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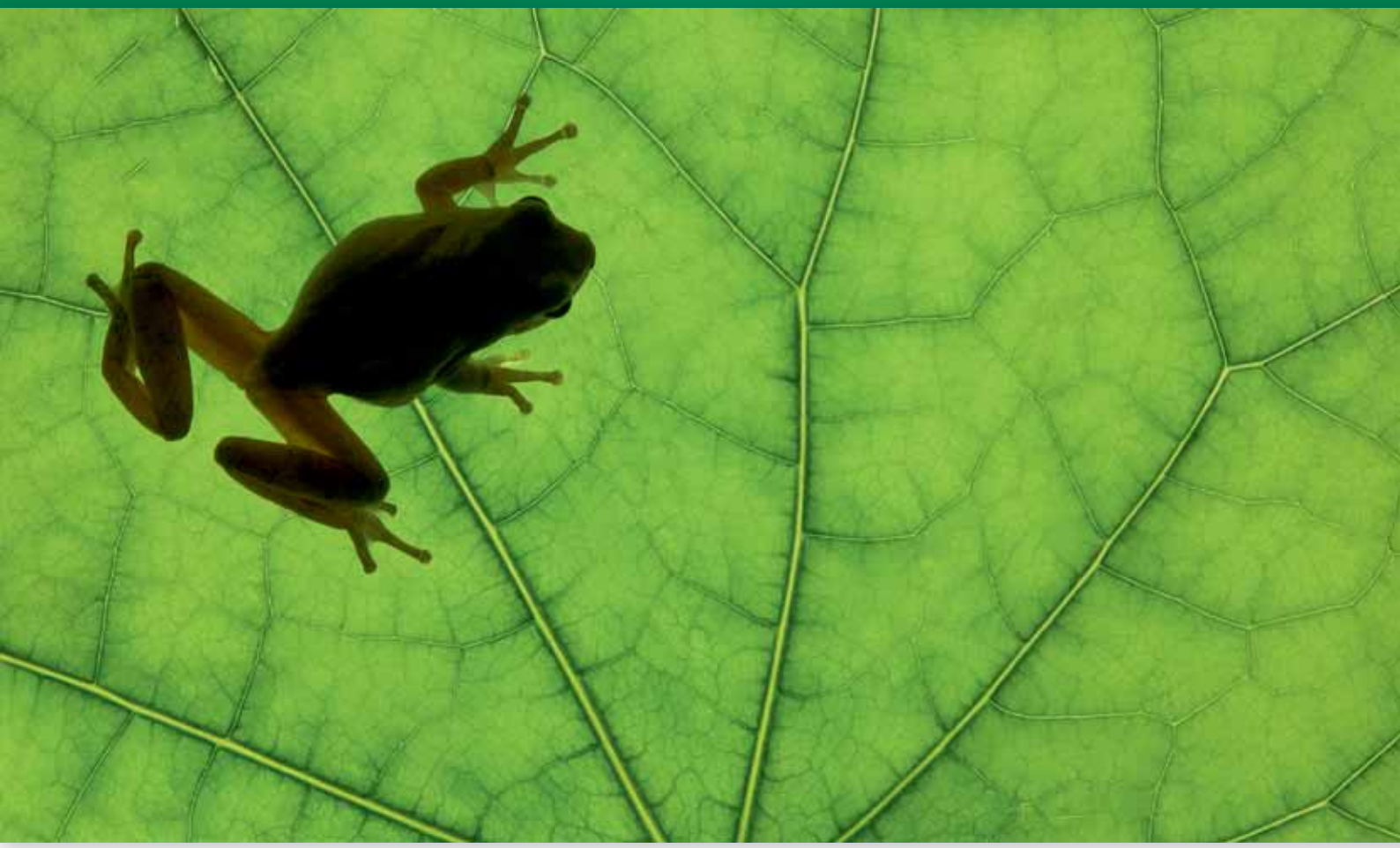

Biodiversity is life

The world's ecosystems provide environmental services we simply cannot live without. As an integral part of nature, our fate is tightly linked with biological diversity, i.e. the huge variety of animals, plants and microorganisms that live in mountains, forests, oceans, wetlands and other ecosystems. We rely on this diversity of life to provide us with essentials such as water, food, fuel and medicine. Yet each day an estimated 150 species disappear, many due to human activities. The rate of loss is as much as 1000 times higher than the pre-human, or background, extinction rate.

Forests are particularly rich in biodiversity. They harbor an estimated two-thirds of all terrestrial species, as well as a fascinating array of ecological processes. Tropical forests, in particular, are among the most biologically diverse ecosystems on earth. To raise awareness of the importance of biodiversity, and the threats that are causing its rapid decline, the UN General Assembly declared 2010 the International Year of Biodiversity (IYB). During the year, people are celebrating

Contents

Regular features

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Cover image: Tree frog. *Photo: iStockphoto/Spanishalex*

... Editorial continued

the diversity of life on the planet, and its contribution to human well-being, while working to take steps needed to combat its loss.

The IYB 2010 boasts more than 500 events worldwide. Its flagship event is the 10th meeting of the Conference of the Parties to the Convention on Biological Diversity (CBD) which will take place in Nagoya, Japan, from 18–29 October. COP 10, as it is called in short, will be attended by several thousand delegates representing the 193 Parties to the Convention and many observers. The delegates will adopt a new strategic plan for the Convention for 2011-2020 with the participation of all stakeholders. The new strategic plan will include clear and measurable targets to achieve the objectives of the Convention in forests and other ecosystems by 2020 (Stahl and Christophersen, p. 3).

COP 10 is also expected to adopt a protocol on access and benefit sharing of genetic resources which will benefit the world's forests through improved arrangements to equitably share the benefits from the utilization of forest genetic resources, which are the basis for numerous medicinal and other products. The protocol would also add to the growing understanding of the full economic value and potential of forest biodiversity. The report The Economics of Ecosystems and Biodiversity (TEEB), which will be presented at COP 10, contains a wealth of data and analysis on the true value of forests. Unfortunately, few of these values are currently being remunerated at meaningful levels but this is changing. The TEEB report will contribute to promoting the valuation and remuneration of ecosystem services (Sukhdev, p. 8).

Biodiversity and climate change will be another central focus of the negotiations. COP 10 will consider a series of recommendations to address climate change-related challenges and opportunities for forest biodiversity and local livelihoods. Among other recommendations, COP 10 may invite Parties to implement the protection of primary forests and sustainable forest management in production forests (Sayer and Boedhihartono, p. 11). COP 10 may also invite Parties to take into account biodiversity and ecosystem services when designing, implementing and monitoring afforestation, reforestation and forest restoration activities for climate change mitigation. In addition, COP 10 will discuss the risks and benefits from Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD+), and other sustainable land management activities, for mitigation, biodiversity, and forest-dwelling indigenous and local communities (Harvey and Dickson, p.13).

Finally, COP 10 will discuss the role of the Convention in monitoring forest biodiversity. Although significant advances were made in recent years, reporting and monitoring of forest biodiversity still suffers from high costs and uncertainties, and problems of data compatibility. For this reason, the CBD relies on the Collaborative Partnership on Forests (CPF), and its joint 'Task Force on Streamlining Forest-related Reporting,' to further improve forest biodiversity reporting and monitoring. In this context, COP 10 may also request improved definitions of forest and forest types, with a view to further improving the biodiversity monitoring component of the FAO Global Forest Resources Assessment.

Biodiversity underpins the long-term stability of ecosystem goods and services derived from forests. The permanence of these goods and services rests on forest resilience, i.e. a forest's ability to withstand and recover from disturbance. Forest resilience, in turn, rests on biodiversity at multiple scales (Thompson, p. 16; Nasi *et al.* p. 19). Maintaining and restoring forest biodiversity promotes forest resilience to human-induced pressures, such as climate change or invasive alien species (see Jackson and Howard, p. 22). Conserving and sustainably using forest biodiversity, and maintaining forest resilience, is therefore a crucial 'insurance policy' to make sure forest ecosystems continue to provide us with the essentials on which we all depend.

As the slogan of the International Year of Biodiversity reminds us: Biodiversity is life…biodiversity is OUR life.

Tim Christophersen[1], Johannes Stahl[1], Steve Johnson[2], Eduardo Mansur[2]
Co-editors (1. CBD; 2. ITTO)

Forests to the fore

The Convention on Biological Diversity and its forest agenda

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Aiming to stop this: CBD's forest agenda will seek to reduce forest biodiversity losses from destructive practices.
Photo: iStockphoto/Brasil2

Established at the Earth Summit in Rio de Janeiro in 1992, the Convention on Biological Diversity (CBD) is an international treaty for the conservation and sustainable use of biodiversity and the fair and equitable sharing of benefits arising out of the utilization of genetic resources. The CBD recognizes that biological diversity is about more than plants, animals, microorganisms and their ecosystems – it is about people and our need for food security, medicines, fresh air and water, shelter, and a clean and healthy environment in which to live. With 193 Parties – 192 member states and the European Union – it has near-universal participation.

Forests are a particular focus of the CBD. They harbor an estimated two-thirds of all terrestrial species, as well as a fascinating array of ecological processes. Tropical forests, in particular, are among the most biologically diverse ecosystems on earth. To better address the global forest biodiversity loss, the 193 Parties to the CBD adopted an expanded programme of work on forest biological diversity at their sixth meeting in the Hague in 2002. In May 2008, they reviewed the programme's implementation and adopted a set of priorities for further implementation (SBSTTA 2007). At its upcoming tenth meeting to be held in Nagoya, Japan, from 18 – 29 October 2010, the Conference of the Parties (COP 10) will review the sustainable use of forests and other ecosystems, and adopt a revised and updated strategic plan, including new forest biodiversity targets for the post-2010 period. In Nagoya, the Parties will also assess recommendations by the CBD's scientific, technical and technological advisory body, SBSTTA, on how to achieve these targets. This article provides a brief overview of the CBD's forest biodiversity programme of work, the proposed forest biodiversity targets of its post-2010 strategic plan, and the forest-related recommendations that will be considered at COP 10.

The CBD forest programme

The CBD's programme of work on forest biodiversity consists of 130 measures, which the Parties have agreed to implement in accordance with national priorities (CBD 2002). The measures are clustered in three elements:

- Element 1 relates to measures for the conservation and sustainable use of forest resources and the equitable sharing of the multiple benefits arising from their use. The measures include activities to increase sustainable

New priorities of the CBD Programme of Work on Forest Biodiversity

Following a review process from 2006 to 2008, the Parties to the CBD adopted a new set of priorities for the CBD Programme of Work on Forest Biodiversity in May 2008 (Decision IX/5), including:

- unregulated and unsustainable use of forest products and resources (including unsustainable hunting and trade of bushmeat, and their impacts on non-target species)
- climate change
- desertification and desert creep
- illegal land conversion
- habitat fragmentation
- environmental degradation
- forest fires
- invasive alien species

forest management, implement the ecosystem approach, establish effective protected areas, restore degraded forests, fight against forest fires and invasive alien species, and ensure equitable access and benefit-sharing with indigenous and local communities.

- Element 2 involves measures to further develop the institutional and socio-economic environment necessary to enable forest conservation, sustainable use and benefit-sharing. Measures in this cluster include activities to provide incentives for the use of sustainable practices (e.g. certification), to develop good practices in forest law enforcement and governance (FLEG), and to clarify land tenure and resource rights.
- Element 3 concerns scientific and technical measures for better knowledge, assessment and monitoring of forest trends. These measures include activities to advance assessment methods, research forest ecosystem functioning, develop a global forest classification system, and improve the infrastructure for data and information management.

Since the inception of the forest programme of work, many countries and regions have considerably moved ahead with its implementation. For example, Brazil reduced deforestation in the Brazilian Amazon by some 50% from 2002 to 2008, and designated half the Amazonian state of Acre's territory as protected areas. Similarly, Madagascar reduced the rate of decline of tropical forest by almost 50% from 2000 to 2005; Liberia set aside 30% of forest land for conservation; Malaysia and Viet Nam have established forest corridors to connect forest biodiversity hotspots; and India enacted landmark legislation which assigned ownership rights to minor forest produce to indigenous peoples and local communities (Fourth National Reports 2009). However, despite encouraging progress, review of the programme of work and of the CBD's 2010 targets indicates that still greater efforts have to be made to enhance the protection of forest biodiversity. In particular, the continuing loss and degradation of primary tropical forests needs to be addressed more effectively.

Elements of the CBD strategic plan

The revised and updated Strategic Plan of the Convention, which will be discussed at COP 10 in Nagoya[1], contains several targets aimed to enhance forest biodiversity. The Strategic Plan is developed with a view to achieve synergies between the Rio Conventions, in the spirit of 'Rio +20', and strengthen the coherence between biodiversity-related targets and the Millennium Development Goals and other international goals. By 2020, it aims to:

The 2010 Biodiversity Target

In April 2002, the Parties to the CBD committed themselves to achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level. This target was subsequently endorsed by the World Summit on Sustainable Development in Johannesburg in 2002, and by the United Nations General Assembly. It was also incorporated as a target under the Millennium Development Goals. To monitor progress towards achieving the target, 21 sub-targets and 16 headline indicators were developed, based on scientifically rigorous assessments of whether trends in various aspects of biodiversity were showing improvement, no change or deterioration.

In its *Global Biodiversity Outlook 3*, an assessment of the current state of biodiversity, the CBD concludes that the 2010 biodiversity target has not been met (CBD 2010). None of the sub-targets has been achieved globally, although some have been partially or locally achieved. Of those biodiversity indicators for which global data are available, ten show negative trends, three show no clear trend but provide grounds for concern, and three show positive developments. The diversity of species, diversity within species (genetic diversity) and diversity of ecosystems continue to decline globally.

- **halve [or bring close to zero] the rate of loss, degradation, and fragmentation of forests.** This could be achieved through improvements in production efficiency and land use planning combined with the recognition of the economic value of the ecosystem services provided by forests. Emphasis should be on preventing the loss of primary forests and other high-biodiversity value habitats.
- **manage all areas under forestry sustainably, ensuring the conservation of biodiversity.** Useful tools to achieve this target can be the criteria and indicators for sustainable forest management that have been adopted by the forest sector. In addition, the customary use of forest biodiversity by indigenous and local communities can offer lessons of wider applicability. This target would be pursued *inter alia* in collaboration with ITTO, building on the 'ITTO Objective 2000'.
- **protect at least [15%] [20%] of terrestrial areas, including forests, through comprehensive, ecologically representative and well-connected systems of effectively managed protected areas.** Particular emphasis is needed to protect tropical forests. Protected areas should be established and managed in close collaboration with indigenous and local communities. They should be integrated into the wider landscape and relevant sectors by applying an ecosystem approach and taking into account ecological connectivity and the concept of ecological networks.

