, the integration of biodiversity and livelihoods into the design of REDD carbon credits has vast potential to result in more stable projects, improved permanence of carbon stocks, and higher prices, thus fulfilling the interests of all stakeholders.

What is REDD?

At its thirteenth meeting in Bali in December 2007, the Conference of the Parties (COP) of the United Nations Framework Convention on Climate Change (UNFCCC) adopted decision 1/CP.13: Bali Action Plan, and decision 2/CP.13: Reducing emissions from deforestation in developing countries: approaches to stimulate action

'The Conference of the Parties, […] decides to launch a comprehensive process to enable the full, effective and sustained implementation of the Convention through long-term cooperative action, now, up to and beyond 2012 [….] by addressing, inter alia: Policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries.'

REDD pilot and demonstration activities are currently implemented by several initiatives such as the Forest Carbon Partnership Facility (FCPF) and the UN REDD Programme. These pilots integrate efforts to include ecological and socioeconomic aspects. For example, one of the FCPF objectives is 'within the approach to REDD, to test ways to sustain or enhance livelihoods of local communities and to conserve biodiversity'. Thus, one of the selection criteria for FCPF pilot projects is that they 'focus on innovative and / or advanced concepts of monitoring, reporting and remote sensing, including for forest degradation, biodiversity protection and social benefits'. Priority is given to countries with 'high relevance of forests in the economy of a country including relevance for poverty reduction, the livelihoods of forest-dependent indigenous peoples and other forest dwellers'. Representatives of forest-dependent indigenous people and forest dwellers can observe meetings of the FCPF participants committee.[1] Additionally, the FCPF invited the indigenous peoples' representatives for consultations (see FCPF webpage: www.forestcarbonpartnership.org/fcp/).

[1] See World Bank (2008): Charter establishing the Forest Carbon Partnership Facility

REDD and REDD-plus

In present discussions under the UNFCCC, the term 'REDD-plus' is used to combine the various possible activities listed in the Bali Action Plan (Decision 1/CP.13): reducing emissions from deforestation and forest degradation, conservation, sustainable management of forests, and enhancement of carbon stocks. In this brochure, the terms REDD and REDD-plus (when referring to the full range of possible REDD activities) are used without any attempt to pre-empt ongoing or future negotiations under the UNFCCC.

What is biodiversity, and what makes it a REDD benefit?

Biological Diversity, or biodiversity in its shortened form, can be described as the diversity of life on earth. Biodiversity is frequently understood to refer simply to the variety of species on the planet. Although this is an important component, its wider meaning, as generally used by scientists, refers to diversity both above and below the level of individual species. It is, in its fullest form, the complete variety of life on earth, from the smallest to the largest of scales.

The Convention on Biological Diversity (CBD) defines biodiversity as, '*the variability among living organisms and the ecological complexes of which they are part, including the diversity within species, between species and of ecosystems*'.

Interactions between the various components of biodiversity make the earth habitable for all species, including humans.

Biodiversity is the basis for achieving sustainable development. For example, the Millennium Development Goal 7 'Ensure Environmental Sustainability' depends on biodiversity, which directly affects the quality and quantity of ecosystem services provided, such as carbon sequestration, watershed protection, soil fertility, recycling of nutrients, control of erosion and pollination of crops and trees. More than 3 billion people depend on marine and coastal biodiversity, while over 1.6 billion people rely on forests and non-timber forest products for their livelihoods. Habitat degradation and the loss of biodiversity are threatening the livelihoods of more than 1 billion people living in dry and subhumid lands.

Work under the Convention on Biological Diversity (CBD)

The Convention on Biological Diversity has three main objectives:

» the conservation of biodiversity,

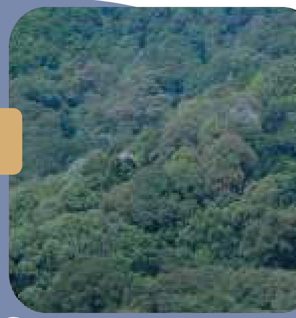
» the sustainable use of its components, and

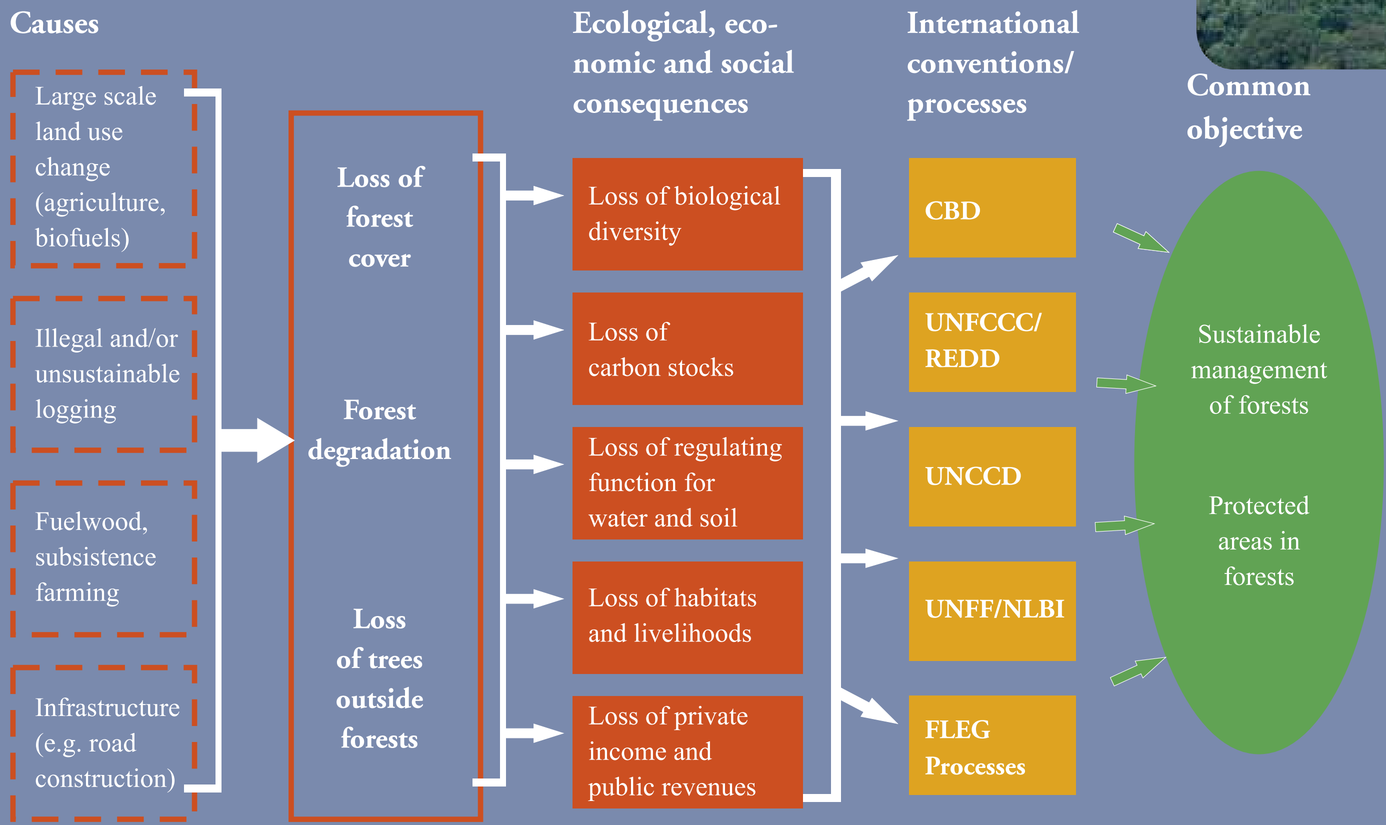
» the fair and equitable sharing of benefits arising out of the utilization of genetic resources.

The CBD addresses deforestation and forest degradation in numerous ways, for example in the programme of work on forest biodiversity (CBD decision VI/22) and the programme of work on protected areas (decision VII/28). REDD efforts can build on the implementation of the CBD, and activities at national level under the UNFCCC and CBD can be mutually supportive.

A number of international agreements provide relevant guidance on how deforestation and forest degradation can be reduced in the long term and sustainable forest management can be enhanced. In particular, the CBD programs of work on forest biodiversity, protected areas, and economic incentive measures, as well as the non-legally binding instrument on all types of forests will support the goals of REDD if they are fully implemented. They provide a blueprint for how deforestation and forest degradation can be tackled. Any REDD mechanism should capitalize on lessons learned from efforts to promote SFM and to implement the provisions of the UNFF and the CBD. Policies and measures which contribute to the implementation of several international commitments simultaneously, such as forest restoration or sustainable forest management, have a better chance of long-term success, although coordination and planning costs might initially be higher.

Deforestation and forest degradation





Examples of coherent forest-related aims of UNFCCC, CBD and UNFF

UNFCCC[2]

Invites parties to further strengthen and support ongoing efforts to reduce emissions from deforestation and forest degradation on a voluntary basis.