1 *Square brackets indicate that no consensus has been achieved so far. The draft is presented for information purposes, without the intent to pre-empt negotiations at COP 10.*

- **enhance the resilience of forests and other ecosystems, and the contribution of biodiversity to carbon stocks, through conservation and restoration, including restoration of at least 15% of degraded ecosystems.** Appropriate incentive schemes (such as 'Reducing Emissions from Deforestation and Forest Degradation in Developing Countries – REDD-plus'[2]) could enhance the conservation, restoration and sustainable management of forests and, with appropriate safeguards, could deliver substantial benefits for biodiversity and local livelihoods. Monitoring, as it is currently developed, for example under the ITTO thematic programme on reducing deforestation and forest degradation and enhancing environmental services in tropical forests (REDDES), will have to be an integral part of these incentive schemes. Moreover, recent developments, such as commitments of countries under the UN Framework Convention on Climate Change (UNFCCC) Copenhagen Accord, open new opportunities to link efforts for the conservation and sustainable use of forest biodiversity with climate change mitigation and adaptation measures. Furthermore, forest landscape restoration, as promoted by the Global Partnership on Forest Landscape Restoration (www.ideastransformlandscapes.org), of which both ITTO and the CBD Secretariat are members, offers the tools to achieve synergies between international commitments under the Rio Conventions, and the UN Forum on Forests.

Forest biodiversity and climate change

In order to seize the opportunities for forest biodiversity and local livelihoods associated with the on-going REDD-plus discussions, COP 10 will consider a series of recommendations that invite the Parties to:

- implement the protection of natural forests and the use of native assemblages of forest species in reforestation activities;
- implement improved land management, reforestation and forest restoration in forest landscapes subject to harvesting, clearing and/or degradation;
- implement reforestation and forest restoration in natural forest landscapes that have already been largely cleared and degraded;
- consider biodiversity and ecosystem services when designing, implementing and monitoring afforestation, reforestation and restoration activities for climate change mitigation. This could be done, for example, through converting only land of low biodiversity value or ecosystems largely composed of non-native species; choosing, whenever feasible, local and acclimated native tree species when selecting species for planting; avoiding invasive alien species; and strategically locating afforestation activities within the landscape to enhance connectivity and increase the provision of ecosystem services within forest areas; and
- enhance the benefits from REDD-plus, and other sustainable land management activities for mitigation, for forest-dwelling indigenous peoples and local communities through, for example, considering land ownership and land tenure; respecting, preserving and maintaining the knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biological diversity; and ensuring space for the full and effective participation of indigenous and local communities in relevant policy-making processes.

COP 10 will also consider requests to the CBD Executive Secretary to convene, in collaboration with relevant partners, a joint expert workshop on REDD-plus with a view to enhancing the coordination of capacity-building efforts on issues related to biodiversity and the conservation of forest carbon stocks. Moreover, COP 10 may request the Executive Secretary to contribute to the discussions on, and the possible development of, REDD-plus biodiversity safeguards and mechanisms to monitor the impacts of REDD-plus on biodiversity. To this end, the CBD Secretariat may investigate whether there are inadequacies in forest biodiversity reporting and monitoring, and if so, suggest ways to address these inadequacies, including by proposing improved definitions of forest and forest types.

Sustainable use of bushmeat

Next to climate change, the unregulated and unsustainable use of forest resources, including unsustainable hunting and trade of bushmeat, is a major human-induced threat to forest biodiversity. This is particularly so in tropical forests, where the loss of fauna is reaching critical levels (Nasi *et al.* 2008). Forestry operations are often closely linked to commercial bushmeat hunting and trade through logging roads and crews. The 'empty-forest syndrome' caused by habitat degradation and the over-exploitation of mammals, birds, reptiles, and amphibians in many tropical and sub-tropical countries has become a global threat to forest biodiversity (Brodie and Gibbs 2009).

For this reason, COP 10 will consider a set of recommendations that have been developed by the CBD Liaison Group on Bushmeat (CBD 2009). The Liaison Group recommends *inter alia* that:

- national governments increase their capacity to monitor levels of bushmeat harvest and consumption in national statistics to inform improved policy and planning;
- forest certification schemes take into account the conservation and sustainable use of wildlife to maintain healthy forest ecosystems;
- extractive industries (oil, gas, minerals, timber, etc.) operating in tropical and sub-tropical forests include wildlife management as an essential part of their business plans; and
- local stakeholders who have a vested interest in maintaining the resources and who can deliver sustainable, desirable solutions receive rights and associated duties to sustainably manage wildlife resources. The capacity of these empowered local communities should be built and strengthened to ensure that they have the capacity to exercise these rights.

2 *The acronym 'REDD-plus' is used in this paper without any attempt to pre-empt future negotiations under the UNFCCC.*

Cooperation with partners

Finally, COP 10 will consider further collaboration with the relevant partners of the CBD in the Collaborative Partnership on Forests (CPF), a voluntary association of 14 international organizations and secretariats with substantial forest programmes. In the past, the CBD Secretariat has collaborated with ITTO, for example, on guidelines for the conservation and sustainable use of biodiversity in tropical timber production forests (see Sayer and Boedhihartono, p. 11), and published a good practice guide for sustainable forest management jointly with the International Union for Conservation of Nature (CBD/IUCN 2009). In March 2010, the CBD Secretariat and ITTO signed a Memorandum of Understanding to further intensify their collaboration. The agreement is aimed at facilitating the implementation of activities linked to the conservation and sustainable use of tropical forest biodiversity within the CBD and ITTO work programmes. Concrete joint activities for 2010 and 2011 include the organization of an International Conference on Biodiversity Conservation in Transboundary Tropical Forests (the proceedings of which will be published in an upcoming TFU); the development, use and dissemination of publications of common interest; and the development of a support programme for the implementation of the CBD forest programme of work in ITTO member countries.

In December 2009, the CBD Secretariat also signed a Memorandum of Understanding with the Secretariat of the United Nations Forum on Forests (UNFF), in which the two Secretariats agree to cooperate on joint activities, such as capacity-building on forest biodiversity and climate change, in particular in developing countries. The Secretariats are also working together to ensure a seamless bridging of the International Year of Biodiversity to the International Year of Forests in 2011, through a joint ceremony in December 2010 in Ishikawa Prefecture, Japan, as well as through several joint activities throughout 2011. As a contribution of the CBD to the International Year of Forests, the International Day of Biodiversity on 22 May 2011 will focus on forest biodiversity.

In addition to cooperation with ITTO, IUCN and UNFF, the CBD Secretariat cooperates with other organizations of the CPF on the monitoring of forest biodiversity and the clarification of definitions of forest and forest types. In this capacity, the Secretariat contributes, for example, to the Global Forest Resources Assessments of the United Nations Food and Agriculture Organization (FAO) and the Global Forest Expert Panels led by the International Union of Forest Research Organizations (IUFRO).

Recent CBD publications on forests

Water, wetlands and forests. A review of ecological, economic and policy linkages. CBD Technical Series No. 47.

Making Protected Areas Relevant: A guide to integrating protected areas into wider landscapes, seascapes and sectoral plans and strategies. CBD Technical Series No. 44.

Forest Resilience, Biodiversity, and Climate Change. A synthesis of the biodiversity/resilience/stability relationship in forest ecosystems. CBD Technical Series No. 43.

Review of the Literature on the Links between Biodiversity and Climate Change: Impacts, Adaptation and Mitigation. CBD Technical Series No. 42.

Connecting Biodiversity and Climate Change Mitigation and Adaptation: Report of the Second Ad Hoc Technical Expert Group on Biodiversity and Climate Change. CBD Technical Series No. 41.

Cross-Sectoral Toolkit for the Conservation and Sustainable Management of Forest Biodiversity. CBD Technical Series No. 39.

Conservation and Use of Wildlife-based Resources: The bushmeat crisis. CBD Technical Series No. 33.

Biodiversity and Livelihoods: REDD benefits.

Tourism for Nature & Development: A good practice guide.

Sustainable Forest Management, Biodiversity and Livelihoods: A good practice guide.

All publications are available for download at: *http://www.cbd.int/forest.*

Copies can be ordered free of charge at secretariat@cbd.int.

Not dinner: Control of bushmeat harvesting is a key part of CBD's forest agenda. *Photo: Intu Boedhihartono*

Conclusion

In sum, the CBD's forest programme of work and the COP 10 agenda are highly relevant to the forest sector. The collaboration of forest enterprises and institutions will be critical for reaching the CBD's post-2010 biodiversity targets, in particular through strengthening sustainable forest management. The International Year of Biodiversity and the International Year of Forests in 2011 provide ample opportunities for all actors to promote the conservation and sustainable use of forest biological resources, and the fair and equitable sharing of the benefits arising out of their use.

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Forest related events in the International Year of Biodiversity

- ITTO/IUCN/CBD Conference on Transboundary Conservation and Forest Management. 14 – 17 July 2010, Quito, Ecuador.
- IUFRO World Congress. 23 – 28 August 2010, Seoul, Korea.
- United Nations General Assembly – High Level Session. 20 - 22 September 2010, New York, USA.
- 10th Conference of the Parties to the CBD. 18 – 29 October 2010, Nagoya, Japan.
- Forest Day 4. 5 December 2010, Cancun, Mexico. Collaborative Partnership on Forests (CPF) event at the 16th meeting of the Conference of the Parties to the UNFCCC.
- Closing ceremony for International Year of Biodiversity and seamless transition to the International Year of Forests 2011. 18-19 December 2010, Kanazawa, Ishikawa Prefecture, Japan.

Convention on Biological Diversity

2010 International Year of Biodiversity

Worth more standing?

The economics of biodiversity and ecosystem services in tropical forests

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Liquid gold?: Ecosystem services like water are valuable but often not adequately remunerated. *Photo: iStockphoto/MsLightBox*

Tropical forests are unique economic assets. While to some, forests are a place for recreation and spiritual quest, others simply view forests as 'free' service providers. The menu of services they offer include: improving water quality, preventing soil erosion, regulating rainfall, providing communities with food, energy and timber, and serving as a rich storehouse of biodiversity. Further, they lock up 4.8 gigatonnes of carbon per year, making them a viable solution to climate mitigation. But at the rate we chop down or burn our forests, we add up to 20% to global carbon emissions annually – an amount more than the combined emissions from cars, ships and airplanes.

Indirectly, forests provide essential supporting services, such as the maintenance of soil fertility, pollination or the maintenance of genetic diversity

Halting deforestation can only be addressed if the values of ecosystem services are fully recognized and represented in decision-making. Because many of the goods and services forests give us are considered 'free', they are unaccounted for by conventional economic accounts, such as the universally used System of Standard National Accounts (SNA). Lack of economic measures is also one of the reasons why deforestation effects remain largely hidden from policy-makers, and from the corrective power of public scrutiny. There is little, if any, recognition that forests make important contributions to long-term economic performance and to human-wellbeing.

A recent study, *The Economics and Ecosystems of Biodiversity* (TEEB), reflects the awareness that we need to bring new thinking to the table. In line with 'Beyond GDP' thinking, TEEB recommends a new and much more advanced macroeconomic compass, or a 'dashboard' of indicators which is based on inclusive wealth (or 'extended wealth') and thus involves tracking per-capita physical, natural, human, and social capital on an ongoing basis.

TEEB has studied the value of nature from the point of view of policy makers, local and regional decision makers and businesses. Using a wide range of tools and policy options, we put forward practical and workable policy prescriptions, mechanisms, and market-based instruments. These can then be used to protect nature in a way that seeks win-win solutions – for human welfare and development, as well as for ecological security. Tropical forests, as TEEB found, are one of the drivers to this change in paradigm.

Value of forest services

Forests have both direct and indirect benefits to human beings. Examples of direct benefits with associated market value include timber, fuel wood and non-timber forest products. Indirectly, forests provide essential supporting services, such as the maintenance of soil fertility, pollination or the maintenance of genetic diversity. The average value of these supporting services is estimated at US$900 per ha per annum (TEEB DO 2008).

Using different methods such as direct market pricing, travel costs and contingent valuation, we have obtained 230 values from 19 ecosystem services. The table on the next page presents an overview of the services we derive from tropical forests and their corresponding values.

We're rich!: Values of ecosystem services in tropical forests

Ecosystem service	Value of ecosystem services (US$/ha/year – 2007 values)		No. of studies
	Average	Maximum	
Provisioning services			
Food	75	552	19
Water	143	411	3
Raw materials	431	1 418	26
Genetic resources	483	1 756	4
Medicinal resources	181	562	4
Regulation services			
Influence on air quality	230	449	2
Climate regulation	1 965	3 218	10
Water flow regulation	1 360	5 235	6
Waste treatment/water purification	177	506	6
Erosion prevention	694	1 084	9
Cultural services			
Recreation and tourism opportunities	381	1 171	20
Total	**6 120**	**16 362**	**109**

Source: TEEB Climate Issues Update 2009

Forests are known as the lungs of the planet. But climate regulation, with the highest value of US$1965/ha/ year, is just one major ecosystem service. TEEB results highlight the importance of considering all services when making decisions about forests and other ecosystems. Policies should therefore not focus on a single ecosystem service, but should aim to ensure that other services and their values are considered.

An example of this is the Mayan Forest Road Project along the border of Mexico and Guatemala. Up to an estimated 311 000 hectares of jaguar habitat were found to be at risk of deforestation. But negative rates of return on investment were found when only carbon dioxide emissions (225 million tonnes over 30 years) were accounted for. A fuller evaluation including other ecosystem values would have tilted the conclusions more firmly in the direction of continued conservation rather than road development (TEEB DO 2008).

There are also cases when the local economy suffers heavy blows in the interests of short-term private gains. For instance, although one-time returns from deforestation (US$12 000/ha) may in some cases dwarf the average value of conserving forests (US$6120/ha/year), our study reveals that sustainable forestry is already more economically beneficial than unsustainable logging after two years. In fact, much of the lost ecosystem services are of greater benefit to communities than private gains.

One example is the case of Leuser National Park in Indonesia. A valuation study estimated that conservation and selective use of the forest would provide the highest return for the region over the long term (US$9.1-9.5 billion, using a 4% discount rate). Meanwhile, continued deforestation would cause the degradation of ecosystem services and generate a lower overall economic return for the province (US$7 billion; TEEB D1 2009).

The monetary difference between the deforestation and conservation options amounted to US$2.5 billion over a period of 30 years. Most of this would have to be borne by local communities who would benefit from forest conservation (mainly through water supply, non-timber forest products, flood prevention, tourism and agricultural production). This valuation exercise clearly demonstrated that logging the tropical forest not only worked against overall economic growth and development but also produced a negative impact on hundreds of rural forest dwelling communities compared to the limited private gain by a few logging companies (TEEB D1 2009).

Saying yes to PES

Investments and incentives are crucial in reversing current deforestation trends. According to Eliasch (2008), if we spend around US$17-$33 billion per year to 2030 to halt deforestation, we could generate long-term net benefits of about US$3.7 trillion, in present value terms.

Even the investment in degraded areas is economically compelling. Restoration of degraded areas helps regain productive potential as examples have shown: Eucalyptus plantation re-vegetation in Australia costs about US$1200/ha but yields benefits in increased land productivity worth US$33 000/ha (Dorrough and Moxham 2005). Also, planting mangroves along the coastline in Vietnam cost US$1.1 million but saved US$7.3 million annually in dyke maintenance (Tallis *et al.* 2008).