CBD – Programme of Work on Forest Biological Diversity[3]

Develops coordinated response strategies and action plans at global, regional and national levels;

Promotes maintenance and restoration of biodiversity in forests to enhance their capacity to resist, and recover from and adapt to climate change;

Promotes forest biodiversity conservation and restoration in climate change mitigation and adaptation measures.

[2] UNFCCC-Decision 2/CP.13

[3] UNCBD-Decision VI/22, Annex

UN General Assembly / UNFF – 4 Global Objectives on Forests[4]

Objective 1: Reverse the loss of forest cover worldwide through sustainable forest management, including protection, restoration, afforestation and reforestation, and increase efforts to prevent forest degradation.

CBD – Programmes of Work on Protected Areas, and on Incentive Measures[5]

Establishment and maintenance of comprehensive, effectively managed, and ecologically representative national and regional systems of protected areas (by 2010 for terrestrial, and by 2012 for marine areas);

The creation of incentives for integration of biodiversity covers all sectors.

[4] UN General Assembly, resolution 62/98, 17 December 2007

[5] UNCBD-Decision VII/28 and UNCBD-Decision V/15

2. Mitigation and adaptation: linked benefits provided by forests

REDD is foremost a mitigation strategy. But it can provide significant adaptation benefits for societies and its long-term success will depend on the ability of forest ecosystems to adapt to climate change.

Some facts about forests

- Forests are the largest terrestrial ecosystem; with 4 billion hectares they cover 30% of the earth's surface.
- With an estimated 2,400 Gt of stored carbon they account for almost half the terrestrial carbon pool.
- They harbor an estimated 75% of all terrestrial biodiversity.
- Forests underpin the livelihoods of more than 1.6 billion people.
- More than 2,000 groups of indigenous peoples live in forest ecosystems, which satisfy their basic needs, such as food, energy and health.
- More than 3% of all global trade is in forest products, which have a value of more than USD 300 billion per year.
- Every year 13 million hectares of forests are destroyed.
- Deforestation contributes approximately 17 to 20% of global annual greenhouse gas emissions, which is approximately 5.8 Gt of carbon dioxide equivalents per year.
- 97% of all emissions from deforestation occur in the tropics and sub-tropics.

The IPCC (AR4) identified forestry as one of the sectors where synergies exist between mitigation and adaptation options. Maintaining intact forest ecosystems, including their genetic and species diversity, is essential in meeting the UNFCCC's ultimate objective. This is due to the role of forests in the global carbon cycle, their significant carbon stocks, their contribution to adaptation, and the wide range of ecosystem services they provide that are essential for human well-being.

Forest ecosystem goods and services

Provisioning Services	Cultural Services	Regulating Services	Supporting Services
Food, Fiber and Fuel Genetic resources Biochemicals Fresh water	Spiritual resources, religious values Knowledge system Education/ inspiration Recreation and aesthetic value	Invasion resistance Herbivory Pollination Seed dispersal Climate regulation Pest regulation Disease regulation Natural hazards protection Erosion regulation Water purification	Primary production Provision of habitat Nutrient recycling Soil formation and retention Production of atmospheric oxygen Water cycling

Land-use activity is not the only factor that threatens forests and the sustainability of REDD efforts. Climate change influences forest ecosystems and, thus, may turn into a risk for the permanence of REDD efforts. Recent work on the adaptation of forests to climate change has generated strong evidence that the current number and scale of natural disasters at local level are causing widespread and unusual changes in forests. These changes harm the stability and even the existence of forest ecosystems and thus their ability to store carbon and contribute to climate change mitigation. Both mitigation and adaptation to climate change are essential and complementary.

Mitigation

Mitigation consists of activities that aim to reduce GHG emissions, directly or indirectly, by avoiding or capturing GHGs before they are emitted to the atmosphere or sequestering those already in the atmosphere by enhancing 'sinks' such as forests. Such activities may entail, for example, changes to behavioral patterns or technological development and diffusion.

(IPCC 2001)

Adaptation

Adaptation is defined as adjustments in human and natural systems, in response to actual or expected climate stimuli or their effects, that moderate harm or exploit beneficial opportunities.

(IPCC 2001)

OECD: Adapting is inevitable

While mitigation of climate change is crucial to limit long-term impacts, climate change is already happening, and is bound to continue simply because of the GHGs that have already been emitted. Furthermore GHG mitigation relies on difficult policy choices as well as further technological development, so emissions are bound to keep rising before they may eventually taper off. For those reasons, climate change will inevitably continue, and even accelerate, at least for several decades to come. Adaptation to these impacts which are already 'locked in' is therefore critical.

(OECD 2009)

Furthermore, it is essential that forest-based mitigation is seen as an addition to mitigation efforts to limit emissions from fossil fuels and not as a substitute. REDD is basically a mitigation policy. However the success of mitigation projects depends on the ability of forest ecosystems to adapt to climate change. Unless global action succeeds in mitigating dangerous climate change, forest ecosystems are likely to reach a tipping point and alter drastically into a new state. This would then contribute to GHG emissions despite efforts to protect them, for example under a REDD scheme.

Adaptation in relation to forests broadly falls into two categories: adaptation for forests, which focuses on the management changes needed to increase the resistance and resilience of forests, and forests for adaptation, which targets the role that forests can play in helping societies adapt to climate change. It is important to consider both categories in the context of REDD. Substantial synergies and savings can be realized by achieving mitigation and adaptation simultaneously through coherent policies and measures. Furthermore, a lack of adaptation of forest management to climate change would endanger the permanence of the carbon stocks and thereby undermine REDD's ultimate objective.

Many recent efforts successfully combine forest-based adaptation with mitigation options. The conservation, restoration and sustainable management of ecosystems including forests, are integral to both adaptation and mitigation efforts:

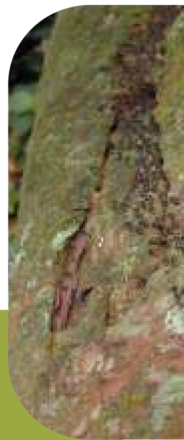
- Ecosystem-based adaptation policies and measures (see chapter 3) that conserve e.g. natural forests also provide significant climate change mitigation benefits by maintaining existing carbon stocks and sequestration capacity, and preventing future emissions from deforestation and forest degradation.
- Adaptation projects that prevent fires or restore tropical forest peatlands will be particularly important for mitigation efforts, as these ecosystems have high carbon stocks and release significant quantities of greenhouse gasses when degraded or destroyed.
- Restoration of degraded forest ecosystems enhances carbon stocks.
- Conservation and restoration of other natural ecosystems (such as savannahs, grasslands, mangroves and wetlands) usually results in both adaptation and mitigation benefits through carbon sequestration and increased ecosystem resilience.

The hidden treasure: biodiversity in forest soils

An immense range of biodiversity, especially animals (worms, ants, beetles etc.) and microorganisms (fungi, bacteria etc.) inhabit forest soils. For example, just one square meter of soil in a temperate forest may contain more than 1,000 species of invertebrates, whilst there may be an even greater number and diversity of microbes in just one gram of soil. Therefore these groups of organisms form complex interacting networks: the animals transform aboveground biomass and litter and discharge them into smaller organic pieces and humus. Microorganisms split this up into nutrients, which then become accessible to plants. Meanwhile the organisms till the soil so plants can root deeply to exploit nutrients and water, and strengthen their stability.

This diversity is dramatically reduced when forests are converted to agricultural land and when agricultural land use is intensified. This can lead to decreases in agricultural productivity, reducing the 'resilience' of agricultural systems and making them more vulnerable to climatic events, erosion, pests, diseases and other threats.

(ICRAF 2008)



3. Reducing forest degradation, and forest restoration: flip sides of the same coin

Ecosystem-based adaptation can support forest restoration and avoid forest degradation. It is cost-effective and easily accessible to the rural poor.

Reducing deforestation and forest degradation contributes considerably to the objective of allowing ecosystems to adapt naturally to climate change. In order to enhance the contribution of reduced deforestation and forest degradation to adaptation, certain activities should be prioritized. These activities minimize the fragmentation of large intact forest ecosystems, maximize resilience, and support the establishment and maintenance of ecological corridors.

Forest degradation

UNEP / CBD: A degraded forest is a secondary forest that has lost, through human activities, the structure, function, species composition or productivity normally associated with a natural forest type expected on that site. Hence, a degraded forest delivers a reduced supply of goods and services from the given site and maintains only limited biological diversity. Biological diversity of degraded forests includes many non-tree components, which may dominate in the under-canopy vegetation.

IPCC: A direct human-induced loss of forest values (particularly carbon), likely to be characterized by a reduction of tree cover. Routine management from which crown cover will recover within the normal cycle of forest management operations is not included.

FAO: The long-term reduction of the overall potential supply of benefits from the forest, which includes carbon, wood, biodiversity and other goods and services.[6]

[6] Source: FAO 2006. *Definitional Issues Related to Reducing Emissions from Deforestation in Developing Countries*. Forests and Climate Change Working Paper 5. FAO, Rome, Italy. As cited in CPF (2009).

Adaptation approaches that include ecosystem-based adaptation will often be cost-effective and can provide significant additional social, economic and environmental benefits. For example, the restoration of mangrove systems can not only provide shoreline protection from storm surges, but also increase fishery opportunities and carbon sequestration. As such, ecosystem-based adaptation can achieve multiple benefits for many sectors through a single investment.

What is Ecosystem-based adaptation?

Ecosystem-based adaptation aims to identify and implement a range of strategies for the management, conservation and restoration of ecosystems to provide services that enable people to adapt to the impacts of climate change. The concept aims to increase the resilience and reduce the vulnerability of ecosystems and people due to climate change. Ecosystem-based adaptation is most effective if integrated into broader adaptation and development strategies. Examples include:

- Coastal defense through the maintenance and / or restoration of mangroves and other coastal wetlands to reduce coastal flooding and coastal erosion.
- Sustainable management of upland wetlands and floodplains for maintenance of water flow and quality.
- Conservation and restoration of forests to stabilize land slopes and regulate water flows.
- Establishment of diverse agroforestry systems to cope with increased risk from changed climatic conditions.

Ecosystem-based adaptation options are often more accessible to the rural poor than actions based on infrastructure and engineering. The poor are often the most directly dependent on ecosystem services and thus benefit from adaptation strategies that maintain those services. Ecosystem-based adaptation can be consistent with community-based approaches to adaptation, can effectively build on local knowledge and needs, and can provide particular consideration to the most vulnerable groups of people, especially women, and to the most vulnerable ecosystems.

Case Study:

Forest Carbon Financing for Biodiversity Conservation, Climate Change Mitigation and Improved Livelihoods: the Makira Forest Protected Area, Madagascar

The sale of CO_2 emission reductions from avoided deforestation through the growing carbon market may represent a unique opportunity to reconcile natural resource conservation and poverty reduction in Madagascar. The funds generated by this market can be used to create and manage protected areas to conserve biodiversity and safeguard critical ecosystem services important for human livelihoods. These funds can also provide financial incentives for community-led land stewardship. With this in mind, the Wildlife Conservation Society, the government of Madagascar and other partners (companies, NGOs and celebrities) have been working with local communities living in the Makira plateau in north-eastern Madagascar since June 2008 to establish a protected area which will be financed by the marketing and sale of nearly 9.5 million tons of carbon offsets over the next 30 years.

The funds from carbon sales, generated through the avoided deforestation of 350,000 ha of the Makira forest, will be used to finance the long-term conservation of the forests, improve community land stewardship and governance, and support sustainable livelihood practices to improve household welfare.

The restoration[7] of forest ecosystems can also be a cost-effective ecosystem-based adaptation strategy. Restoration activities include limiting human activities, such as logging, to allow ecosystems to recover, or restoring ecological components such as connectivity or hydrological regimes, through activities such as re-flooding wetlands. For example, an alternative to constructing additional dams or reservoirs for increased floodwater storage could be flood plain restoration, which would also improve riparian habitats.

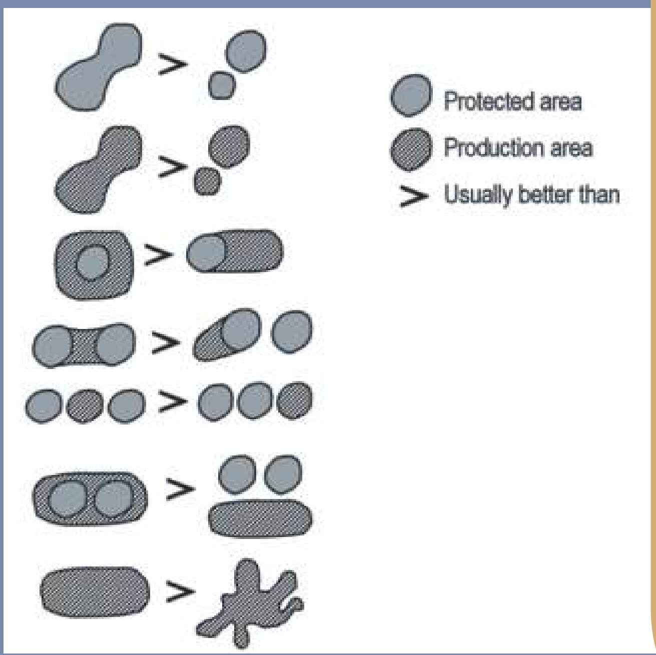
[7] UNEP-WCMC defines ecological forest restoration as follows: 'to re-establish the presumed structure, productivity and species diversity of the forest originally present at a site. In time, the ecological processes and functions of the restored forest will closely match those of the original forest' (http://www.cifor.cgiar.org/rehab/_ref/glossary/restoration.htm)

Connecting forest ecosystems for forest restoration

The diversity of genes and species in an ecosystem and the ecological processes they are a part of, determine a forest's stability against pressures such as rapid climate change and extreme weather events. The flow of genes and species within and between different forests, which allows species which are not adapted to the pressure to migrate out and better adapted species and genes to migrate in, is essential in maintaining this stability. Forest fragmentation can jeopardize the long-term health and vitality of the forest ecosystem as it cuts off pathways for migration. Forest fragmentation can also result in species loss as the size of a forest becomes too small to support a viable population of a certain plant or animal species, or if migratory routes and corridors cease to exist (UNEP/GRID 2008).

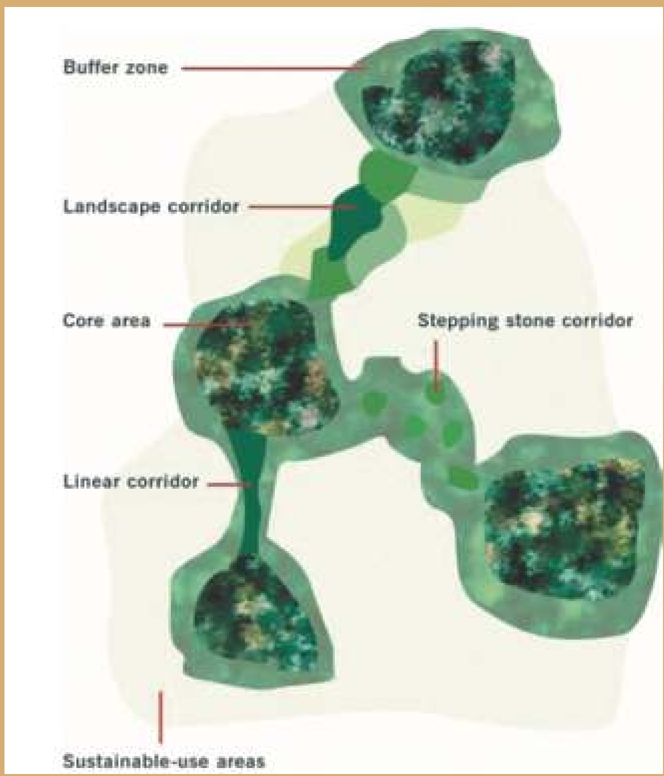
The provision of corridors and 'stepping stones' of natural forest located within non-forest or planted forest areas facilitates the movement of forest species. REDD investments should aim to maximize ecological connectivity by restoring degraded lands between forest ecosystems, creating biological corridors and planning at landscape level.

Ecological connectivity



Source: ITTO, IUCN (2009): ITTO/IUCN guidelines for the conservation and sustainable use of biodiversity in tropical timber production forest.

Landscape linkages and different forms of ecological corridors



Source: cited from Bennett, Graham (2001): *Linkages in Practice.*

4. Synergies between mitigation and adaptation

Multiple benefits can be achieved in every forest-based adaptation / mitigation project. If carefully considered in the planning process, they can be enhanced in a cost efficient way. Initial investments in the planning phase are worthwhile in the long term.

The anticipated impacts of climate change due to emissions already in the atmosphere is much greater than the ability of ecosystems and species to adapt at their natural or historic pace. More climate variability is predicted, with increased precipitation in some areas and extreme dry and hot periods in other regions.

Migration of plants and animals due to changing site conditions

Rising temperatures force many living organisms to migrate to cooler areas while new organisms arrive. Such movements involve all species, including plants. Some species will seek higher altitudes; others will move further pole-wards. In temperate regions, plants and trees can migrate naturally by 25 to 40 kilometers in a century. However, if there is a 3°C increase in temperature over a hundred year period in a particular region, the conditions in that area would undergo dramatic change.

(UNEP / GRID 2008)

The rates of tree species migration during the waxing and waning of the most recent ice age about 10,000 years ago were estimated to be about 0.3 to 0.5 kilometers a year. This rate is only a tenth the rate of change in climate zones that is predicted to occur over the coming century.

(UNDP 2009)

Plantations and modified natural forests will face greater damage and risks of large-scale losses in future due to a changing climate. There is therefore a need to adapt forest ecosystems to climate change through active management.