Likewise, corporations are increasingly seeing value in biodiversity preservation and recognizing the interconnectivity with long-term business durability. For instance, insurance firms and shipping companies have financed the reforestation of the Panama Canal region to restore freshwater flow to its locks and thus prevent the rise of shipping premiums caused by the risk of Canal closures.

There is also a high level of interest in tools that help capture the public goods value of natural ecosystems by implementing payments for ecosystem services (PES, see chart next page). PES seeks to ensure that the people who benefit from a particular ecosystem service compensate those who provide the service, giving the latter group an incentive to continue doing so.

Costa Rica remains a poster child for PES, where it is virtually a country-wide strategy for forest and biodiversity conservation as well as sustainable development. Set up in 1997, the national program remunerates landholders for providing carbon sequestration and hydrological (watershed protection) services as well as for preserving biodiversity and landscape beauty. From 1997-2004, Costa Rica invested some US$200 million, protecting over 460 000 hectares of forests and forest plantations and providing additional income to over 8000 forest owners. By 2005, the program covered 10% of national forest areas. US$64/ha/year was paid for forest conservation in 2006 and US$816/ha over ten years for forest plantations (TEEB D1 2009).

The program is based on partnerships at national and international level, contributing to long-term financial sustainability. National fossil fuel tax (US$10 million/year) is

the primary source of revenue, along with grants from the World Bank, Global Environment Facility and the German aid agency (Kreditanstalt für Wiederaufbau (KFW)). Funds are also provided through individual voluntary agreements with water users (US$0.5 million/year) which will increase with the gradual introduction of a new water tariff and potential new opportunities from carbon finance (TEEB D1 2009).

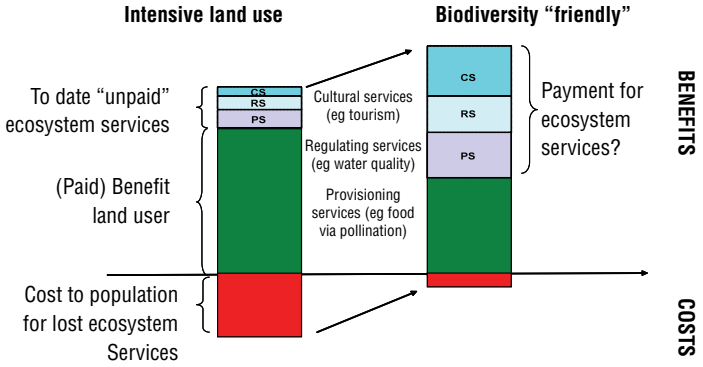
Costa Rica's program was successful overall in slowing deforestation, adding monetary value to forests and biodiversity and enhancing understanding of the economic and social contribution of natural ecosystems. However, recent assessments suggest that many areas covered through the program would have been conserved even without payments, for three main reasons: deforestation pressures were already much reduced by the time the program was introduced; the use of uniform payments (fixed prices); and limited spatial targeting of payments in the early stages of implementation. The program is being adjusted in response to these lessons (TEEB D1 2009).

Recommended actions

In the 'Cost of Policy Inaction' study during the first phase of TEEB, we estimated a value of US$3.4 trillion for the total benefit flows from tropical forests (Braat and ten Brink cited in TEEB D0 2008). Providing investments and incentives are necessary steps in ending forest degradation, but it should not stop there. Strict regulations and fiscal measures need to be put in place, making the economic cost of forest degradation visible to and felt by those incurring these costs. The TEEB reports aim to develop guidance for decision makers at international, regional and local levels in order to foster sustainable development and better conservation of ecosystems and biodiversity. This guidance includes a detailed consideration of subsidies and incentives, environmental liability, national income accounting, cost-benefit analysis, and methods for implementing instruments such as PES.

The guiding principles and operating framework for forest carbon, compatible with a wider framework of incentives for forest ecosystem services, will have significant influence on the development of other environmental markets – for freshwater enhancement, soil conservation, biodiversity conservation, etc. These also have to include a range of ecological, socio-economic and biodiversity criteria that more fully reflect the true economic value and development role of forests.

A higher bar: PES to encourage biodiversity friendly land use (higher ecosystem service provision)



Source: Bassi S. and ten Brink P., IEEP, adapted from S. Bassi *et al., Agriculture and Environment: Payments for Environmental Services (PES)*, presentation at the conference *Common Agriculture Policy and its Impacts* in Malta, 7-9 November 2008

Ultimately, such criteria could form the basis of entirely new classes of forest ecosystem services (e.g. freshwater quality) that can be 'sold' alongside or separately from carbon credits, generating yet more revenue for forest conservation and sustainable rural livelihoods.

Protecting forests from deforestation, conserving them against degradation and going even further by restoring them generates substantial co-benefits in the form of public goods and services which need to be treated explicitly rather than being treated as externalities in decision making.

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Sustaining the potential

Applying the ITTO-IUCN Guidelines for the Conservation of Biodiversity in Tropical Production Forests

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Fertile ground: Production forests offer significant potential for the sustainable use and conservation of biodiversity. *Photo: CIB*

ITTO has an important role in negotiating 'normative' guidelines that establish best practice in different domains of forestry. In 1993, a set of *Guidelines for the Conservation of Biodiversity in Tropical Production Forests* was published. These were informally reviewed by ITTO and its partner the International Union for Conservation of Nature – IUCN – in 2004 and it was decided that although the Guidelines were technically correct they did not address a lot of the policy issues that were fundamental to achieving better conservation outcomes – in addition they were not being widely applied. ITTO and IUCN therefore decided to embark upon a more inclusive process of developing a new set of Guidelines. Workshops were convened with representatives of major international organizations concerned with forest conservation, international conservation NGOs, research scientists working on forest biodiversity and forest managers from the private sector.

A first draft of the Guidelines was developed at a workshop in Switzerland in 2005. The Guidelines were subsequently subject to field testing in forest harvesting operations in Indonesia, Cameroon and Brazil. An expert panel was then convened in Thailand in 2007 and the Guidelines were prepared for submission to the ITTC later that year. Members of the ITTC were then given the opportunity to examine the text and propose modifications and the Guidelines were finally approved by the Council at the end of 2008. They were launched at the FAO Committee on Forestry (COFO) meeting in April 2009 in Rome.

Progress in implementation

A year has now elapsed since the ITTO/IUCN *Guidelines for the Conservation of Biodiversity in Tropical Production Forests* were distributed to timber producers, governments and conservation NGOs in the ITTO producer member countries. The Guidelines argue powerfully that small changes to management of production forests could provide a very cost-effective way of meeting biodiversity conservation goals. The message was picked up in the CBD Programme of Work on Forest Biodiversity as a priority. So now it is time to take a look at what has already been achieved and what additional measures are needed to ensure the wider application of the Guidelines.

An initial examination of the evidence is encouraging. Although we do not have examples of companies who have followed the Guidelines to the letter there are many examples of their having influenced national policies and industrial practices. The economic downturn in 2008 made things difficult for industries working in remote areas and may have made some companies reluctant to take on new measures. However several of the companies who collaborated in the development and field testing of the Guidelines have now moved on towards certification and the Guidelines have helped in this.

Many timber companies in South-east Asia and the Congo Basin are now certified and this suggests that they have met high standards for conserving biodiversity in their operations. While there is no current evidence that certification companies make use of the Guidelines, we would hope that certifiers might use them to inform their assessment of logging operations. In general certifiers are more knowledgeable about silviculture, logging roads, labour issues etc than they are about biodiversity. Most certifiers seem to have taken the position that if good old-fashioned forest management is applied then biodiversity will be able to fend for itself. Perhaps more needs to be done to encourage the certifying bodies to make their staff familiar with the Guidelines and use them in their field assessments.

NGOs lagging

Much of the movement for certification has been driven by pressure from conservation NGOs. They might have been expected to use the Guidelines to inform their efforts. However there is again not much evidence of this. The biodiversity focus of the activist NGOs during the past few years has concentrated on only two issues. First illegal hunting of bushmeat, and second the existence of High Conservation Value – HCV - areas within land destined for forestry. The bushmeat and HCV issues are fully addressed in the Guidelines and are ranked as of high importance in them. However they are only two amongst numerous issues that foresters should be aware of. The Guidelines emphasise the reality that what you do for biodiversity in a given forest will depend very much upon local circumstances. An overall assessment of the situation is needed first before deciding which measures will produce the biggest bang for the buck in any given situation. It is disappointing that few of the activist NGOs or the certifiers have the technical competence to make such judgements. The information required is in the Guidelines but it is not, in general, being exploited. So more needs to be done to make sure that activist NGOs are familiar with the Guidelines and support their application.

Perhaps ITTO and IUCN were not sufficiently pro-active in disseminating the Guidelines. Seminars with forest companies and government officials were held and events organized at international conferences of the Convention on Biological Diversity (CBD), the United Nations Food and Agriculture Organization (FAO), the International Union of Forest Research Organizations (IUFRO) and at IUCN's own World Conservation Congress - but that was clearly not enough. We did not really look at what sorts of pressures and incentives cause forest companies to change their practices. It now appears that we should have targeted certification companies and NGOs and provided them with practical training in the field to ensure that they fully understood the Guidelines and could draw upon them in their day to day activities. Maybe by doing this we could have made allies of these important drivers of change in forestry and we might have equipped them to be able to make better technical judgements on biodiversity issues.

Notwithstanding this there is still plenty of good news. There are examples emerging where at least some elements of the Guidelines have clearly had an impact on forestry operations in the field. New forest management regulations that have emerged in Brazil in the recent past picked up on some of the best practice suggestions in the Guidelines. A major plantation company in Sumatra has used the Guidelines in setting its strategy for situating its plantations in the landscape. WWF has been working with concessionaires in south-east Cameroon and using the Guidelines to help them address biodiversity issues in planning their operations. ITTO is seeking funding to allow more targeted activities like these to implement the Guidelines.

REDD ready

The Guidelines emphasized the logic that if a commercial forest company was going to incur costs to favour biodiversity – a public good – then those costs ought to be met by the people who benefit from that biodiversity – the global public. The argument ran that if society wants to conserve biodiversity in production forests then it should make payments for this environmental service to the company. This has never yet happened but there is now some hope. Vast sums are being made available for REDD+ and most concepts of REDD+ require that the forests are maintained or managed not just for carbon sequestration and storage but also for their other environmental values – notably biodiversity. The difficulty has always been to know how to measure those biodiversity benefits. The ITTO/IUCN Guidelines provide exactly the information that is required if REDD+ is to pay for the conservation of broader forest values. So perhaps here again lies a neglected audience for the Guidelines. Should IUCN and ITTO be promoting the Guidelines amongst those who are planning REDD+ investments? Should it be obligatory that those receiving REDD+ payments for conserving or managing forests agree to apply the Guidelines or at least an agreed subset of them?

It is increasingly recognised that well managed forests provide an excellent compromise between the need to create jobs and drive economies and the need to conserve environmental services. The fact that the '+' was added to REDD is evidence of this. The biggest challenge facing tropical developing countries is to maintain their forests for their global values whilst allowing their use for local development. All of the ITTO Guidelines are excellent sources of information on how this can be achieved and the Biodiversity Guidelines are especially pertinent. 2010 is the International Year of Biodiversity and 2011 is going to be the International Year of Forests. Forest biodiversity and sustainable forest management will be on the agenda of the Conference of the Parties of the Convention on Biological Diversity in Nagoya, Japan in October. This provides an excellent opportunity to further push the case for managed forests providing a real resource for biodiversity conservation and for these forests to be seen as a major part of the solution to the biodiversity crisis and not as one of its causes. ITTO and IUCN members need to mobilise resources to ensure that more efforts are made to disseminate the messages in the Guidelines to all parties who make decisions on how and when forests are managed for timber.

Tools and measures for ensuring REDD+ provides biodiversity benefits

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Carbon and biodiversity: REDD+ can support all forest values if well designed. *Photo: T.Bruder/ITTO*

Although the overall goal of REDD+ is to reduce greenhouse gas emissions from deforestation and degradation and to increase carbon sequestration in forests, the way in which REDD+ is designed and implemented will have a significant, and possibly unparalleled, impact on the conservation of biodiversity. If a REDD+ mechanism is approved and successfully applied, it is expected to lead to significant reductions in tropical forest loss and degradation, provide unprecedented revenues to developing countries to retain their forests and manage them more sustainably (on the order of US$15 to 30 billion annually), and, more generally, lead to improved land tenure and governance of tropical forests, all of which will largely be beneficial for biodiversity conservation (Harvey *et al.*, 2010).

However, there are also some potential risks for biodiversity from REDD+ (e.g., Putz and Redford, 2009). For example, if only a subset of countries choose to participate in REDD+, there may be leakage (displacement of deforestation) to other forested countries that have high biodiversity. And even within countries that participate in REDD+, there may be a shift from deforestation in forests with high carbon densities to forests with lower carbon densities, or a shift in agricultural expansion away from forested areas to other sensitive ecosystems (such as savannahs or wetlands) with negative consequences for the biodiversity of these systems. Moreover, forest carbon stock enhancement may be carried out in ways that have harmful effects on biodiversity. The overall impact of REDD+ on biodiversity will therefore depend closely on both how the global REDD+ mechanism is designed, as well as how individual countries implement REDD+ on the ground.

This article provides a short overview of the key design and implementation issues that will determine the impact of REDD+ on biodiversity conservation, and highlights the measures and tools that policy makers and forest managers can use to achieve biodiversity conservation through REDD+.

REDD+ design and biodiversity conservation

The design of the REDD+ mechanism by the UNFCCC[1] will shape both the opportunities and risks for biodiversity. In particular, decisions about the scope of eligible activities will determine which countries participate in REDD+, how much they reduce their emissions, and how much (and where) forest is conserved. The current draft negotiating text proposes that the following range of activities be eligible under a REDD+ scheme: reducing emissions from deforestation, reducing emissions from forest degradation, conservation of forest carbon stocks, sustainable management of forests; and enhancement of forest carbon stocks (UNFCCC, 2010). However, at present, there is not yet a common understanding of what these different activities entail, nor is it clear how they will be incentivized under the REDD+ mechanism. The incentive structure for each of these activities will depend, in turn, on issues such as the reference levels that are used, the scale at which REDD+ is implemented, and the origin and volume of the finance that is available (see Harvey *et al.*, 2010 for more details). The resolution of these design issues will have important consequences for biodiversity conservation, as they determine how much (and which) tropical forests are conserved or sustainably managed.

1 *United Nations Framework Convention on Climate Change (UNFCCC)*

In addition, the direction of the on-going negotiations suggests that the REDD+ mechanism will likely include 'safeguards' on a number of social and environmental issues, including biodiversity. The current draft of the negotiating text states that REDD+ activities should be "consistent with the conservation of natural forests and biological diversity, ensuring that actions... are not used for the conversion of natural forests, but are instead used to incentivize the protection and conservation of natural forests and their ecosystem services, and to enhance other social and environmental benefits" (UNFCCC, 2010). However, there is some debate as to whether or not the safeguards should be voluntary or legally binding, and whether there should be monitoring, reporting and verification on these safeguards. But even if the UNFCCC does not make these safeguards legally binding, there may still be scope for individual countries or REDD+ funding agencies to make these safeguards mandatory in particular instances. If such safeguards are endorsed and monitored, this would be an important step for biodiversity conservation.

In order to identify how different REDD+ designs may influence tropical forest cover and associated biodiversity benefits, a number of authors have developed models that identify which countries- and which forest areas- are most likely to be conserved under different REDD+ designs. For example, the OSIRIS (Open Source Impacts of REDD+ Incentives Spreadsheet model; Busch *et al.*, 2010) allows users to explore the impacts of four different designs for REDD+ on national deforestation rates in 86 tropical countries, as well as the impacts of different levels of REDD+ finance. Other authors have examined the spatial congruence of carbon and biodiversity (e.g., Kapos *et al.* 2008), or carbon income potential from REDD+ and biodiversity (Eberling and Yasue 2008), drawing attention to both the potential synergies and tradeoffs between REDD+ and biodiversity conservation. From a biodiversity conservation perspective, these analyses point to the importance of ensuring that a global REDD+ mechanism be designed to include as much tropical forest as possible, prevent the international displacement of deforestation, reduce deforestation and degradation rates as quickly as possible, and ensure that REDD+ finance is sufficient and sustainable, so that the reductions in deforestation and degradation rates can be sustained over time.

REDD+ implementation and biodiversity conservation

Although the global REDD+ mechanism provides the framework of how greenhouse gas emission reductions and removals will be credited and compensated and thereby establishes the potential for conservation benefits, it is the implementation of REDD+ on the ground which will ultimately determine its net impact on biodiversity. Individual countries will decide which forest mitigation activities to pursue (e.g., forest conservation, sustainable management of forests, carbon stock enhancement), as well as where, and how quickly, to apply these strategies (see Harvey *et al.* 2010 for more details). These decisions, in turn, will affect the quantity, quality and distribution of forest habitat available for wildlife.

In general, policy makers and forest managers can help ensure REDD+ implementation contributes to biodiversity conservation in a variety of ways. These include (but are not limited to) spatially targeting REDD+ to forests of greatest biodiversity value, prioritizing the reduction of deforestation and forest conservation over the reduction of forest degradation and forest carbon stock enhancement (as the former will have greater immediate conservation benefits), establishing new protected areas where appropriate, replacing conventional logging with reduced impact logging or forest conservation, requiring environmental and social impact assessments (EAIA's) for REDD+ programs and/or establishing environmental safeguards.

Ensuring REDD+'s contribution

There are a range of tools that can be used, often in combination, to assist countries and forest managers to increase the opportunities for biodiversity conservation through the implementation of REDD+, and to decrease the risks. These tools include spatial analyses, scenario development (including assessments of economic costs and benefits), guidelines and standards, and monitoring.

Spatial analyses can show the relationship between carbon stored in forests and areas of importance for biodiversity. They can therefore be useful in identifying areas where it is possible to take action that will contribute to both climate change mitigation and to maintaining biodiversity, as well as pinpointing potential trade-offs. Global maps of carbon stocks are already available (e.g., Scharlemann *et al.*, 2009), however the value of these maps would be enhanced if they would also identify where that carbon is most threatened (e.g., due to agriculture, logging, fires or other threats) and where there is potential for increasing carbon stocks through restoration, reforestation or sustainable management. The different measures of biodiversity include global datasets such as Important Bird Areas (http://www.audubon.org/bird/iba/), Key Biodiversity Areas (Eken *et al.*, 2004), and Alliance for Zero Extinction sites (www.zeroextinction.org), as well as regional and national datasets of biodiversity priority areas, which exist for some countries and some taxonomic groups. UNEP-WCMC has already undertaken work that utilizes these different datasets at global, regional, national and sub-national level (e.g., Kapos *et al.*, 2008, Miles *et al.*, 2009b), providing valuable examples of how to use spatial analysis to incorporate biodiversity considerations into REDD+ planning. In addition, individual countries are now starting to incorporate spatially-explicit information on biodiversity into the development of national-level strategies to reduce deforestation and degradation and the prioritization of sites for conservation efforts (e.g., the Socio Bosque program of Ecuador; http://www.ambiente.gob.ec/ paginas_espanol/sitio/sociobosque.html).

As countries face choices about which policy options to adopt, spatially explicit scenarios that estimate the outcomes of different policy choices and development paths can also be a useful tool in planning the implementation of REDD+. For example, the 'Valuing the Arc' project in Tanzania is mapping the spatial distribution of carbon storage, water regulation and endemic species (among other aspects), and exploring the consequences of alternative development trajectories on ecosystem services (www.valuingthearc.org). The challenge posed by the use of such models and scenarios is that they rest

on necessarily untestable assumptions about what will happen and are often very data-hungry when the relevant data may not be available. In addition, these models also require information about the costs and benefits of different land uses and land management options (including the opportunity costs of maintaining forests), which is often difficult to obtain but critical for management decisions.

A different type of tool is provided by the REDD+ Social and Environmental Standards that are being developed by the Climate, Community and Biodiversity Alliance (CCBA) and Care International (CCBA and CARE, 2010). These standards consist of a set of principles, criteria and indicators, which provide generic guidance to countries as they develop and implement their national or state-level REDD+ strategies to ensure that a range of social and environmental issues are taken into account. They also suggest a process for monitoring, reporting and verification on social and environmental aspects of government-led REDD+ programs. These standards are currently being tested by several countries (Nepal, Ecuador, Tanzania) and the State of Acre (Brazil) to determine their ease of use, feasibility, cost, and overall performance, and it is likely that additional countries will join these efforts over the next year. If these standards prove to be effective and are broadly adopted across REDD+ countries, they could play a significant role in shaping the social and environmental impacts of REDD+.

Finally, monitoring the impacts of REDD+ implementation on biodiversity will be essential to determine if the outcomes have been positive and to allow for any necessary adjustments to ensure biodiversity benefits. Standard methodologies and approaches for monitoring certain aspects of biodiversity already exist (e.g., for species richness and rarity) and guidance is available from the Convention on Biological Diversity (www.cbd.org) and other organizations. There is also on-going work to develop a framework for evaluating and monitoring biodiversity for the CBD 2010 target and beyond (www.twentyten.net). Coordinating such initiatives and potentially adapting some of the existing methodologies for REDD+ could enable their use in the monitoring, reporting and verification (MRV) of REDD+. A key challenge, however, will be to ensure that adequate, and sustained, finance is available to establish a biodiversity baseline and cover the costs of monitoring biodiversity over the long-term in countries where REDD+ is implemented.

Conclusions

REDD+ has the potential to transform the future of tropical forest conservation and to deliver significant benefits to biodiversity conservation. However, the extent to which these benefits are delivered will depend on how the international REDD+ mechanism is designed and implemented. Fortunately, there are a growing number of analyses and tools that can be used by policy makers and forest managers to explore the impacts of different REDD+ designs on biodiversity conservation, as well as to help incorporate biodiversity considerations into the implementation of REDD+ activities on the ground. As countries prepare to implement REDD+, it will be critical that they make full use of these existing tools and models to increase the opportunities for biodiversity conservation, decrease any risks, and strategically target the implementation of REDD+ towards areas which provide both the highest climate mitigation and highest biodiversity benefits.

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The relevance of resilience

A forest manager's primer on linkages between biodiversity and forest resilience

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Phoenix: Biodiversity underpins forest resilience. *Photo: iStockphoto/vicm*

Biodiversity underpins most forest ecosystem goods and services and many tropical forests maintain high levels of biodiversity. Loss of biodiversity has considerable consequences for the productive capacity of the forest resource. Maintaining these goods and services and the biodiversity is a cornerstone of sustainable forest management.

Forests have many unique properties, related to their high rates of primary productivity and biodiversity, which distinguish them ecologically from other ecosystems. Some of these properties include biological structures that develop in vertical and horizontal layers of live and dead plants, complex processes at multiple vertical levels from within the soil layers up to the canopy, the capacity for self-renewal in the face of constant small and large disturbances, plant-animal and plant-plant interactions, and the influence forest landscapes can have on micro- and regional climates, especially in large areas of closed-canopy tropical forests. Forests are comprised of multiple ecosystems that are associated with variable edaphic and microclimate conditions across broad landscapes. To sustain the goods and services we derive from forests, forest ecosystems must recover after disturbances and not become degraded through the loss of biodiversity. In large part, this means maintaining the resilience of forests through careful management with the clear recognition that the global climate is changing.

As forests change after logging, insect attack, or under global warming, managers need to be concerned with bringing the forest back to a condition that will supply the goods and services that were desired from that forest.

Resilience and forests

Resilience is a quality that is commonly associated with people, companies, sports teams, and also forests. In all cases, being resilient has to do with an inherent capacity to recover from adversity. In forests, resilience is the capacity to recover from severe disturbance, such as fire or logging, to the original state. Forests are generally resistant to change, that is, they change little within bounds as a result of non-catastrophic disturbances such as insect herbivory or minor blowdown. Canopy gaps created by the death of individual or small groups of trees are quickly filled by new young trees. Forests may also be resistant to certain environmental changes, such as weather patterns over time, owing to redundancy among functional species (where redundancy refers to the overlap and duplication in ecological functions performed by the diversity of species in an ecosystem, see below). Redundancy can also confer system resilience and/or resistance in response to the impact of disease and pests. Ecosystems may be highly resilient but have low resistance to a given disturbance. For example, grasslands are not resistant to fire, but they are highly resilient and recover quickly after fire. Generally, most well-developed forests, especially primary old forests, are both resilient and resistant to changes.

As forests change after logging, insect attack, or under global warming, managers need to be concerned with bringing the forest back to a condition that will supply the goods and services that were desired from that forest. There is strong evidence that forest resilience is tied to the biodiversity that normally occurs in the ecosystem. In particular, certain species perform key functions in forests and so are essential for the forest to maintain all of its processes. Pollinators, some insects, bats and birds, are excellent examples of

highly functional species in ecosystems; without them many plants could not propagate. Similarly, bird predation can maintain insects at low abundances, reducing insect herbivory and hence increasing tree productivity. Forest resilience depends, in large part, on these key species and functions being maintained especially after forest management.

In the absence of biodiversity there would be no ecosystems and no functioning. There is evidence that complex forest ecosystems are more productive than less diverse ones (under the same conditions), and more productive ecosystems are more resilient than less productive ones. Forests comprised of few species supply few goods and services and are highly prone to various catastrophes including disease and invasion. Resilience in forest ecosystems comes from several different kinds of biodiversity in forests. First, the genetic make-up of species enables a range of tolerance to climate, moisture, and soil conditions. So, for example, the same species of tree growing under different site conditions may differ slightly in their DNA, as a long-term response to their environment. Similarly, species may differ in their relative abundances in the same kind of ecosystem depending on local conditions. For example, conditions might change sufficiently to favor one functional species over another such that, under those different conditions, the function of the system would not be lost but the species performing the primary functional roles might have changed. Finally, across large landscapes, certain species might replace others entirely in a forest system owing to different conditions. This 'landscape level' of resilience is common to many forest types, especially among animal species. So, forest resilience is a consequence of multiple aspects of biodiversity, and an emergent property of the ecosystem.

Climate change impacts

Superimposed on the many other human impacts on forest ecosystems noted above is global climate change. Most evidence suggests that tropical forests may not be resilient to climate change over the long term, primarily owing to a predicted reduction in rainfall and increased drought. Climate has a major influence on rate of production, respiration, and other forest processes, acting through temperature, radiation, and moisture regimes over medium and long time periods. Climate and weather conditions also directly influence shorter-term processes in forests, such as frequency of storms and wildfires, herbivory, and species migration. As the global climate changes, forest ecosystems will change because species' physiological tolerances may be exceeded and the rates of biophysical forest processes will be altered. If climate change results in a significant reduction in water availability, then the forest ecosystem will naturally change species composition and hence, the state (the recognizable condition) of the ecosystem will be different. For example, conditions may reach a threshold beyond which the vegetation structure is not sufficiently tall and dense to comprise a closed-canopy forest, and there will be changes in the dominant composition of the plant community. Under severe drying conditions, forests may be replaced by savannahs or grasslands (or even desert).

The synergistic effects of biodiversity on primary productivity are also most evident in primary tropical forests with respect to nutrient cycling. Many tropical forests naturally form on nutrient-poor substrates but these ecosystems have developed through natural selection such that they can harvest from rainwater the nutrients lacking in the soils. Furthermore, through retention and recycling they build up the stock of nutrients needed to support the high levels of plant growth enabled by moist tropical climates. Plants have special adaptations that serve to conserve nutrients and a myriad of other fungal, bacterial and animal species aid in their efficient and rapid recycling. Overall, biodiversity-related processes serve to increase the productivity and resilience of carbon dynamics in tropical forests.

Ecosystems and forests are comprised of assemblages of species. Across regions, individual species' ranges reflect their physiological and ecological niches, with the latter reflecting where the conditions are advantageous. Species with broad physiological niche requirements may be highly resilient to even significant global climate change. Likewise, species with narrow ecological niches might be more resilient than they appear, if changed conditions provide them with an advantage at the expense of competitors. In either situation, this capacity only applies to species which have large enough gene pools and/or the ability to migrate but for many species this is not the case. Where population sizes and genetic diversity have been reduced, or the mobility of species is restricted through habitat fragmentation or by natural lack of species mobility, the likelihood of successful adaptation to environmental change, such as climate change, is diminished. In some cases, populations exposed to a rate of environmental change exceeding the rate at which populations can adapt, or disperse, may be doomed to extinction. In the biological realm, maintaining species and genetic diversity addresses the need to be prepared for whatever environmental changes might happen, and this is fundamental to the concept of resilience.

Forests can also influence regional climates, depending on their extent and this is particularly true of the Amazon forest because of its huge area. As the climate changes, numerous feedbacks will occur between climate and forests, mediated through albedo, carbon cycle dynamics, energy fluxes, and herbivory. Hence, maintaining forest resilience can be an important mechanism to mitigate and adapt to climate change.

Managing for forest resilience

A large part of a forest manager's job is helping a forest recover after timber harvesting, through sustaining the properties of the ecosystem over the long term. However, this job is now more complicated by the additional stress of climate change. Maintaining biodiversity is a key to maintaining forest resilience. The biodiversity in a forest is linked to and underpins the ecosystem's productivity, resilience, and stability over time and space. Biodiversity increases the long-term resilience and resistance of forest ecosystem states, increases their primary production, and enhances ecosystem stability at all scales. Forests have a capacity to resist environmental change owing to their multiple species and complex multiple processes. However, a reduction in biodiversity in forest systems has clear implications for the functioning of the system and the amounts of goods and services that these systems are able to produce. While it is relatively simple to plant trees and produce a short-term wood crop, the lack of diversity at all levels (i.e., gene, species of flora and fauna, and landscape) in these systems reduces resilience and resistance to disturbances, degrades the provision of goods and services that the system can provide, and renders it vulnerable to catastrophic disturbance.