Management should build on the key variables that determine the level of forest resistance and resilience, which are:

- *size and connectivity*: the overall area of a forest ecosystem and its unfragmented area (i.e. area with uninterrupted flow of genes and species). Size and connectivity determine whether a sufficiently large pool of diverse genes and species is available, and whether ecological processes can unfold at sufficient scales
- *genetic diversity*: the diversity within animal, plant, microorganism and fungi species
- *species diversity*: the diversity between animal, plant, microorganism and fungi species
- *structural diversity*: the diversity of habitats and ecological niches in a forest ecosystem, created for instance by morphology, geology, age diversity of trees, diversity of tree stands, etc.

Various management options exist to promote adaptation. The risks can be partly mitigated by adhering to a number of general forest management recommendations, which maintain resistance and resilience based on forest biodiversity:

- Maintain genetic diversity in forests by not selecting only certain trees for harvesting based on site, growth rate, or form.
- Maintain stand and landscape structural complexity using natural forests and natural processes as models.
- Maintain connectivity across forest landscapes by reducing fragmentation, recovering lost habitats (forest types), expanding the protected area networks, and establishing ecological corridors.
- Maintain functional diversity and eliminate conversion of diverse natural forests to monotypic or reduced species plantations.
- Reduce non-natural competition by controlling invasive species and reduce reliance on non-native tree crop species for plantation, afforestation or reforestation projects.
- Manage semi-natural forests in a sustainable manner that recognizes and plans for predicted future climate. For example, hedge bets by apportioning some areas of assisted regeneration with trees from regional provenances and species from climates of the same region that approximate expected conditions in the future, based on climate modeling.
- Maintain biodiversity at all scales (stand, landscape, bioregion) and elements (genetic, species, community) and by protecting isolated or separate populations of trees, populations at margins of their distributions, source habitats and refugia networks. These populations are the most likely to represent pre-adapted gene pools for responding to climate change and could form core populations as conditions change.
- Ensure that there are national and regional networks of scientifically designed, comprehensive, adequate and representative protected areas. Build these networks into national and regional planning for large-scale landscape connectivity.

How do these considerations affect REDD-plus activities?

Permanence of forest carbon stores can only be achieved if the forests are able to adapt to climate change. Since temperature rise in this century is predicted to be higher than 2°C, chances are slim that ecosystems will be able to continue providing the same goods and services. REDD+ could promote measures that can lead to ecosystem corridors and enhance biodiversity in degraded forests. These measures not only increase carbon stocks through afforestation / reforestation of areas to connect ecosystems but especially raise the resilience and the adaptive capacity of the ecosystem – and therefore benefit the people who depend on it. Mitigation and adaptation policies are clearly linked.

Examples of ecosystem-based adaptation measures that also provide multiple benefits

Adaptation measure	Adaptative function	Additional benefits: Social and cultural	Economic	Biodiversity	Mitigation
Mangrove conservation	Protection against storm surges, sea-level rise and coastal inundation	Provision of employment options (fisheries and prawn cultivation) Contribution to food security	Generation of income to local communities through marketing of mangrove products (fish, dyes, medicines)	Conservation of species that live or breed in mangroves	Conservation of carbon stocks, both above and below-ground
Forest conservation and sustainable forest management	Maintenance of nutrient and water flow Prevention of land slides	Opportunities for recreation, culture, protection of indigenous peoples and local communities	Potential generation of income through: ecotourism, recreation, sustainable logging	Conservation of habitat for forest plant and animal species	Conservation of carbon stocks Reduction of emissions from deforestation degradation
Restoration of degraded wetlands	Maintenance of nutrient and water flow, quality, storage and capacity Protection against floods or storm inundation	Sustained provision of: livelihood, recreation, employment opportunities	Increased: livelihood generation, potential revenue from recreational activities, sustainable use, sustainable logging of planted trees	Conservation of wetland flora and fauna through maintenance of breeding grounds and stop over sites for migratory species	Reduced emissions from soil carbon mineralization
Establishment of diverse agro-forestry systems in agricultural land	Diversification of agricultural production to cope with changed climatic conditions	Contribution to food and fuel wood security	Generation of income from sale of timber, firewood and other products	Conservation of biodiversity in agricultural landscape	Carbon storage in both above and below-ground biomass and soils
Conservation of agrobio-diversity	Provision of specific gene pools for crop and livestock adaptation to climatic variability	Enhanced food security, diversification of food products, conservation of local and traditional knowledge and practices	Possibility of agricultural income in difficult environments Environmental services such as bees for pollination of cultivated crops	Conservation of genetic diversity of crop varieties and livestock breeds	
Conservation of medicinal plants used by local and indigenous communities	Local medicines available for health problems resulting from climate change or habitat degradation, e.g. malaria, diarrhea, cardiovascular problems	Local communities have an independent and sustainable source of medicines	Potential sources of income for local people	Enhanced medicinal plant conservation Local and traditional knowledge recognized and protected	Environmental services such as bees for pollination of cultivated crops
Sustainable management of grassland	Protection against flood Storage of nutrients Maintenance of soil structure	Maintenance of local knowledge and traditions	Generate income for local communities through products from grass (ex: broom)	Forage for grazing animals Provide diverse habitats for animals that are predators and prey	Maintenance of soil carbon storage of soil carbon

Source: CBD (2009a)

5. Indigenous and local communities: partners and beneficiaries of REDD efforts

Indigenous and local communities are key stakeholders in the maintenance of forest ecosystems and in supporting the permanence of REDD efforts. Integrating them in any REDD design and implementation as equal partners is a prerequisite for success: it will activate vital local knowledge, strengthen ownership and build essential local support.

Indigenous and forest-dependent peoples are stewards of their forests and have often managed forests sustainably for millennia. The experience and traditional knowledge of indigenous peoples could significantly contribute to the success of any REDD efforts. While it is generally recognized that REDD has potential benefits for forest-dwelling indigenous peoples and local communities, a number of conditions are important in realizing these benefits. Indigenous peoples are likely to benefit more from REDD and other sustainable land management activities for mitigation where they own their lands, where there is the principle of free, prior and informed consent, and where their identities and cultural practices are recognized and they are able to participate in policy-making processes.

The implementation of the UN Declaration on the Rights of Indigenous Peoples is key to delivering benefits from REDD to indigenous peoples. Involving local stakeholders, in particular women, and respecting the rights and interests of indigenous and local communities will be important for the long-term sustainability of the undertaken efforts. There is a need for capacity building on indigenous issues and rights on the part of governments, indigenous people and local communities. This should include education, awareness raising and indigenous-to-indigenous transfer of knowledge and capacity building (CBD 2009a).

The role of traditional knowledge

Many indigenous peoples and local communities have managed forests sustainably for thousands of years. Traditional Knowledge of indigenous peoples and local communities includes innovations, practices, knowledge, technologies, institutions and adaptation skills in relation to their environment. There is abundant local and traditional knowledge in many indigenous and local communities, and the holders of this knowledge have an incentive to utilize it to reduce deforestation and forest degradation. Traditional knowledge can be an excellent and cost-effective means of ground-truthing, as part of monitoring, verification and reporting efforts. Traditional knowledge can also be an element of 'early warning systems' for threshold degradation levels, for example through monitoring ecosystem goods and services such as Non-Timber Forest Products (NTFPs). This 'long-term memory' of forest aspects can contribute valuable recommendations for restoration: what species might work best in the long term, and which natural vegetation existed on degraded lands. Elements of local and traditional customary governance structures could also serve as a blueprint for benefit sharing in terms of REDD's financial mechanisms. Local and traditional knowledge could support forest law enforcement and governance through traditional governance systems, and through local reporting of infringements (e.g. poaching or illegal logging). Finally, traditional knowledge can also support communication with local and indigenous stakeholders, through traditional communication networks and channels (e.g. for awareness raising and sharing of experience).

(CBD/UNFF Workshop on Forest Biodiversity and Climate Change, September 2009)

Natural forests offer a wide variety of nuts and fruits at certain times of the year and other non-timber forest products (NTFP) such as cocoa, coffee and honey. Since the poorest are the most vulnerable to climate change the rely most of all on biodiversity which offers the basis of a wide range of these products for their daily life and income generation. Consideration of many NTFPs is a key element of human adaptation to climate change as it reduces the livelihoods risks if one product can no longer be supplied due to changing conditions. But NTFPs will not be sufficient to supply all goods and services needed for local communities. There must also be sustainable agricultural practices and agroforestry.

Damage in the Amazon puts stress on indigenous peoples

In the Amazon region, climate changes due to deforestation, forest fragmentation and the transformation of tropical rainforest into dry grassland savannah leads to critical loss of biodiversity and severe droughts and has put indigenous livelihood strategies under increased stress.

(Conference on Indigenous Peoples and Climate Change, Copenhagen 2008).