The application of ecological sustainability principles in forest management will provide part of a long-term approach to mitigating and adapting to climate change. While proper sustainable forest management is a major part of maintaining forest resilience, response to climate change requires some extra planning and actions. The capacity to conserve, sustainably use, and restore forests rests on our understanding and interpretation of pattern and process at several scales, the recognition of thresholds, and the ability to translate knowledge into appropriate management actions in an adaptive manner. Part of the adaptation component is to develop an understanding, based on predictions and observations, of what the plausible future scenarios may be. The following suggestions are developed from ecological principles that can be employed to maintain and enhance long-term forest resilience, especially under climate change:

1. Plan ahead to maintain biodiversity at all forest scales (stand, landscape, bio-regional) and of all elements (genetic, species, community) based on expected future climate conditions.
2. Maintain genetic diversity in forests through management practices that do not select only certain trees for harvesting based on site type, and their growth rate or form.
3. Maintain stand and landscape structural complexity using natural forests as models and benchmarks. Managers should try to emulate the natural stands, in terms of species composition and structure, by using silvicultural methods that relate to the major functional tree species.
4. Maintain connectivity across forest landscapes by reducing fragmentation, recovering lost habitats (forest types), and expanding protected area networks.
5. Maintain functional diversity (and species redundancy) and eliminate conversion of diverse natural forests to monotypic or reduced species plantations.
6. Reduce non-natural competition by controlling invasive species and reduce reliance on non-native tree crop species for plantation, afforestation, or reforestation projects.
7. Reduce the possibility of negative outcomes by apportioning some areas of assisted regeneration with trees from regional provenances and from climates of the same region that approximate expected conditions in the future. For example, compile a list of tree species that may be more drought-resistant than local species, and that provide similar wood value, and supplement re-planting using some of these.
8. Protect isolated or disjunct populations of organisms (populations at margins of their distributions) as source habitats. These populations represent pre-adapted gene pools for responding to climate change and could form core populations as conditions change.
9. Ensure that there are national and regional networks of scientifically designed, comprehensive, adequate, and representative protected areas. Build these networks into national and even regional planning for large-scale landscape connectivity.
10. Develop an effectiveness monitoring plan that monitors climate conditions and results of post-harvest silvicultural actions, and adapt planning and implementation as necessary.

A key aspect of any plan to maintain a flow of forest goods and services is a good understanding of local forest ecology on which to base sustainable forest planning and management.

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Ending empty forests

Management and sustainable use of wildlife in tropical production forests

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Keystone cat: The loss or depletion of top predators in forest ecosystems can trigger ecosystem collapse. *Photo: Fotonatura*

Unsustainable levels of hunting for consumption or trade are often associated with extractive industries (logging, mining) in the tropics. These industries facilitate access to remote forests by opening roads in previously inaccessible areas, thus providing access to markets and transforming hunting from a largely subsistence activity into a commercial one (Thibault and Blaney 2003, Poulsen *et al.* 2009). Increased human densities are linked to company infrastructure and camps, as they offer better facilities than existing urban centers (Nasi *et al.*, 2008) and attract people (workers, family members and traders) into areas that were formerly sparsely populated. As much as 29% of currently forested areas in Central Africa are likely to have increased wildlife harvesting pressures due to the access and market opportunities provided by new logging towns (Laporte *et al.* 2007).

The depletion of wildlife (defaunation) linked to over-harvesting threatens the food security and livelihoods of many forest-based communities and impacts important fauna-dependant ecological processes. It thus has the potential to negatively impact forest ecosystems more broadly than the mere removal of fauna, by creating 'empty forests' (Redford 1992). Although only ecological aspects will be considered here, livelihood issues are as, if not more, important to consider, as harvested wildlife populations are reduced to densities whereby they cease to ensure sustained livelihoods for dependent populations.

How is forest resilience impacted by defaunation?

Although every organism contributes to ecosystem processes, the nature and magnitude of individual species' contribution vary considerably. Most ecosystem processes are driven by the combined activities of many species. Plant regeneration (loss of pollinators, seed dispersers and seed predators), food webs (loss of top predators or of their prey), and plant diversity (change in herbivory patterns, increased pests) are amongst the various processes dependent upon the presence of fauna. Therefore activities such as hunting have the potential to impact not only targeted species but the ecosystem more broadly. Species performing similar roles in ecosystem processes and having similar trophic status or life-history constitute what have been termed functional groups. Species within these groups, such as grazing mammals, large predators, perennial grasses, or nitrogen-fixing microbes, are functionally similar despite their uniqueness in genes, life history, and other traits. It is therefore often difficult to determine the relative contribution of a given species to ecosystem processes as several species may contribute in similar ways. Some of these predicted changes have been empirically demonstrated while others have yet to be demonstrated or have so far proved to be inexact.[1]

'Keystone species', 'ecosystem engineers', or organisms with high 'community importance value' are species or groups whose loss is expected to have a disproportionate impact on the ecosystem when compared to the loss of other species. As hunters prefer large animals (given a choice) and as these large animals are often keystone species, the local extinction of these animals results in dramatic changes to ecosystems.

1 *The interested reader can refer to Bennett and Robinson (2000), Wright (2003), Stoner et al. (2007a), Wright et al. (2007b), Şekercioğlu et al. (2004) for reviews and discussion on ecological impacts of defaunation in general and to Galletti et al. (2006), Forget and Janzen (2007), Nuñez-Iturri and Howe (2007), Stoner et al. (2007b), Wright et al. (2007a), Terborgh et al. (2008) or Vanthomme et al. (2010) for specific empirical examples of ecosystem processes modified due to changes in faunal composition.*

Top predators (e.g. large cats, raptors, crocodiles) impact biodiversity by facilitating resources that would otherwise be scarcely available to other species (e.g. carrion, safe breeding sites) or by initiating a trophic cascade[2] (see Sergio *et al.* 2008 for a comprehensive discussion). Local extinction of these predators can trigger large changes in prey populations, which in turn dramatically alters browsing or grazing to the point where large regime shifts or ecosystem collapse happen (e.g. Johnson *et al.* 2006). Elephants and other mega-herbivores can play a tremendous role in modifying vegetation structure and composition through their feeding habits (differential herbivory, seed dispersal) and movements in the forest (killing a large number of small trees). Their impact on vegetation has in some cases appeared to be positive (Goheen *et al.* 2004), in others negative (Guldemond and Van Aarte 2008), but they do have a strong impact on vegetation dynamics. Two similar forests will undergo different succession and regeneration patterns based on the presence or absence of elephants, as shown by long term studies in Budongo (no elephants) and Rabongo (large elephant population) forests in Uganda (Sheil and Salim 2004). Ungulates such as wild pigs (*Sus* spp., *Potamochoerus* spp., *Tayassus* spp., etc.), tapirs and antelopes are among the most active seed dispersers or predators. A significant change in their population densities will have a major effect on seedling survival and forest regeneration (e.g. see Beck 2006 or Peres and Palacios 2007).

Human extractive activities in tropical forests (including but not restricted to hunting) are therefore disruptive processes and can trigger numerous, yet not completely understood, mechanisms (compensatory or predation rate changes) or effects (trophic cascade or keystone effects), which will in turn alter, in a more or less significant way, the overall function, structure and composition of the ecosystem. As forest resilience is dependent upon all these processes and functions (see Thompson, p. 16, and Thompson *et al.* 2009 for a review), it is very likely to be impacted by the loss of biodiversity linked to the direct and indirect impacts of defaunation.

Sustainable use of wildlife in production forests

Although the negative impacts of timber or other natural resource extraction on forest biodiversity are well-documented, the role of well-managed logging concessions as potential 'wildlife reservoirs' compared with unsustainably managed forests is also increasingly recognized (see Sayer and Boedhihartono, p.11, and Clark *et al.* 2009). Indeed, well-managed and certified production forests can be an important addition to protected areas, which are often too small, fragmented or ineffectively managed to support wide-ranging or rare species. Forest industries can promote the sustainable use of biodiversity and human livelihoods by moving toward sustainable practices that explicitly consider the direct and indirect effects of their activities on wildlife (Aviram *et al.* 2003, Bass *et al.* 2003). Extractive industries can mitigate the negative impacts of their operations on wildlife by controlling and managing bushmeat hunting in their concessions through appropriate measures (Nasi *et al.* 2008), such as guaranteeing the importation or development of affordable protein alternatives for their workers and their families, preventing the use of company vehicles for bushmeat hunting, limiting access to forest roads to company vehicles, and rendering roads that are no longer required for logging impassable for vehicles. Through local enforcement and control, companies can ensure that their workers hunt legally (with proper licenses and permits) and impose penalties or fire workers who break the law. Forest industries may also formalize hunting territories within their management plans and prioritize access to the original inhabitants of the area (Poulsen *et al.* 2009). Other suggested practices include banning commercial hunting on concession grounds, establishing conservation zones within the concession where hunting is forbidden, prohibiting unselective hunting methods such as snare hunting and trap hunting, and producing educational and information materials for both the public and staff (Meijaard *et al.* 2005). Wherever possible, local governance structures and customary sustainable use by indigenous and local communities should be strengthened, in addition to other measures to achieve sustainable wildlife management.

Maintaining/increasing the resilience of hunted forests

Hunting for food or wildlife products is one of the oldest human practices; it will not go away and repressive measures and protection alone will not suffice. Solutions lie in managing the exploitation of the resource to maintain both the conservation and economic value of forest ecosystems.

The CBD Liaison Group on Bushmeat met in October 2009 at the World Forestry Congress in Buenos Aires, and elaborated national and international recommendations for the sustainable use of bushmeat that are relevant to the sustainable use of wildlife overall (CBD 2009). They include eleven national-level and nine international-level recommendations, cutting across various themes such as climate change, health, science and alternative means of subsistence.

The recommendations highlight the need to engage the private sector and extractive industries and recognize the role that forest certification schemes designed to include wildlife management measures can play to maintain healthy and resilient forest ecosystems. Members of the International Tropical Timber Organization (ITTO) can contribute to implementation of many of the CBD Liaison Group's recommendations, as follows:

- The responsibility for wildlife management should be transferred whenever possible to local stakeholders, who have a vested interest in maintaining the resources, while the capacity of these empowered local communities should be built and strengthened to ensure that they have the capacity to exercise these rights.
- National governments should increase their capacity to monitor levels of bushmeat harvesting and consumption and incorporate this information in national statistics to inform policy decisions and planning.

2 *A trophic cascade is a series of interactions that "cascade through the community, transmitted by a chain of strongly interacting links" (Paine 1980). In its simplest form, a cascade takes place when a consumer influences at least two other trophic levels, such as when a predator limits the populations of its prey, which in turn limits the populations of its own prey(Sergio et al. 2008).*

- While an effective network of protected areas is critical to ensure the conservation of wildlife, populations outside protected areas are also essential, and management should encompass the largest possible landscape scale.
- The development of alternative food and income sources is necessary, as wildlife cannot sustainably support current or future livelihood needs, but these palliative measures alone (such as farming, ranching and captive breeding) are unlikely to be effective in conserving wildlife resources. In the long term, there is no substitute for effective management of the resource for protection and production.
- To achieve conservation and sustainable use of wildlife resources, capacity building and public awareness are needed at national and local levels, including governance and law enforcement, wildlife monitoring and management and livelihood alternatives; collaboration across government, private and public sectors is also required.
- The conservation and sustainable use of wildlife resources are enhanced through the use of the most ecologically benign (e.g. species-specific), cost-efficient, and humane hunting methods.

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Unwelcome guests

The threat of invasive species to tropical forests

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Crowding out: *Toona ciliata* invading a pine plantation in eastern Africa. *Photo: IUCN*

The movement of species from one place to another by humans is possibly as old as the history of humans, but the modern era has seen unprecedented deliberate and accidental movement of species at a scale of monumental proportions. As Harold Mooney put it "… the consequences of the biotic exchange are staggering when you tally up what the biotic world looks like now in comparison with recent past" (Mooney *et al.* 2005).

Biological invasions occur when species of animals, plants and micro-organisms are introduced into an ecosystem and they harm their new ecosystem. The term invasive species is used to distinguish them from introduced or exotic species that do no measurable harm to an ecosystem. Thus the conditions of introduction and harm to an ecosystem need to be met in order for a species to be considered invasive.

The Convention on Biological Diversity (CBD) uses the term invasive alien species to describe species whose introduction and/or spread outside their natural past or present distribution threatens biological diversity. The term 'alien' relates to the introduction of a species to an ecosystem and does not mean the species is exotic to a country or a region. Alien species may include alien genotypes such as the varieties or subspecies of the same species introduced from elsewhere. Invasiveness relates to an ecosystem not to political or administrative boundaries.

Because an invasive species occurs outside its original ecosystem it often faces less competition, fewer diseases, and lower predator pressure and other forms of 'control'. It is thus able to flourish and acquire "a competitive advantage following the disappearance of natural obstacles to its proliferation, which allows it to spread rapidly and to conquer novel areas within recipient ecosystems in which it becomes a dominant population" (Valery *et al.* 2008).

In tropical forests, invasive plants can compete with native species for space, light, nutrients and/or water. They often exhibit fast rates of growth, short times between generations, competitiveness, high production of propagules, and adaptability to differing climatic and other conditions such as soils. Invasive plants, animals and micro-organisms can be parasitic, cause mechanical damage to trees and interfere with the reproductive capacity of indigenous plants and animals. Invasive species can be plant pests or vectors of pathogens which are often responsible for tree diseases. Furthermore, invasive species can alter the functioning of forest ecosystems by, for example, altering natural fire regimes and disrupting hydrological cycles.

A quick look at the International Union for Conservation of Nature's Red List of Threatened Species (www.iucnredlist.org) shows that invasive species are one of the primary threats to biodiversity. Invasive species can impact directly on human well-being, for example on human health and by causing changes to biodiversity and consequently to the flow of ecosystem goods and services used by humans, thus affecting human infrastructure, development and livelihoods. Whilst data does not allow analysis of the threat to forest species, it is reasonable to assume that invasive species represent a substantial problem for tropical forests and, by implication, a serious threat to social and economic well being of people.

Types of forest invasion

Invasion of alien species into healthy tropical forests is not common, but there are increasing reports of invasions in secondary and disturbed forests. Our experience in Africa is that notorious invaders such as *Lantana camara* are beginning to appear even in lightly disturbed natural forests, brought in by frugivorous birds first establishing in forest

clearings and then in denser vegetation, with a tendency to become strangling climbers that ascend many meters into forest trees (see photo). Lantana can form single-species thickets and impact a wide area and range of species through the allelopathic properties of its leaves as well as the dense shade it provides.

Another invader, spreading across central, eastern and southern African forests is the Australian Black Wattle (*Acacia mearnsii*). This plant spreads easily along roads (see photo next page) and can enter relatively closed forest where it can replace native species.