Community and small / medium-sized forest enterprises

There is increasing evidence that community forestry enterprise and small and medium-sized forest enterprises represent a more promising route to sustainable forest management and especially to poverty reduction benefits, compared to the industrial forestry sector. However historically, these stakeholders have been underserved by forestry agencies with regard to supporting their role in sustainable forest management. For community and indigenous forest management initiatives to succeed, key elements of support would include:

- Legal protection of tenure and political rights
- Strengthening of intermediary institutions that provide business development or technical assistance to communities
- Certification models more appropriate for communities (based on a 'criteria and indicators' approach)
- Development of community-company partnerships.

(CIFOR 2007)

Recommendations for the participation of indigenous and local communities

- Defining rights to land, territories, and resources, including ecosystem services;
- Strengthening rights and governance through implementation of forest tenure reforms, mapping of lands, and recognition of rights to ecosystem services;
- Prioritizing 'pro-poor' policies and measures to achieve REDD;
- Aligning REDD with national development processes, for example by integrating REDD into inclusive and broad-based development strategies;
- Using REDD funding to support local government reform processes and social capital development, to help channel financial flow to indigenous and local communities and also to improve broader forest governance.
- Developing stronger accountability structures and institutions, involving transparent information provision to indigenous and local communities; inclusive multi-stakeholder processes, systems to monitor the social impacts of REDD, and appeal systems.

(Source: REDD – OAR[8])

[8] Angelsen / Brown / Loisel / Peskett / Streck / Zarin (2009): Reducing Emissions from Deforestation and Forest Degradation (REDD): An Options Assessment Report

Who will benefit from REDD?

To ensure effective participation throughout the process of establishing REDD, the following aspects should be considered:

- **Provision of information** to all stakeholders, including the poor and supporting experts. This can be done via third party verification, extended expert review processes and publication of project process documents (e.g. on the UNFCCC website).

- **Use of participatory processes** in the design and implementation of REDD. Provision of upfront finance and use of mechanisms for reducing costs (forest-backed bonds, carbon funds, bank / micro-credit schemes, and self-financing through improved agricultural production and non-farm employment). There are several distribution options for financial contributions that were designed to prevent the damnification of 'low risk' countries, areas where implementation is most cost effective or that fit internationally established rules. These options are stabilization funds or preventive credits, levies or taxes on market mechanisms within countries that have reinvested into pro-poor policies and measures.

- **'Pro-poor' policies**: strong political commitment is needed to maximize the possible benefits for the poor. The mechanism has to be flexible: contracts should be long enough to ensure sustainability yet not 'lock in' unfavorable deals, and they should develop regional / national standards. There has to be permanence to create stable and predictable benefits that could provide significant security to the poor, especially in increasing resilience to shocks (adaptation).

- **Measures for an equal distribution** of benefits and risks. This includes the application of 'soft' enforcement of regulations, meaning that no penalties will be enforced if commitments are not met. Payment on delivery of emission reductions could reduce the risk that the poor might be disproportionately affected. The legal institutions should be strengthened to improve communities' access to legality. Legal staff have to be trained on legal provisions relating to REDD projects.

- **Clear social standards** have to be developed and streamlined within sectoral and extra-sectoral standards. Existing standards must be adapted to REDD, bearing in mind the pro-poor impact. Poverty impact monitoring should be included within programs and projects. To reduce the risk of perverse effects of REDD due to limited direct benefits, these benefits need to be distributed across wide areas and actors. Additionally demand-based measures have to be taken, such as the promotion of alternative, more sustainable products in consumer countries.

- **Technical assistance** has to be provided to national and local governments, NGOs and the private sector. While the methodology for monitoring and accounting of emissions is still being discussed, safeguards for the equitable distribution of the benefits have to be included in future designs. The data collection for baselines should include small-scale and informal enterprises, subsistence and even cultural values.

Excerpt from 'Making REDD work for the poor', prepared on behalf of the Poverty Environment Partnership (2007)

6. Forests and climate change: avoiding dangerous feedback loops

Climate change is exacerbated by its own impacts. This momentum has to be avoided by adaptive ecosystem management and supporting the ecosystems' resilience to changing site conditions. REDD efforts must consider the possibility of feedback loops and minimize this risk by maintaining biodiversity and ecosystem resilience.

Anthropogenic changes in climate and atmospheric CO_2 have already made obvious impacts on ecosystems and species: some species and ecosystems are demonstrating their capacity for natural adaptation but others are suffering from negative impacts.

Natural adaptation and negative impacts of climate change

Geographic distributions: species' geographic ranges are shifting towards higher latitudes (pole-ward shifts) and elevations (elevational shifts). Not all species are expanding elsewhere. Geographic limits exist on how far some species will be able to go.

Timing of life cycles (phenology): timing of natural event changes. This includes the advancement of spring events (e.g. leaf unfolding, flowering, and reproduction) and the delay of autumn events. The timing of cycles has direct consequences on the interaction between species.

Interaction between species: changes in differential responses to timing are leading to mismatches between the peak of resource demands by reproducing animals and the peak of resource availability (e.g. timing of flowering and appearance of bees and butterflies). This is causing population declines in many species and may indicate limits to natural adaptation.

Photosynthetic rates, carbon uptake and productivity in response to CO_2 'fertilization' and nitrogen deposition: regional modeling project increases in gross primary production (GPP) for some regions, but possible decline in others. In some areas CO_2 fertilization is favoring fast growing species over slower growing ones and changing the composition of natural communities.

Community and ecosystem changes: observed structural and functional changes in ecosystems are resulting in substantial changes in species abundance and composition. These have impacts on livelihoods and traditional knowledge. This includes for example, changing the timing of hunting and fishing and traditional sustainable use activities, as well as people's traditional migration routes.

(CBD 2009a)

Climate change is projected to increase species extinction rates. Approximately 10 per cent of the species assessed so far are at an increasingly high risk for every 1°C rise in global mean surface temperature within the range of future scenarios typically modeled in impacts assessments (usually <5°C temperature rise). The risk of extinction increases when ecosystems are not connected to each other. So 'exits' via migration routes are cut off.

Climate change leading to extinction and loss of species

Increased CO_2 levels could lead to a massive destruction of forests and the extinction of countless species. According to the International Union for the Conservation of Nature (IUCN), between 22 and 47 per cent of all species could disappear in the coming decades, making this the sixth mass extinction that the earth has seen. For example, modeling focusing on the Amazonia region has indicated that 43 per cent of plant species which were gathered as samples could become non-viable by the year 2095 due to the fact that changes in climate will have fundamentally altered the composition of species' habitats.

(UNEP/GRID 2008)

Estimates of habitat loss might be reduced depending on migratory capacity, although most species would not find surrogate habitats. In terms of broad range change, other studies suggested that higher latitudes of temperate and boreal forests would be most affected, resulting in habitat loss of 60% or more for many species.

(IUFRO 2009)

Even at the regional level, deforestation generally leads to decreased rainfall and thus can amplify negative climate change impacts. The relationship between forest loss and precipitation decrease can form a positive feedback[9], which under certain conditions, can lead to a nonlinear change in forest cover.[10] Well-adapted forests avoid feedback loops that enforce climate change and its consequences.

[9] Despite the misleading name, a 'positive feedback' in this case would have very negative consequences for human well-being. The term positive feedback relates to the fact that climate change impacts can cause changes in ecosystems which in turn accelerate climate change, such as the potential large-scale dieback of forest ecosystems, and the resulting release of stored carbon.

[10] Millennium Ecosystem Assessment (2005).

Feedback loops in forests

One consequence of climate change is its self-enforcing power caused by 'feedback loops'. In a feedback loop, the rising temperature on earth changes the environment in ways that create even more heat. As such deforestation may alter albedo – the reflection of sunlight and atmospheric radiation from terrestrial surfaces – because forests absorb more sunlight energy than open field areas and agricultural farmland. Together with the increased latent heat flux, an increased albedo causes changes in the local climate that may lead to further forest decline and more release of carbon or reduced carbon uptake.[11]

[11] The Royal Society (2008): Biodiversity climate interactions: adaptation, mitigation and human livelihoods.

Additionally, changes of site conditions can be disadvantageous for the well-established flora and fauna in competition with invasive alien species. If those are better adapted to the new site conditions, they invade the existing ecosystem and migration takes place. The natural community loses stability – pests, diseases and other calamities can spread and lead to a phase of species extinction in this particular area.

These projected changes and impacts will have cascading effects on forest functions, including carbon storage. Well-functioning ecosystems have greater resilience to climate change, which will aid their natural adaptation and assure their sustainability under changing climate conditions.

To ensure that ecosystem-based adaptation and mitigation measures (such as REDD) deliver significant additional social, cultural, economic and biodiversity benefits, it is important that these benefits be specifically considered in the planning, design, implementation, monitoring, reporting and evaluation of such measures. Adaptation measures are more likely to deliver multiple benefits if social, economic, and cultural aspects are explicitly considered in all phases of project development and implementation; if all tradeoffs and synergies are carefully identified and explored; and if all stakeholders are given a voice in deciding how adaptation measures are implemented.