There is much debate about the likelihood of increasing invasion of native forests because some believe that a multispecies forest is innately resistant to plant invasion; others disagree. However, it is clear that disturbance, including by forest roads and forest harvesting and clearing, increases the likelihood of plant invasions (see for e.g. Fine 2002; Malik and Husain 2007). Logging tracks and log loading areas enable many plant invaders to initiate entry into a forest. Poor hygiene practices including failure to properly clean and disinfect logging and road construction machinery is another major vector for invasive plants and micro-organisms.

However, not all species that are introduced will become invasive and many invasive species take a long time to become invasive, a process known as lag time or 'sleeper' invasive species. The phenomenon of sleeper invasive species occurs when plants that have been long established in an ecosystem, but have not spread widely, begin to spread. Sometimes the lag time can be many years, decades or even centuries. Examples of sleeper invasive species include toona (*Toona ciliata*) in central Africa and neem (*Azadirachta indica*) in parts of west Africa and coastal east Africa. In Australia *Mimosa pigra* (mimosa), which existed in low numbers for 70 years, has recently become a major problem in the Northern Territory (CSIRO 2010).

Sleeper invasive species are expected to become an increasing problem as a result of climate change and as more areas become degraded in one way or another and the stability or resilience of ecosystems erodes (e.g. Alston and Richardson 2006; Dukes *et al.* 2009). Indeed, global change will likely increase the rate of biological invasions across the board (Dukes and Mooney 1999). Accordingly, managers need to recognize that climate change is likely to increase the threat of invasive species to both forest production and biodiversity conservation to an enormous extent (see Mainka and Howard 2010).

In tropical forest plantations three types of forest invasion occur – one originates from within the new ecosystem itself, a second is when an invader affects the exotic species, and third is from a species of the same origin as the exotic plantation and has "caught up with it" in its new ecosystem. This applies to all manner of invasive species - plants, pests and diseases.

In the first case indigenous species can become invasive in the new ecosystem created by the plantation. This phenomenon is usually seen by managers as plantation weeds and pests, but it is a form of invasion as their persistence affects productivity. Native species of vine, climber and scrambling shrubs often take advantage of the new conditions of a plantation and cause damage – specifically because they have a new habitat.

Climber: *Lantana camara* growing 7 m up an indigenous tree near Victoria Falls, Zambia. *Photo: IUCN*

The second type of invasion occurs when an introduced species disturbs forest growth and productivity. This includes diseases and their vectors, pests such as wood borers and defoliators and competing plants. In tropical eastern Africa some pine plantations are being invaded by toona (*Toona ciliata*) that was introduced decades ago from Asia and widely planted as a shade tree in parks (see photo previous page). In addition, plantation species themselves can become invasive. According to ITTO and IUCN (2009) some tree species widely used in plantations and agroforestry schemes have the potential to become invasive, for example *Azadirachta indica, Cedrela odorata* and *Leucaena leucocephala*. Forest managers would do well to keep in mind that exotic tree species may have the capacity to become invasive and when new tree species are being considered it is possible to guard against their becoming invasive in the future with a proper risk assessment (e.g. Gordon *et al.* 2008).

The third type of invasion in plantations is when pests or disease species from the original ecosystem of the planted trees appear. These species can cause considerable damage to both plantations and surrounding natural forest and trees on farmlands. For example, *Phoracantha* species from

Invader: *Acacia mearnsii* along a forest road in eastern Africa; vehicle access roads are important pathways for the spread of alien plants. *Photo: IUCN*

Australia are serious borer pests of eucalypts in Africa. In their native Australia they are considered minor pests, but in many temperate and tropical regions they have been known to kill healthy trees (FAO 2007).

Management of forest invasions

Dealing with biological invasions should be a basic element of good forest management. However, the reality is that not all forest managers regularly ensure inspections of their estates for invading species, and even when they do the information available to identify species, the risks they pose and the options for response is often inadequate.

Early detection, identification and rapid management action to address invasive species before they become well established are the best lines of defense. There are various established means for extinguishing new invasions and information is readily available from such sources as the IUCN, Invasive Species Specialist Group Global Invasive Species Database (www.issg.org), the Global Invasive Species Programme (GISP) (www.gisp.org) and several tropical forest invasive species networks including the Asia Pacific Forest Invasive Species Network (www.apfisn.net) and the Forest Invasive Species Network for Africa (www.fao.org/forestry).

Regular monitoring of forests for new plants, animals and/or damage is essential to recognizing a biological invasion when it first appears. Established invasions are extremely difficult to manage – although a combination of mechanical, chemical and biological control approaches may work with time. The *Guiding Principles for the Prevention, Introduction and Mitigation of Impacts of Alien Species that Threaten Ecosystems, Habitats or Species* of the CBD are helpful in this respect (CBD 2002) as is other guidance from the CBD and GISP (CBD 2001; Wittenberg and Cock 2001).

The ITTO/IUCN (2009) *Guidelines for the conservation and sustainable use of biodiversity in tropical timber production forests* (see Sayer and Boedhihartono, p.11) recognize the importance of managing for invasive species including that forestry operations can encourage the introduction and spread of invasive alien species and measures should be taken to minimize this risk and to ensure that plantation forestry does not facilitate the introduction of invasive species.

At national level, any deliberate introduction of new species should be subject to a risk assessment to assess potential invasiveness of the new species to forest management and local community interests. The International Plant Protection Convention, IPPC develops regulations for prevention and management of all pests (animals, plants or pathogens) of plants.

We have the tools to recognize, prevent and manage invasive species and information and training is available. We need to ensure these measures are applied if we are to address the seriousness of threats to nature and people from biological invasions.

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Recently funded projects

The projects summarized below were financed in the third quarter of 2010. In addition to these projects, funding was also recently provided for several projects under the Community Forest Management and Enterprises (CFME), Forest Law Enforcement, Governance and Trade (TFLET), and Trade and Market Transparency (TMT) thematic programs . Details of these projects are provided following the regular project listings, with the relevant thematic program indicated in the first three letters of the project number (ie, "CFM" = CFME; "TFL" = TFLET; see www.itto.int for more details of the thematic programs). Funds were also pledged during the first half of the year for capacity building for implementing CITES for tropical timber species and for a workshop on trans-boundary conservation areas under ITTO's 2010-11 Work Program. The US$1.4 million committed for approved projects, pre-projects and activities during the period, combined with the $2.6 million in grants under the thematic programs (plus $5.2 million allocated earlier in 2010) gives a total of US$9.2 million in ITTO support pledged to member countries in the first three quarters of 2010.

Achieving sustainable management of mangrove forests in China through local capacity building and community development

Serial number:	PD 460/07 Rev.2 (F) – Phase II
Budget:	ITTO Contribution: US$155,585 Government of China: US$90,112 **Total: US$245,697**
Implementing agencies:	Beijing Forestry University in collaboration with Fujian Zhangjiakou Mangrove Nature Reserve

Summary

This project aims to contribute to the sustainable management of mangroves in China through local capacity building and community development. Its specific objectives are: i) to enhance capacity of the local forestry institutions in mangrove management; and ii) to reduce community reliance on mangrove resources as a source of income by introducing suitable income generating activities.

Capacity building for CDM-Forestry in the framework of SFM emphasizing community forests and poverty alleviation in Ghana

Serial number:	PD 450/07 Rev.2 (F,I)
Budget:	ITTO Contribution: US$402,516 Government of Ghana: US$110,039 In kind Michigan Technological University: US$94,500 SAMARTEX: US$59,200 In kind **Total: US$666,255**
Implementing agency:	Forestry Research Institute of Ghana (FORIG)

Summary

The project intends to develop the capacity for CDM-Forestry in Ghana via a community rehabilitation of Ghana's degraded forests targeted at poverty alleviation in conjunction with sustainable forest management (SFM), and by involving the private sector and native communities. The specific objective of the project is to improve capacity for CDM-Forestry in Ghana via a community forest targeted at poverty alleviation in conjunction with SFM.

Thematic programs

Strengthening capacity of stakeholders for the development of community-based plantation forest at three selected areas in Indonesia

Serial number:	CFM-PD 001/10
Budget:	ITTO Contribution: US$468,283 Government of Indonesia: US$88,560 **Total: US$556,843**
Implementing agency:	Directorate of Plantation Forest Development, Directorate General of Production Forest Development

Summary

The government of Indonesia has initiated new policies and legislation allowing local communities to be actively involved in forest management especially in the state production forest. Community-based plantation forest (CBPF, launched in 2007) is offered as a priority program in Indonesia to achieve SFM. Constraints to the development of HTR include limited managerial and technical capacity. The project will improve the knowledge and skills of CBPF owners in managing their forest. It will enhance the capacity of communities to plan, utilize, monitor, manage and market their forest resources, which is critical to reduce illegal logging and associated trade. Expected outputs of the project include: 1) Improved capacity of community groups in developing community based plantation forest (CBPF) management plan and in forest cultivation; 2) Increased number of facilitators and technical persons in the field of forestry at the district level, provincial and central to guide the community in managing their plantation forest; 3) Improved market access for forest products from CBPF and other plantation business.

Increasing access to markets and capital for teak plantation smallholders in Thailand

Serial number:	CFM-PPD 005/10
Budget:	ITTO Contribution: US$28,800 Government of Thailand: US$22,800 **Total: US$51,600**
Implementing agency:	Forest Resource Management Office 3 (Lampang), Royal Forest Department of Thailand

Summary

Smallholder tree plantations are contributing significantly to income generation in rural households. Many countries have developed policies and regulations to establish such plantations, involving in many cases various forms of government subsidy schemes. However, there are still considerable barriers in government legislation to create a supportive environment for enabling smallholder access to markets. The main objective of this pre-project is development of a full proposal to improve both the quality and quantity of the supply base for high value timber plantations, at the same time increasing income and contributing to poverty reduction through smallholder forestry in rural areas of Thailand.

Enabling customary landowners to participate effectively in CFM and REDD schemes within four pilot areas of PNG

Serial number:	CFM-PPD 006/10
Budget:	ITTO Contribution: US$116,588 Government of PNG: US$25,000 **Total: US$141,588**
Implementing agency:	PNG Forest Authority

Summary

The pre-project proposal is a direct outcome of the PNG Forestry and Climate Change Policy Framework for Action, highlighting the need for engaging customary landowners at the local level and enhancing the capacity of government institutions at the national level. Forest communities in the four pilot areas are dependent upon forest products and services for subsistence and commercial purposes. The pre-project will enable the PNG Forest Authority to formulate a full project proposal to support CFM and REDD schemes in PNG through the establishment of a model platform for collecting and managing data and other information related to customary land ownership and forest quality. The pre-project will enable participating communities, the PNG Forest Authority and other stakeholders to systematically gather and consolidate forest and land tenure information using a single platform to jointly address the interrelated challenges of CFM and REDD.

Enrichment of young forest plantations with selected NTFPs for livelihood improvement and support of forest fringe communities in Atwima Mponua District of Ghana, in order to secure and protect the resources on a sustainable forest management basis

Serial number:	CFM-PPD 007/10
Budget:	ITTO Contribution: US$149,000 Government of Ghana: US$137,000 **Total: US$286,000**
Implementing agency:	Rural Development and Youth Association (RUDEYA)

Summary

The development goal of this pre-project is to establish sustainable Community Forest Management and Enterprises (CFME) to reduce rural poverty through improved livelihood options, reduced land degradation, and soil fertility management in a young reforestation area in the Atwima Mponua District of Ghana. The project will use a participatory approach to initiate and establish pilot forest enterprises for short to long-term management of young forest plantations for 150 farmers using beekeeping, grains of paradise and black pepper. It is envisaged that at the end of the pre-project business management groups are established and the 150 forest dwellers will have agreed legal rights to the land and forest resource they are managing. This will help improve community participation in sustainable forest management, enhance livelihoods, promote community based forest enterprises and reduce poverty among taungya farmers and forest communities.

International conference on forest tenure, governance and small and medium forest enterprises with focus on Asia-Pacific

Serial number:	CFM-PA 009/10
Budget:	ITTO Contribution: US$242,950 **Total: US$242,950**
Implementing agency:	ITTO Secretariat

Summary

The Activity focuses on Activities 32 and 47 of the ITTO Biennial Work Programme 2010-2011 approved by the 45th Session of the ITTC (Decision 2/XLV), requiring ITTO to organize an international conference on forest tenure, governance and small and medium forest enterprises with focus on the Asia-Pacific region. The Activity will also develop a global study on gender in relation to tropical forests, to assess the status of gender equity in forest ownership and forest enterprises in the tropics. The Conference will complete a series of similar conferences organized by ITTO and partners with previous focus on Latin America (Brazil, 2007) and Africa (Cameroon, 2009).

Developing collaborative management of Cibodas Biosphere Reserve, West Java Indonesia

Serial number:	TFL-PD 019/10
Budget:	ITTO Contribution: US$496,670 Government of Indonesia: US$94,608 **Total: US$591,278**
Implementing agency:	Balai Besar Taman Nasional Gunung Gede Pangrango Mountain Gede Pangrango National Park, Directorate General Forest Protection and Natural Conservation

Summary

The project will support the implementation of a collaborative management activity as the key tool for the effective management of the Cibodas Biosphere Reserve. The specific objective of the project is to strengthen forest law enforcement and governance, conservation, and the sustainable use of biodiversity and environmental services rendered by the Cibodas Biosphere Reserve. The expected outputs of the project are: 1) increased stakeholder commitment to the effective management of the Cibodas Bioshpere Reserve; 2) development of an integrated management plan for the Cibodas Biosphere Reserve; and 3) enhanced community awareness on the conservation and sustainable use of biodiversity and environmental services, and on forest law enforcement and governance.

Equipping small and medium sized enterprises in China for procurement of tropical timber from legal and sustainably managed forests

Serial number:	TFL-PD 017/09 Rev.1
Budget:	ITTO Contribution: US$322,056 Government of China: US$112,820 Industry Association (China): US$70,160 **Total: US$505,036**
Implementing agency:	The Institute of Forestry Policy and Information, Chinese Academy of Forestry (CAF)

Summary

Small and medium sized wood processing enterprises (SMFES) in China play a vital role in the domestic and international markets for processing wood products as they account for around 90% of the total output value of China's timber enterprises. The project will provide the means for SMFES to become equipped for procurement of timber from legal and sustainably

managed tropical forests. SMFEs in Zhangjiagang in Jiangsu Province, Huzhou and Jiashan in the Zhejiang province and in Shanghai will be surveyed to assess the status of their procurement management. Training and advice will be delivered to enterprises along with information (via a technical bulletin) on marketing, trade, procurement and corporate social responsibility. Policy suggestions will be made and selected SMFEs will be guided through COC certification. A web-based platform for better communication between SMFEs, government and other stakeholders will be established.