7. Permanence: a key concern for REDD

'Permanence' of forest-based carbon storage is pertinent for the success of REDD efforts. The term refers to the length of time that carbon will be stored in a carbon sink, in this case in a forest, either as biomass above ground (mostly in trees) or in the soil. The IPCC defines permanence as 'the longevity of a carbon pool and the stability of its stocks, given the management and disturbance environment in which it occurs.' Entering into a REDD-related agreement requires forest landowners to commit to a time period to maintain their standing forests and thus the carbon stored within them.

If greenhouse gas emissions and other changes continue at or above current rates, the resilience of many ecosystems including forests is likely to be exceeded by an unprecedented combination of change in climate, associated disturbances (flooding, drought, wildfire, insects, ocean acidification) and other global change drivers (especially land-use change, pollution, and over-exploitation of resources) during this century (IPCC WG2, chapter 4).

So permanence is directly linked to the stability and resilience of forest ecosystems. A recent synthesis report by the CBD strongly supports the conclusion that the capacity of forests to resist change, or recover following disturbance, is dependent on biodiversity at multiple scales (CBD, 2009b). Therefore, maintaining and restoring biodiversity in forests is an essential 'insurance policy' and safeguard against climate change impacts and a strategy to minimize the investment risks of REDD.

Forest degradation and deforestation reduce biodiversity and thus, ecosystem resilience. Investments into REDD should consider biodiversity as a major factor for long-term stability of carbon stocks.

Forest types and ecosystem resilience

The types of forest should be considered when balancing mitigation with the natural adaptation of ecosystems. This is also necessary when deciding which REDD activity would be best for the various types of forests.

Intact primary forests contain the most carbon stocks, harbor the highest biodiversity and have the highest resilience to climate change. Forest conservation should generally be the management objective for remaining primary forests.

Modified natural forests (those that have been logged or degraded) have lower carbon stocks, less biodiversity, and less resilience than primary forests. The main management objectives here should be improvements to sustainable forest management as well as restoration (enhancement of carbon stocks).

Plantation forests may store and sequester considerable amounts of carbon but are not as beneficial for biodiversity conservation as natural forests. Among plantations types, those that comprise diverse mixtures of native species have potential for a higher biodiversity value than those comprising monocultures or exotic species. Plantations can also serve as ecological corridors if they are planned at landscape level. Here, the application of the principles of sustainable forest management can further increase the benefits and stability of plantation forests.

(CBD 2009a)

To ensure permanence, the underlying factors of deforestation and forest degradation must be constantly addressed over a long period and reflect an understanding of the likely effects of climate on forests. These drivers may be human-induced or naturally induced (i.e. pests, diseases, fire, storms or other natural disasters which are partly accentuated by climate change). Biodiverse ecosystems reduce the vulnerability of forest ecosystems to the effects of climate change, strengthen their vitality and resistance against natural disasters and calamities, and ensure that they have the resilience to 'bounce back' from temporary disturbances. Several management options exist to increase the resistance and resilience, and thereby the ecological stability of forests (see chapter 4). They are comprised in the concept of Sustainable Forest Management.

Sustainable Forest Management

In December 2007 the UN General Assembly adopted the non-legally binding instrument on all types of forests (forest instrument). This instrument represents the first widely and inter-governmentally agreed language on the meaning of SFM. It states that *'Sustainable forest management as a dynamic and evolving concept aims to maintain and enhance the economic, social and environmental value of all types of forests, for the benefit of present and future generations.'*

It further specifies: *'To achieve the purpose of the present instrument and taking into account national policies, priorities, conditions and available resources, Member States should:*

(a) Develop, implement, publish and, as necessary, update national forest programs and other strategies for sustainable forest management which identify actions needed and contain measures, policies or specific goals, taking into account the relevant proposals for action of the Intergovernmental Panel on Forests / Intergovernmental Forum on Forests and resolutions of the United Nations on Forests;

(b) Consider the seven thematic elements of sustainable forest management which are drawn from the criteria identified by existing criteria and indicator processes, as a reference framework for sustainable forest management.'

To further increase the positive impact of sustainable forest management, cautious harvesting techniques such as reduced impact logging can be applied. They minimize the ecological damage caused by logging through the use of site-sensitive harvesting techniques (low-weighted machines, low-volume logging). Research undertaken at the Center for International Forest Related Research (CIFOR) has shown that reduced impact logging methods can reduce impacts on soil from heavy logging machinery by 25 per cent, and lead to a gain of as much as 50 per cent in the 'carbon storehouse' benefits from the remaining vegetation.

Seven thematic elements of SFM

The seven elements of SMF are (i) extent of forest resources; (ii) forest biological diversity; (iii) forest health and vitality; (iv) productive functions of forest resources; (v) protective functions of forest resources; (vi) socio-economic functions of forests; and (vii) legal, policy and institutional framework.

Resilience of ecosystems

IPCC: Resilience is the amount of change a system can undergo without changing state.

Millennium Ecosystem Assessment: Both the supply and the resilience of ecosystem services are affected by changes in biodiversity. Biodiversity is the variability among living organisms and the ecological complexes of which they are part. When a species disappears from a particular location (even if it does not go extinct globally) or if it is introduced to a new location, the various related ecosystem services change. Generally, when a habitat is converted, an array of ecosystem services associated with the species at that location change, often with direct and immediate impact on people. Changes in biodiversity also have numerous indirect impacts on ecosystem services over longer time periods. This includes influencing the capacity of ecosystems to adjust to changing environments (medium certainty), causing disproportionately large and sometimes irreversible changes in ecosystem processes, influencing the potential for infectious disease transmission, and altering the potential impacts of pests and pathogens (medium to high certainty).

TEEB interim report to the CBD:[11] Ecosystem resilience is the capacity of an ecosystem to absorb shocks and stresses in constructive ways. The economic importance of the contribution of aggregated biodiversity to ecosystem resilience is probably very high but still poorly quantified. This important gap in knowledge reflects the difficulty of first quantifying the risks of a system collapse from an ecological perspective, and then measuring people's willingness to pay to reduce those risks that are not yet properly understood.

[11] The Economics of Ecosystems and Biodiversity, TEEB www.teebweb.org, see also European Communities (2008).

The multiple benefits of REDD do not hamper but enhance climate benefits of REDD. Any financial compensation mechanism has the potential to reward them all simultaneously and remunerate their mutual promotion.

8. Market interest in multiple benefits

Since risk plays a crucial role in purchase and investment decisions in any market, risk considerations will also influence any decision on REDD. The main issues that make buyers wary and lower price expectations relate to the risk of non-permanence of emission reductions, leakage and carbon accounting questions.

There are mainly three options for the financial architecture of the REDD mechanism: a direct (voluntary) market approach, the creation of a voluntary fund whose expenditures are governed by a regulated system, or a hybrid approach representing a mixture of both. It is expected that voluntary and regulatory markets will co-exist in the future. All options present the opportunity for rewarding multiple benefits that come with the reduced emission of greenhouse gases.

Different buyers value different benefits. Buyers on regulated markets are likely to attach importance to the reliable delivery of a concrete volume of credits over a defined time period, and to the price of emission reductions. However, the willingness to buy credits from the forest sector through the REDD mechanism and not on the market for other mitigation measures will be strongly influenced by fundamental criteria such as underlying project risks, quality, price and volumes traded. While a financial incentive scheme has the potential to curb anthropogenic pressure such as infrastructure development, conversion to agriculture or illegal logging, and natural threats like pest outbreaks, disease and fire have the potential to release the carbon stored within forest reserves despite conservation efforts. Under a bilateral agreement between the host country and the buyer of carbon credits generated by a REDD scheme, it is important to determine who bears the risk of such factors. Maintaining high biodiversity and ecosystem resilience, and full and transparent involvement of key stakeholders, will limit the risk of non-permanence.

Private buyers are expected to benefit most from biodiversity and livelihood benefits since they make voluntary commitments compared to regulated requirements. These voluntary commitments can be and are already used for Corporate Social Responsibility (CSR) and Public Relations (PR) purposes. These PR and CSR aspects are important to some buyers. This has potential for high biodiversity REDD credits and schemes on the voluntary market.

This potential could result in higher prices for credits. Recent surveys have shown that projects certified by the CCBA Standard (see box) have higher prices than those traded at the Chicago Climate Exchange. This reflects the expectation described earlier that regulatory carbon market buyers have little incentive to value any offset attributes other than carbon benefits because they are not required to do so. The multiple benefits of REDD activities will therefore not be seen as a comparative advantage in regulatory markets.

Example of standard for REDD and multiple benefits – CCBA

The Climate, Community & Biodiversity Alliance (CCBA) is a global partnership of leading companies and non-governmental organizations created in 2003. The CCBA aims to leverage policies and markets to promote the development of forest protection, restoration and agroforestry projects through high quality multiple-benefit land-based carbon projects. The Climate, Community & Biodiversity Standards (CCBS) were created to foster the development and marketing of projects that deliver credible and significant climate, community and biodiversity benefits in an integrated, sustainable manner. Projects that meet the Standards adopt best practices to deliver robust and credible greenhouse gas reductions while also delivering net positive benefits to local communities and biodiversity.

CCB Standards distinguish between obligatory and optional requirements that must be met by the projects, which are divided into a general section (general conditions, baseline, project design and goals, management capacity, legal status etc.), climate impacts, community impacts, and biodiversity impacts. Besides these obligatory standards that form the 'approved status', a 'gold status' can be achieved through climate change adaptation benefits, exceptional community benefits or exceptional biodiversity benefits.

The standards can be applied to any land-based carbon projects including projects that reduce greenhouse gas emissions through avoided deforestation and forest degradation (REDD) and projects that remove carbon dioxide by sequestering carbon (reforestation, afforestation, revegetation, forest restoration, agroforestry and sustainable agriculture).

Recent surveys underpinned the observation that buyers in voluntary markets are only interested in high quality credits with demonstrable co-benefits. This interest is related to PR and CSR motives, and to the fact that these high quality offsets are widely accepted by NGOs and many customers as credible and legitimate.

This is also true for governments as buyers of carbon credits that might come under closer scrutiny by voters and interest groups, notably environmental NGOs. They will have to explain their decision for having chosen carbon credits with or without additional benefits.

Win-win-win Projects: Climate, Biodiversity, and Livelihoods

Project in Brazil validated by ambitious CCB Standards

The 'Juma Sustainable Development Reserve Project: Reducing Greenhouse Gas Emissions from Deforestation in the State of Amazonas, Brazil' became the second REDD project to receive validation from the Climate, Community & Biodiversity (CCB) Standards on September 30th, 2008. More: http://www.climate-standards.org/projects/index.html.

This includes the financial engagement of Marriott Int. to reduce its own carbon footprint:
http://www.marriott.com/marriott.mi?page=green_protecting.

The execution of this project relies primarily on the financial benefits of carbon, which will be generated with the implementation of a RED mechanism of the same magnitude as the Amazonas State Policy on Climate Change (PEMC-AM). A partnership with Marriott International (MI) is being implemented exclusively for the Juma Reserve RED Project. This partnership aims to develop a RED mechanism to 'compensate' the emissions generated by Mi's guests worldwide.

Possible win-win-activities for implementation of CBD and UNFCCC (CBD 2009a)

Mitigation activity	Potential benefits for biodiversity	Potential risks to biodiversity	Possible actions to enhance benefits or reduce negative impacts on biodiversity
Reducing emissions from deforestation and forest degradation	Reduced forest loss and reduced forest degradation Reduced fragmentation Maintenance of diverse gene pools and robust species populations	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 in the REDD mechanism, to minimize international leakage Involve forest-dwelling indigenous and local communities
Forest Conservation	Conservation of intact forest habitat Reduced fragmentation Maintenance of diverse gene pools and robust species populations Maintenance of ecological and evolutionary processes and functions Enhanced integrity of the landscape and enhanced resilience of ecosystems to climate change		Prioritize conservation of forests with high biodiversity Conserve large areas of primary intact forest Maintain landscape connectivity Conserve a diversity of forest types, covering different microclimatic conditions and including altitudinal gradients Avoid unsustainable hunting
Sustainable Management of Forests	Reduced degradation of forest (relative to conventional logging)	Potential encroachment in intact forest, resulting in biodiversity loss	Prioritize sustainable management in areas that are already subject to intensive land use and are of high biodiversity values Minimize use in primary forests and intact forests of high biodiversity value Apply best-practice guidelines for sustainable forest management including reduced impact logging

Mitigation activity	Potential benefits for biodiversity	Potential risks to biodiversity	Possible actions to enhance benefits or reduce negative impacts on biodiversity
Afforestation and Reforestation (A/R)	Habitat restoration of degraded landscapes (if native species and diverse plantings are used) Enhancement of landscape connectivity (depending on spatial arrangement) Protection of water resources, conserving aquatic biodiversity (depending on type of plantation)	Introduction of invasive and alien species Introduction of genetically modified trees Replacement of native grasslands, wetlands and other non-forest habitats by forest plantations Changes in water flow regimes, negatively affecting both aquatic and terrestrial biodiversity	Apply best practices for reforestation (e.g., native species, mixed plantations) Prevent replacement of intact forests, grasslands, wetlands, and other non-forest native ecosystems by forest plantations. Locate reforestation in such a way to enhance landscape connectivity and reduce edge effects on remaining forest patches Develop premiums within incentive measures for biodiversity co-benefits
Other land use and land-use change activities:			
Land-use change from low carbon to higher carbon land use (e.g., annual cropland to grassland; revegetation)	Restoration of native habitats	Introduction of invasive species Prioritization of high net carbon land uses over biodiversity considerations Conversion to non-native ecosystem types	Promote the use of native species when changing land use Restore native ecosystems Improve the assessment / valuation of biodiversity and ecosystem goods and services during decision making regarding land use change (e.g. water cycling, flood protection, etc.) Develop premiums within incentive measures for biodiversity co-benefits
Implementation of sustainable cropland management (including soil conservation, conservation tillage, fallows, etc)	Provision of habitats for agricultural biodiversity Reduced contamination of streams and other water bodies, affecting aquatic biodiversity	Expansion of cropland into native habitats Possible increased use of herbicides associated with conservation tillage	Promote sustainable crop management as part of a broader landscape level planning that includes conservation of remaining native ecosystems and restoration, as appropriate Consider traditional and local knowledge Provide capacity-building and information on appropriate sustainable cropland management
Implementation of sustainable livestock management practices (including appropriate stocking density, grazing rotation systems, improved forage, etc.)	Provision of habitat for species present in pastoral systems Reduced contamination of streams and other water bodies, affecting aquatic biodiversity	Expansion of area used for livestock into native habitats	Promote sustainable livestock management as part of a broader landscape level planning that includes conservation of remaining native ecosystems and restoration, as appropriate Consider traditional and local knowledge Provide capacity-building and information on appropriate sustainable cropland management

Mitigation activity	Potential benefits for biodiversity	Potential risks to biodiversity	Possible actions to enhance benefits or reduce negative impacts on biodiversity
Implementation of agroforestry systems on existing croplands or grazing lands	Provision of habitat for agricultural biodiversity Restoration of degraded landscapes Enhancement of landscape connectivity (depending on spatial arrangement) Protection of water resources, conserving aquatic biodiversity (depending on type of agroforestry system) Reduced contamination of streams and other water bodies (due to reduced use of agrochemicals) affecting aquatic biodiversity	Introduction of invasive and alien species Encroachment into native ecosystems	Promote agroforestry as part of a broader landscape level planning that includes conservation of remaining native ecosystems and restoration, as appropriate Consider traditional and local knowledge Provide capacity-building and information on appropriate agroforestry systems Provide appropriate credit to apply best practices
Conservation and restoration of peatlands and other wetlands including mangroves	Habitat conservation and restoration for both terrestrial and aquatic biodiversity Maintenance of ecological processes and functions, particularly those related to hydrology Enhanced integrity of the landscape and enhanced resilience of ecosystems	Increased methane emissions if restoration is done inappropriately	Prioritize restoration of peatlands and wetlands of high biodiversity Maintain and restore entire hydrological catchments or at least the headwaters Restore and maintain landscape connectivity Maintain natural water flow regimes Encourage regeneration – or replant – native mangrove trees Involve indigenous and local communities
Biofuels	Restoration of soils in degraded lands Enhanced connectivity between ecosystems Reduced air pollution Reduction in application of pesticides and fertilizers Reduction in water used for irrigation	Conversion and fragmentation of natural ecosystems, resulting in biodiversity loss Introduction of invasive species Intensification of pesticide and fertilizer use and irrigation Contamination of water reserves, affecting aquatic biodiversity Changes in water flow, affecting aquatic and terrestrial biodiversity	Prevent replacement of intact forests, grasslands, wetlands, and other native ecosystems by biofuel crops Minimize encroachment of biofuels into intact ecosystems of high biodiversity value Plant biofuel crops on already degraded lands Apply best practices and standards for biofuels Use native species where possible
Other large-scale renewable energy (including solar, hydro, wind, etc.)	Reduced air pollution	Habitat destruction Disruption of migration patterns of terrestrial and/or aquatic fauna Increased mortality of birds (wind turbines)	Identify areas for renewable energy projects that will have a lesser impact on biodiversity Conduct a comprehensive environmental impact assessment Apply best management practices

9. Looking forward

The knowledge and tools to achieve REDD biodiversity and livelihood benefits exist at many levels. Political will and coordination at country level can result in significant synergies and cost savings.

Each government that is or will be participating in REDD efforts and the national and international institutions and organizations supporting them have valuable tools at their disposal. However the successful design and implementation of REDD activities will require cooperation between different branches of government (for example the National Focal Points of the UNFCCC, CBD, and UNFF, and their respective departments and ministries). This is to ensure that existing tools, guidelines and international commitments are fully utilized and that countries can implement REDD efforts cost efficiently with maximum returns on their investments in terms of economic incentives and environmental benefits.