Development and implementation of a species identification and timber tracking system with DNA fingerprints and stable isotopes in Africa

Serial number:	TFL-PPD 023/10
Budget:	ITTO Contribution: US$89,437.50 Government of Germany: US$89,437.50 vTI: US$21,000 **Total: US$199,875**
Implementing agency:	Johann Heinrich von Thünen Institute (vTI), Federal Research Institute for Rural Areas, Forestry and Fisheries

Summary

Based on experiences from pilot-studies in Cameroon and Latin-America the pre-project will develop a full project proposal on 'Development and implementation of a species identification and timber tracking system in Africa with DNA fingerprints and stable isotopes' with regional focus on the timber producing countries Cameroon, Central African Republic, Congo Dem. Rep, Congo Rep, Gabon, Ghana, and Kenya as an important timber transit country. The pre-project will (a) define the role and contribution of collaborating agencies; (b) seek support and agreements with the governments of African countries involved in the project; (c) draw conclusions from former pilot studies to define the technical work plan; (d) identify the stakeholders and define their roles in the full project; and (f) seek additional financial support for the full project. Expected outputs of the full project to be developed include (a) a timber tracking system with DNA and stable isotopes working for 5 important timber species in Africa; (b) reference databases on genetic and isotopic spatial patterns ready for control uses; and (c) facilities for DNA-fingerprinting and stable isotopes with trained staff in timber producer and timber consumer countries.

Improvement of forest law enforcement at the national level to promote forest governance in Guatemala

Serial number:	TFL-PD 024/10
Budget:	ITTO Contribution: US$543,899 Government of Guatemala: US$200,880 IUCN: US$40,200 **Total: US$784,979**
Implementing agency:	National Institute of Forests (INAB)

Summary

The project will improve the effective implementation of sustainable forest management plans in Guatemala, through strengthening the capacity of forest institutions to enforce the forest management legislation and relevant regulations, as well as through the provision of better services and instruments for the promotion of sustainable forest management. It will strengthen the capacity of INAB to control forest law enforcement through improvement of observation systems and inter-institutional coordination at the national, regional and local levels. The project will increase the involvement of civil society, institutions and local governments in the implementation of activities aimed at strengthening actions to reduce illegal activities and ensure compliance with current forest laws and regulations, among other activities focused on improving forest governance.

Improving resilience of the tropical timber sector to the impacts of global and regional economic and financial crises

Serial number:	TMT-SPD 002/10
Budget:	ITTO Contribution: US$150,000 **Total: US$150,000**
Implementing agency:	ITTO Secretariat

Summary

The proposal is a response towards the lack of resilience of the tropical forestry sector to the impacts of the recent global financial and economic crisis. It will particularly address the concern of itto producer member countries that detailed analyses of the impacts of the crisis and policy responses are required to enable them to be better prepared for future economic and financial downturns. In addition, the study will address the concern of itto consumer member countries that the analyses will improve the understanding of the underlying factors impacting demand for tropical wood products in consumer markets. The proposal focuses on increasing the resilience of the tropical timber sector to the threats arising from global economic and financial shocks by increasing the capacity of itto producer member countries to manage, adapt, recover from and anticipate such crises. The study will develop a knowledge base for informed decision-making at international, regional and national levels on strategies for minimizing the risks to the tropical timber sector from global economic and financial shocks.

ITTO members

Producers

Africa

Cameroon
Central African Republic
Congo
Côte d'Ivoire
Democratic Republic of the Congo
Gabon
Ghana
Liberia
Nigeria
Togo

Asia & Pacific

Cambodia
Fiji
India
Indonesia
Malaysia
Myanmar
Papua New Guinea
Philippines
Thailand
Vanuatu

Latin America

Bolivia
Brazil
Colombia
Ecuador
Guatemala
Guyana
Honduras
Mexico
Panama
Peru
Suriname
Trinidad and Tobago
Venezuela

Consumers

Australia
Canada
China
Egypt
European Community
- *Austria*
- *Belgium*
- *Denmark*
- *Finland*
- *France*
- *Germany*
- *Greece*
- *Ireland*
- *Italy*
- *Luxembourg*
- *Netherlands*
- *Poland*
- *Portugal*
- *Spain*
- *Sweden*
- *United Kingdom*

Japan
Nepal
New Zealand
Norway
Republic of Korea
Switzerland
United States of America

Tropical and topical

Burger King rejects unsustainable palm oil

The AP reported in early September that Burger King, a major US hamburger chain, will cancel their contract with PT Sinar Mas Agro Resources and Technology due to reports of unsustainable oil palm plantation practices. An independent audit found that the company was in violation of regulations which included planting in some peatland swamps and secondary forests. Recently companies such as Unilever, Nestle and Kraft foods among others have dropped Sinar Mas as a supplier based on accusations of deforestation and other unsustainable practices (including destroying the habitat of orangutans and other endangered species) from the environmental group Greenpeace, which has a long-running campaign against palm oil. Burger King did not say where any alternate source of palm oil — used in cooking oil for frying — would come from. Sinar Mas said in a statement it was disappointed with Burger King's decision, but would work hard to convince the company that it was committed to sustainable practices.

Peru looking inwards to move upwards

Peru is finding that home is where the hardwood is. The first half of 2010 saw exports of wood products from Peru increase by 31 percent compared to the previous year, according to figures just released by Peru's export association. However, due to strong growth of Peru's economy, estimated imports of wood products within a decade could reach US$2 billion per year, dwarfing exports (Peru's imports of wood products, worth about US$800 million in 2009, are already three times its exports). Imports could be reduced if there were a greater domestic supply of wood from Peru's forests, which are the ninth largest in the world and fourth amongst tropical countries. According to Reforesta Peru, the country's 13 million hectares of forest could sustainably produce exports worth up to US$3 billion, with an additional area of 8.5 million hectares of degraded/deforested land available for reforestation. However, those in the industry point out the many problems that could restrict Peru's ability to capitalize on its forest wealth. High transport costs, lack of proper training, lack of sufficient investment in technology (especially wood drying kilns) and lack of a coherent state policy for a sector where investments mature in two decades, are major hurdles hindering expansion of Peru's forest sector.

Abuzz for shade farmed coffee

A recent study[1] shows that bees may be instrumental in pollinating native trees in shade-grown coffee farms and adjacent patches of forest. According to the report, some native species of bees help enhance the diversity of remnant native tree species by facilitating gene flow between the remnant forest and adjacent shade-grown coffee farms. Previous studies have shown that shade-grown farms improve biodiversity by providing a habitat for birds, bats and other creatures beneficial to the farm and forest. The genetic diversity provided by shade farming can provide a reservoir for future forest regeneration. Shade-grown coffee was the norm forty years ago, and most of the coffee consumed by the general public was grown in the shade of the canopy of tropical forests. However, coffee farmers realized that they could significantly raise the production of coffee by growing their crop in the sun following clear cutting of the forest, which has resulted in the destruction of millions of hectares of rainforest. The study advocates the promotion of shade-grown coffee which would benefit farmers and biodiversity while also requiring less synthetic fertilizer, pesticides and herbicides than open-grown coffee plantations.

1 *Jha, S. and Dick, C.W. 2010.Native bees mediate long-distance pollen dispersal in a shade coffee landscape mosaic. Proceedings of the National Academy of Sciences of the United States of America. http://www.pnas.org/content/107/31/13760*

Bridging New York City to tropical forests

The New York Times recently reported on a project proposed by a Manhattan architectural designer and sustainable-development consultant to help maintain the Brooklyn Bridge boardwalk, which currently consists of 11 000 planks of tropical wood. The designer suggests soliciting donations, from US$1000 per board, in exchange for burnishing the donor's name into the board. The donations would finance a project endowment and stewardship for a 5000 acre (2000 hectare) forest in a tropical country to be selected. The wood for the boardwalk and future replacements would come from the project forest which would be sustainably managed and protected using the donor funds generated by the scheme. The idea (known as the Brooklyn Bridge Forest) is facing some stiff criticism however, since it goes against New York City Mayor Michael Bloomberg's initiatives against using tropical timber in public infrastructure. However the scheme's proponents state that it allows natural timber to continue to be used for the boardwalk while providing a way to sustain a forest while using its resources and raising awareness of the environmental impact of infrastructure projects.

Indonesia to ban export of illegal timber

The Jakarta Post reported that the Indonesian government began the implementation of a ban on exports of illegally harvested wood and wood products in early September as part of its moves to sign a Voluntary Partnership Agreement with the EU under its FLEGT scheme. The new rule makes it mandatory for forestry companies to obtain official certificates to verify that timber has been legally sourced from forests. These actions were deemed necessary since official statistics show illegal logging activities have been

destroying more than 1 million hectares of forests each year. Hadi Daryanto, Indonesia's Director General of forest product development at the Forestry Ministry stated, "If a source of timber is untraceable, it will be categorized as illegal and byproducts will be ineligible for export to markets in the EU". The Timber Legality Verification System (SVLK) would be applied within industrial forest concessions. The new requirement was issued after the European Parliament recently voted to ban the sale of illegally harvested timber and timber products in the European market. The EU regulation banning importation of illegal timber is expected to be fully in place by 2013.

Forest carbon estimates too high?

Carnegie Institution's Department of Global Ecology and the World Wildlife Fund in coordination with the Peruvian Ministry of the Environment (MINAM) have made significant advances in accurate monitoring of carbon storage and emissions for the proposed United Nations initiative on Reduced Emissions from Deforestation and Degradation (REDD) with high-resolution maps of carbon stored in tropical forest vegetation and released by land-use practices. The high-resolution mapping will significantly affect the implementation of REDD in tropical countries.

The study, which was published in Proceedings of the National Academy of Sciences[2], was conducted in an area over 16 600 square miles (4.3 million hectares) of the Peruvian Amazon. The researchers mapped vegetation types and disturbance by satellite; used a LIDAR (light detection and ranging) system to develop 3-D maps of vegetation structure; converted the data into carbon density using field plots on the ground; and combined both satellite and LIDAR data to create high-resolution maps of stored and emitted carbon. The researchers used historical deforestation and degradation data with 2009 carbon stock information to calculate emissions from 1999-2009. The study found that carbon storage differed among forest types and with the underlying geology, even for areas within close proximity of one another. Forests growing on older geological surfaces hold about 25% less carbon than the vegetation found on younger, more fertile ground. This variability may affect previous estimates of carbon storage in tropical forests. For example, whereas the Intergovernmental Panel on Climate Change has reported that there is over 580 million tons of carbon stored in a particular study area in the lowland forest of Madre de Dios region, the findings from this study revealed the true figure to be a third less at 395 million tons.

Cocaine users stimulate deforestation

A recent report in Dialogo Ambiental stated that over 100 000 hectares of rainforest have been cleared to grow coca, the base plant for cocaine as well as a traditional highland stimulant, over the past 10 years. According to the report, deforestation has increased over the past four years, which has created problems not just for the Amazon but also for the rest of the country. In 2009 alone, over 15 000 hectares of rainforest may have been lost due to coca cultivation. Observers consider that Peru is now the region's largest coca grower, having surpassed Colombia.

Slow movement on "fast track" funding

Ministers and other high level officials made progress in September on establishing the details of how hundreds of billions of dollars in climate aid will be raised and distributed at a meeting in Geneva, Switzerland. The meeting was held to clarify the status of the billions of dollars for climate mitigation and adaptation in developing countries pledged by developed countries in Copenhagen last December. The funding issue is ready to play a prominent role in the upcoming UN Framework Convention on Climate Change (UNFCCC) Conference of the Parties (COP) in Cancun, Mexico this December. The Copenhagen Accord pledges US$30 billion in what is called "fast-track" climate funding from developed countries to support financing for developing countries to initiate action towards greenhouse gas reduction during 2010-2012, as well as long-term financing of US$100 billion targeted for 2020. It also calls on the developed countries to provide "new and additional resources" for the fund. However some countries such as the UK have stated that fast-track funding would be part of existing funding for overseas development assistance. The Copenhagen Accord is not binding since it did not acquire unanimous support from all signatories of the Climate Convention. Ministers from key countries such as Australia, China, South Africa and the UK were not present at the Geneva meeting, meaning that the issues dealt with there could well be on the table again in Cancun.

Deforestation falls in Brazil

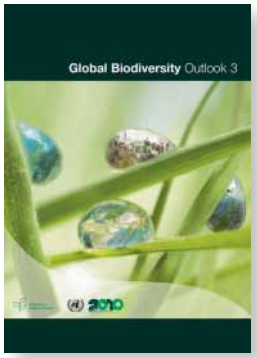
The Brazilian government says that deforestation in the Amazon declined by 47.5% over the past 12 months, according to a preliminary survey by a low-resolution satellite. This is the largest decline since measurements began in 1988 and, if confirmed by data from a second set of satellites due out later this year, it would mark nearly a 90% drop in annual forest area lost from a peak in 2004. The Instituto Nacional de Pesquisas Espaciais (INPE), Brazil's remote-sensing agency, said fires burned 229 600 ha between August 2009 and August 2010. That compares with 437 500 ha for the preceding 12-month period. Clearing was concentrated in the agricultural states of Pará and Mato Grosso. However, Brazil's low-resolution system, known as the Real-time Deforestation Detection System, detects only fires covering more than 25 hectares. Indeed, INPE specialists told the Brazilian press that farmers may now be employing smaller conflagrations to escape detection. The release of the data comes 1 month before a presidential election in Brazil, with the government crediting increased enforcement efforts, including cutting off loans to deforesters, for the improved figures. Analysts also pointed to recent efforts by large soybean and beef processors not to buy products from newly deforested areas as helping to slow the rate of deforestation. They note, however, that the global economic slump may also be playing an important role: if beef and soy prices were to rise, it's unclear whether Brazil could prevent deforestation rates from soaring once again.

2 *Asner, G.P.; Powell, G.V.N.; Mascaro,J.; Knapp, D.E.; Clark, J.K.; Jacobson, J.; Kennedy-Bowdoin, T.; Balaji, A.; Paez-Acosta, G.; Victoria, E.; Secada, L.; Valqui, M. and Hughes, R.F. High-resolution forest carbon stocks and emissions in the Amazon. http://www.pnas.org/content/107/38/16738.abstract*

Recent editions

Convention on Biological Diversity. 2010. Global Biodiversity Outlook 3. Secretariat of the Convention on Biological Diversity. Montreal, Canada. ISBN 92-9225-220-8

Available from: *http://gbo3.cbd.int/*

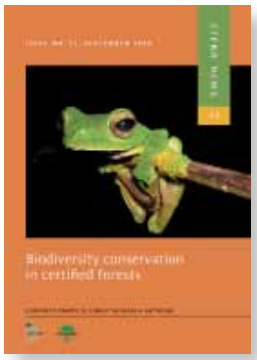


The Global Biodiversity Outlook, the flagship publication of the Convention on Biological Diversity (CBD), draws on a range of information sources, including National Reports, biodiversity indicators information, scientific literature, and a study assessing biodiversity scenarios for the future. This third edition summarizes the latest data on status and trends of biodiversity (see p.3) and draws conclusions for the future strategy of the Convention that will be considered at CBD COP 10 in Nagoya, Japan in October 2010.

Available in: Arabic, Chinese, English, French, Portuguese, Russian and Spanish

European Tropical Forest Research Network. 2010. ETFRN News Issue 51: Biodiversity conservation in certified forests. ETFRN and Tropenbos International, Wageningen, the Netherlands. ISBN: 978-90-5113-093-5

Available from: *http://www.etfrn.org/etfrn/newsletter/news51/index.html*



This edition of *ETFRN News*, jointly produced by Tropenbos International and the Institute of Tropical Forest Conservation, features 33 articles by a wide variety of authors involved in certification and/or the conservation of tropical forest biodiversity providing their views on whether certification is a good conservation strategy for tropical forests. The articles cover practical experiences from concessions and community forests, the challenges of monitoring biodiversity, high conservation value forests and a range of other subjects. The results of a dedicated on-line survey devised especially for this edition provide additional context to the views expressed in the articles. Most authors and respondents agree that certification has in part improved management practices and conserved forest biodiversity within certified forests in the tropics. However, the true extent of conservation benefits remains unknown due to a lack of rigorous and independent information. Many agreed that certification is not equivalent to full conservation and point at the limitations of certification in reducing deforestation rates.

JICA/ITTO 2010. REDD-plus (Reducing Emissions from Deforestation and Forest Degradation) - Forest conservation in developing countries. JICA and ITTO, Yokohama, Japan.

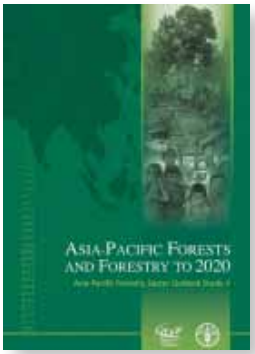
Available from: *http://www.itto.int/brochures/*

This booklet, jointly produced in English and Japanese by The Japan International Cooperation Agency (JICA) and the International Tropical Timber Organization (ITTO), aims to promote further understanding on and interest in REDD-plus by interested parties and the general public. The two organizations have long been working on conservation and sustainable use of forests in developing countries and in September 2010 signed a Memorandum of Understanding to cooperate on forest-related issues in developing countries. Promoting REDD-plus is one of the important common objectives of JICA and ITTO.

Available in: English and Japanese

Asia-Pacific Forestry Commission. 2010. Asia-Pacific forests and forestry to 2020: Report of the second Asia-Pacific forestry sector outlook study. FAO. Rome, Italy. ISBN 978-92-5-106566-2

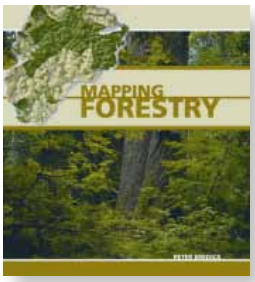
Available from: *http://www.fao.org/docrep/012/i1594e/i1594e00.htm*



This publication summarizes the key findings and results of the second Asia-Pacific Forestry Sector Outlook Study - a comprehensive effort spanning nearly four years and involving all member countries of the Asia-Pacific Forestry Commission. It synthesizes observations and findings from almost 50 country and thematic reports in providing analyses of the status and trends of all aspects of Asia-Pacific forestry. The publication also analyzes key factors driving changes in forestry in the region and sets out three scenarios for 2020: "Boom", "Bust" and "Green Economy". It concludes by outlining priorities and strategies to move the region's forestry sector onto a more sustainable footing and to provide continued benefits to future generations.

Eredics, P. 2010. Mapping Forestry. ESRI Press, California, USA. ISBN: 9781589482098

Available from: *www.esri.com/esripress*



This book provides a unique view into some of the many ways geographic information system (GIS) technology is being used throughout the world to support better forestry and land management decisions. It provides firsthand reports from forestry professionals on their use of GIS to manage commercial operations and promote sustainable stewardship, and presents approaches for determining the best areas for building roads through forest lands, whether logging in a particular area is commercially viable, which fire-damaged areas of forest should be restored first, and more. *Mapping Forestry* contains 20 chapters with full-color maps, featuring detailed descriptions of the types of GIS analysis that they represent, making it an excellent tool for forestry professionals.

Meetings

18-29 October 2010
10th Conference of the Parties to the Convention on Biological Diversity (COP 10)
Nagoya, Japan
Contact: Secretariat of Aichi-Nagoya COP 10 CBD Promotion Committee, 3-2-1 Sannomaru, Naka-ku, Nagoya; aichi-nagoya@cop10.jp; www.cop10.jp/aichi-nagoya/english/index.html; Tel: +81-52-972-7778 or +81-52-972-7779; Fax: +81-52-972-7822

19-21 October 2010
IX Seminar on remote sensing and GIS applied to forestry
Curitiba, Brazil
Contact: Tomasz Zawila-Niedzwiecki; tzawila@ibles.waw.pl; w.9seminarioflorestal.com.br/home/

21 October 2010
6th National Wood Convention of Peru (co-organized by ITTO)
Lima, Peru
Contact: Ms. Ana Maria Planas; aplanas@adexperu.org.pe

21-23 October 2010
3rd International Forest Furniture and Joinery Industry Trade Fair (FENAFOR 2010)
Lima, Peru
Contact: fenafor@fenafor.com; www.peruforestal.org , www.fenafor.com

22 October 2010
ITTO Side Event at CBD COP 10: Biodiversity Conservation in Tropical Forests
Nagoya, Japan
Contact: Eduardo Mansur, ITTO; mansur@itto.int

26 October 2010
ITTO, CBD and UNFF Side Event at CBD COP 10: A 360° View of Forests: People, Biodiversity, Carbon, and More
Nagoya, Japan
Contact: Eduardo Mansur, ITTO; mansur@itto.int

3-4 November 2010
Genetic and isotopic fingerprinting techniques – practical tools to verify the declared origin of wood
Eschborn, Germany
Contact: Dr. Stefanie von Scheliha, GTZ-International Forest Policy (IWP); stefanie.scheliha@gtz.de

10 November 2010
PEFC Stakeholder Dialogue: Advancing Certification in the Tropics
Rio de Janeiro, Brazil
Contact: Caroline Stein, PEFC International; Caroline.Stein@pefc.org

15-18 November 2010
VI International Conference on Forest Fire Research
Coimbra, Portugal
Contact: icffr@dem.uc.pt; http://www.adai.pt/icffr/2010/

15-19 November 2010
Enhancing the legality of the international timber trade: Creating enabling environments and opportunities for the private sector and other stakeholders, a CLI in Support of UNFF
Hanoi, Vietnam
Contact: Tran Kim Long, Deputy Director General, International Cooperation Department, Ministry of Agriculture and Rural Development, Vietnam; longtk.htqt@mard.gov.vn; Tel:+844-38436812; Fax:+844-37330752

16-17 November 2010
REDD-ALERT policy exercise on REDD+ financing options
Amsterdam, Netherlands
Contact: Ms. Constanze Haug; constanze.haug@ivm.vu.nl; Tel:+31-20-5982927; Fax:+31-20-5989-533)

16-17 November 2010
Investment and Financing Forum + Bioenergy Seminar
Buenos Aires, Argentina
Contact: http://www.fao.org/forestry/events/en/

29 November - 10 December 2010
The Sixteenth Conference of the Parties (COP) and the Sixth Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP)
Cancún, Mexico
Contact: http://cc2010.mx/swb/

5 December 2010
Forest Day 4
Cancún, Mexico
Contact: http://www.forestsclimatechange.org/ForestDay-4.html

8-10 December 2010
Fourth International Conference on Plant and Environmental Pollution
Lucknow, India
Contact: Conference Secretariat; isebnbrilko@sify.com; isebmail@gmail.com; http://isebindia.com/icpep-4/icpep-4.html

13-18 December 2010
46th Sessions of the International Tropical Timber Council and Associated Committees
Yokohama, Japan
Contact: ITTO Secretariat; itto@itto.int; www.itto.int; Tel: +81-45-223-1110; Fax: +81-45-223-1111

24 January–4 February 2011
9th Session of UNFF
New York, USA
Contact: http://www.un.org/esa/forests/session.html

8-10 February 2011
Short rotation forestry: Synergies for wood production and environmental amelioration
Ludhiana, India
Contact: Sanjeev Chauhan; chauhanpau@rediffmail.com; www.iufro.org/download/file/5651/1325/india11-1st-announcement.doc/

8-10 February 2011
Australasian Forest Genetics Conference: Integrating quantitative and molecular tools
Christchurch, New Zealand
Contact: Luis A. Apiolaza; Luis.Apiolaza@canterbury.ac.nz; http://www.forestgenetics.com.au/

11-13 February 2011
Tropical Forests Under a Changing Climate: Linking Impacts, Mitigation, and Adaptation
New Haven, CT, USA
Contact: Yale University; http://www.yale.edu/istf/

21-25 February 2011
26th Session of the UNEP Governing Council/Global Ministerial Environment Forum
Nairobi, Kenya
Contact: Secretariat of the Governing Bodies, Jamil Ahmad; jamil.ahmad@unep.org

5-9 March 2011
Global Conference on Entomology
Chiang Mai, Thailand
Contact: http://entomology2011.com/

March 2011
Symposium on landscape level management for SFM
Spain, location/date TBA
Contact: http://www.fao.org/forestry/events/en/

18-21 April 2011
19th meeting of the CITES Plants Committee
Geneva, Switzerland
Contact: info@cites.org; http://www.cites.org/

2-6 May 2011
Planted teak forests – a globally emerging forest resource
Guanacaste, Costa Rica
Contact: Luis Dalpra; LDalpra@catie.ac.cr; or Walter Kollert; Walter.Kollert@fao.org

18-20 May 2011
13th International Symposium on legal aspects of European forest sustainable development
Kaunas, Lithuania
Contact: Romualdas Deltuvas; Romualdas.Deltuvas@lzuu.lt; or Peter Herbst; hp@net4you.at

7-11 June 2011
20th International Wood Machining Seminar
Skellefteå, Sweden
Contact: Anders Gronlund; info@iwms20.se; http://www.ltu.se/ske/IWMS-20/IWMS-20

15-18 June 2011
IUFRO 5.10.00 – Forest Products Marketing and Business Management and the UNECE/FAO Team of Specialists on Forest Products Markets and Marketing
Corvallis, Oregon
Contact: Chris Knowles; Chris.Knowles@oregonstate.edu

19-21 June 2011
Forest Products Society 65th International Convention
Portland, Oregon
Contact: conferences@forestprod.org; www.forestprod.org

26 June 2011 - 2 July 2011
Tree Biotechnology 2011 - From genomes to integration and delivery
Arraial D'ajuda, Porto Seguro, Bahia, Brazil
Contact: Dario Grattapaglia; dario@cenargen.embrapa.br; http://www.treebiotech2011.com/

18-22 July 2011
25th meeting of the CITES Animals Committee
Geneva, Switzerland
Contact: info@cites.org; http://www.cites.org/

Out on a limb

By Ahmed Djoghlaf

Executive Secretary, CBD
ahmed.djoghlaf@cbd.org

and

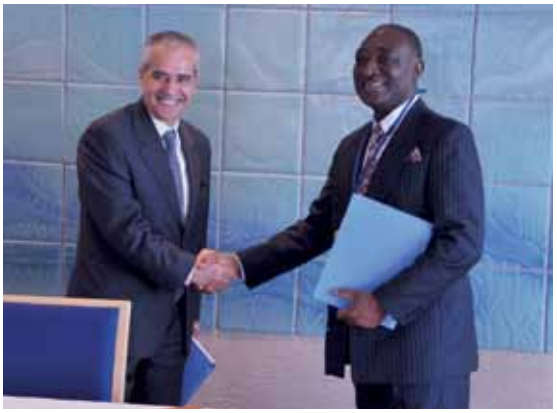
Emmanuel Ze Meka

Executive Director, ITTO
zemeka@itto.int

The world's forests are facing immense pressures and societies are racing against time to find ways of conserving and sustainably using forest biodiversity for the benefit of present and future generations. Key findings from FAO's Global Forest Resources Assessment 2010 show that while deforestation has slowed somewhat in recent years as compared to the 1990s, it is still alarmingly high. Four million hectares (40 000 km²) of highly diverse primary forests, an area the size of the Netherlands, are lost every year. Continued deforestation is resulting in carbon emissions, shortages in water and food supply, and in an unprecedented loss of biological diversity.

The third edition of the Global Biodiversity Outlook, launched in May 2010, demonstrates that the Johannesburg biodiversity target to significantly reduce the loss of biodiversity by 2010 has not been met. Each day, up to 150 species disappear from the face of the Earth, many of them from tropical forests, where the vast majority of terrestrial biodiversity is located. This unprecedented rate of extinction undermines globally important ecosystem goods and services, such as carbon sequestration, clean water supplies, and well over 5000 commercial forest products.

Recognizing the importance of tropical forest biodiversity, the secretariats of the Convention on Biological Diversity (CBD) and the International Tropical Timber Organization (ITTO) signed a Memorandum of Understanding in Tokyo on 2 March this year to strengthen collaboration in the pursuit of their common objective of conserving and sustainably managing tropical forest biodiversity. The collaboration foresees, inter alia, the development of a support programme for implementation of the CBD programme of work on forests in ITTO producer countries.



Teamwork: CBD Executive Secretary Djoghlaf and ITTO Executive Director Ze Meka (right) sign MOU in Tokyo.
Photo: K.Sato/ITTO

Adopted in 2002, the CBD programme of work on forests contains a comprehensive list of 130 national level activities, covering all types of forests. The CBD/ITTO support programme will carry out activities to assist countries that are both party to the CBD and signatories of the International Tropical Timber Agreement (ITTA) to meet objectives established by CBD and shared by ITTO member countries. This will include activities to address major human-induced threats to forest biodiversity, including climate change, unregulated and unsustainable use of forest products and resources (including unsustainable hunting and trade of bushmeat), illegal land conversion, habitat fragmentation, environmental degradation, forest fires and invasive alien species.

In this way, the CBD/ITTO support programme will contribute to the achievement of the forest-related targets in the CBD post-2010 Strategic Plan, and address ITTO's goal contained in its 2010-2011 Biennial Work Programme, and programmes thereafter, to ensure that the ITTO-IUCN Guidelines for the conservation and sustainable use of biodiversity in tropical timber production forests are effectively implemented in the management of timber production forests in all ITTO member countries.

ITTO is uniquely placed to make this programme a success. Its members represent about 80% of the world's tropical forests and over 90% of the global tropical timber trade. The Organization has over 20 years of experience implementing biodiversity conservation projects throughout the tropics. It has assisted in establishing an extensive network of protected areas (most notably providing funding for over 10 million ha of trans-boundary conservation areas in the tropics), and has been active in promoting the conservation of biodiversity in tropical timber production forests.

With CBD and ITTO joining forces, two strong partners have come together through a shared vision to collaborate in conserving and sustainably managing tropical forest biodiversity. We look forward to working with the international community to ensure that our constituencies are fully empowered to put this vision into practice.

Convention on Biological Diversity

2010 International Year of Biodiversity

ITTO