- In order to create synergies between the implementation of the CBD, UNFF and the UNFCCC, biodiversity considerations must be made when developing the REDD methodology. Countries already have several tools to achieve synergies and to identify risks to biodiversity, such as their National Biodiversity Strategies and Action Plans and National Forest Programs.
- One win-win opportunity is the national 'gap analysis' for protected area systems that was recently adopted by over 40 developing countries under the CBD programme of work. The programme's goal is to establish a coherent system of terrestrial protected areas by 2010. The national analyses identify areas of high biodiversity value, as well as priority areas for ecological corridors. The results of this work, including maps (see box), are readily available at national level and could support decision-making on REDD-plus activities. The analyses were developed in a participatory approach. Modern GIS technology at country level will allow for easy compatibility with other mapping efforts like carbon densities. The table overleaf (see box) provides an overview of possible synergies at country level between this CBD tool and REDD activities.
- REDD methodologies based only on assessments of deforestation rates could have negative impacts on biodiversity conservation. In particular the question of whether gross deforestation or net deforestation[12] is considered is important in this context. The use of net rates could hide the loss of mature (primary and modified natural) forests by their replacement *in situ* or elsewhere with areas of new forest growth. This could be accompanied by significant losses of biodiversity. Addressing forest degradation is important because degradation results in biodiversity loss, decreases forest resilience to disturbances and often leads to deforestation[13]. Monitoring to detect the severity and extent of forest degradation is therefore a key issue requiring further development.

[12] Net deforestation (net loss of forest area) is defined in the FAO Global Forest Resources Assessment 2005 as overall deforestation minus changes in forest area due to forest planting, landscape restoration and natural expansion of forests.

[13] Malhi, Y., Aragão, L.E.O.C., Galbraith, D., Huntingford, C., Fisher, R., Zelazowski, P., Sitch, S., McSweeney, C. & Meir, P. 2009. Exploring the likelihood and mechanism of a climate-change-induced dieback of the Amazon rainforest. Proceedings of the National Academy of Sciences doi: 10.1073/pnas.0804619106.

Gap assessment as supportive tool

The overall gap assessment of Mexico's terrestrial 'spaces and species'. Map produced by *The Nature Conservancy, pro natura, Comisión Nacional de áreas naturales protegidas* and *Comisión Nacional para el Conocimiento y el Uso de la Biodiversidad.*

Links between CBD National Protected Area System Gap Analysis and REDD-plus

REDD-plus activity	**Potential contribution of CBD national protected area gap analysis**
Reducing emissions from deforestation (measures outside of forests)	Identify priority areas of high biodiversity value and high risk
Conservation	Identify priority sites of new forest protected areas
Sustainable forest management	Identify areas for SFM and efforts to reduce degradation
Enhancement of carbon stocks: - restoration - reforestation - afforestation	Identify priority areas which could also serve as biological corridors, e.g. between protected areas, and provide blueprint for landscape level planning

- Both intra-national and inter-national displacement of emissions under REDD can have important consequences for carbon and biodiversity and livelihoods. While it does not often matter where deforestation or degradation occurs from a carbon perspective, defining REDD-eligible areas without considering biodiversity could displace deforestation to higher biodiversity valued forests and to forests with great importance for indigenous and local communities.
- Voluntary markets alone are clearly insufficient to achieve significant conservation and climate benefits on a global scale. Regulatory markets, which currently have more magnitude, will almost certainly remain the only instrument for up scaling and mobilizing the financial volumes needed to promote biodiversity as a prerequisite for and co-benefit of any successful REDD scheme.
- Individual buying countries (such as the United States) or groups of countries (such as the European Union) could opt for reserving a percentage of REDD imports for high biodiversity credits. The criteria for defining high biodiversity could either be decided upon unilaterally by the buying country, bilaterally between the selling and buying governments, or they could be part of an internationally recognized (non-UNFCCC) standard.

- In any possible REDD financing option, countries would benefit from increasing their long-term chance of success and spreading the risk of their REDD-related investment, by:
  - maintaining or restoring high levels of biodiversity (and thus ecosystem resistance and resilience) in REDD project areas;
  - maintaining or creating sufficiently large, unfragmented forest areas for REDD activities;
  - involving key stakeholders, particularly indigenous and local communities, in all steps of REDD planning and implementation;
  - ensuring transparency, governance and security in land tenure.

10. Glossary

Forest Degradation: there are several multilaterally agreed definitions of forest degradation. The FAO is presently undertaking efforts to harmonize these various definitions into one global definition. UNEP defines a degraded forest as 'a secondary forest that has lost, through human activities, the structure, function, species composition or productivity normally associated with a natural forest type expected on that site. Hence, a degraded forest delivers a reduced supply of goods and services from the given site and maintains only limited biological diversity. Biological diversity of degraded forests includes many non-tree components, which may dominate in the under-canopy vegetation.' The IPCC defines forest degradation as: A direct human induced loss of forest values (particularly carbon), likely to be characterized by a reduction of tree cover. Routine management from which crown cover will recover within the normal cycle of forest management operations is not included.

Forest management refers to the management (or sustainable management, as opposed to destructive logging) of existing forests, in the context of a carbon project usually in order to enhance carbon stocks in the forest. This is different from afforestation and reforestation, although it equally represents a sink activity. Forest management is not eligible under the CDM but is eligible under the JI.

Greenhouse gases (GHGs) are trace gases that control energy flows in the Earth's atmosphere by absorbing infrared radiation. Some GHGs occur naturally in the atmosphere (e.g. H_2O), while others result from human activities or occur at greater concentrations because of human activities. There are six GHGs covered under the Kyoto Protocol - carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). CO_2 is the most important GHG released by human activities.

Leakage is an increase in emissions outside a project area due to project activities, e.g. the displacement of logging due to forest conservation activities.

Monitoring refers to the collection and archiving of all relevant data necessary for determining the baseline and project-based measuring of anthropogenic emissions by sources (or sinks) of greenhouse gases (GHG) within the project boundary (and leakage of emissions).

Reference Scenarios (Baselines) establish a hypothetical emission level against which actual emissions are measured. In the case of REDD, the main options are historical baselines (average emissions during a past period), modeled baselines (spatially explicit - e.g. land use models or not spatially explicit e.g., econometric models), and negotiated baselines.

Resilience is the capacity of an ecosystem to return to a former state after a disturbance sufficiently large to alter the system in some way (e.g. fire).

Sustainable forest management (SFM) is 'a dynamic and evolving concept aims to maintain and enhance the economic, social and environmental value of all types of forests, for the benefit of present and future generations.' SFM considers 8 thematic elements: (i) extent of forest resources; (ii) forest biological diversity; (iii) forest health and vitality; (iv) productive functions of forest resources; (v) protective functions of forest resources; (vi) socioeconomic functions of forests; and (vii) legal, policy and institutional framework. (UN General Assembly resolution 62/98, December 2007).

United Nations Framework Convention on Climate Change (UNFCCC) was established in 1992 at the Rio Earth Summit. It is the overall framework guiding the international climate negotiations. Its main objective is 'stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic (man-made) interference with the climate system'. The Kyoto Protocol is a Protocol to the UNFCCC.

Verification refers to the process in which a recognized independent third party must confirm that claimed emissions reductions have occurred. This is a precondition for the issuance of carbon credits (e.g. for CDM projects) by the UNFCCC.

Voluntary Markets are markets outside regulatory carbon markets and do not involve international agreements. They are driven by voluntary commitments from organizations (e.g., energy companies, airlines) and individuals.

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Additional literature and sources are cited in footnotes.

Acronyms

CBD	Convention on Biological Diversity
CCBA	Climate, Community & Biodiversity Alliance
CCBS	Climate, Community & Biodiversity Standards
CIFOR	Center for International Forestry Research
CPF	Collaborative Partnership on Forests
CSR	Corporate Social Responsibility
FAO	Food and Agriculture Organization
FCPF	Forest Carbon Partnership Facility
FLEGT	Forest Law Enforcement, Governance and Trade
GEF	Global Environment Facility
GHG	Greenhouse Gas
GIS	Geographic Information System
GPP	Gross Primary Production
GRID	Global Resource Information Database
Gt	Gigaton
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
ICRAF	International Center for Research in Agroforestry
IPCC	Intergovernmental Panel on Climate Change
ITTO	International Tropical Timber Organization
IUFRO	International Union of Forest Research Organizations
IUCN	International Union for Conservation of Nature
MEA	Millennium Ecosystem Assessment
MDG	Millennium Development Goals
NFP	National forest programme
NGO	Non-governmental organization
NLBI	Non-legally binding instrument
NTFP	Non-timber forest product
OECD	Organisation for Economic Co-operation and Development
PR	Public Relations
REDD	Reducing Emissions from Deforestation and Forest Degradation
SFM	Sustainable Forest Management
TEEB	The Economics of Ecosystems and Biodiversity
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNFF	United Nations Forum on Forests
WDR	World Development Report

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