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Forests and Climate Change: adaptation and mitigation

EUROPEAN TROPICAL FOREST RESEARCH NETWORK

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Preface

Climate change is generally recognized as one of the greatest challenges of this century. Forests contain a substantial part of the planet's carbon; therefore, current rates of forest loss contribute to almost 20 percent of total emissions of carbon dioxide. Climate change and forests are intrinsically linked: climate change is a threat to forests, and protecting forests from conversion and degradation helps mitigate the impacts of climate change.

To address climate change, the United Nations Framework Convention on Climate Change (UNFCCC) was established at the Earth Summit in Rio de Janeiro in 1992. It was followed in 1997 by the more powerful and legally binding Kyoto Protocol. The protocol recognizes that developed countries share the main responsibility for the current high levels of greenhouse gas emissions in the atmosphere, and places a heavier burden on them under the principle of "common but differentiated responsibilities." Under this protocol industrialized countries are allowed to meet part of their emission reduction targets abroad through so-called "market-based mechanisms," such as the Clean Development Mechanism.

The first Kyoto commitment period ends in 2012. At the UNFCCC Conference of the Parties in Copenhagen in December 2009 (COP 15) countries are expected to concur on a new agreement to replace the Kyoto Protocol in 2012. One of the challenges in Copenhagen will be to engage developing countries in reducing their emissions and adapting to the impacts of climate change. In 2007 an Action Plan was agreed to in Bali, including a mechanism for reducing emissions from avoided deforestation and forest degradation (REDD).

In the run-up to Copenhagen the challenge is to guarantee that the new protocol will be effective and efficient in terms of carbon reduction, and at the same time equitable and non-detrimental to the Earth's biodiversity. REDD could become a centrepiece for the financing of forestry reform after 2012. How to put this mechanism into practice after Copenhagen will be a challenge, however. Objectives for climate change mitigation and adaptation need to be integrated with sustainable forest management and biodiversity protection, and at the same time must allow for the improved welfare of rural people in developing countries.

With this issue of ETFRN News, containing more than 20 wide-ranging articles on forests and climate change, we wish to contribute to the discussion on the potential role of forests and forest management in mitigating and adapting to climate change.

We thank the authors for their contributions, the editors for reviewing the articles and compiling this ETFRN News, and the donors for their generous support.

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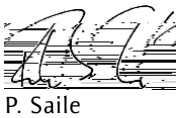

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Forests and climate change: an overview

From the perspective of climate, SFM is a means of achieving the goals outlined by the UNFCCC with respect to forests:

- using forests for carbon capture and storage, thus reducing the emissions of greenhouse gases — in this way, forests become part of a climate strategy for mitigation; and
- using forests and trees as part of a strategy to cope with impacts of climate change — in this way, forests become part of a climate strategy for adaptation.

Anticipating the international policy dialogue and the expected outcomes at COP 15 in Copenhagen, a wide range of forest carbon activities has emerged over the last decade. Several bilateral and multilateral initiatives have supported countries in becoming "REDD ready," such as the World Bank's Forest Carbon Partnership Facility (FCPF) and Forest Investment Program (FIP), and FAO and UNEP's UN-REDD.

On the forest side of the spectrum, it is commonly agreed that an agreement on a REDD mechanism would provide a global incentive for the conservation and sustainable management of forests.

For many years, forest policy-makers, managers and practitioners have worked to conceptualize and implement SFM. The concept of SFM includes a broad range of objectives — from use to conservation — and different types of forests, including natural

This introductory article synthesizes some of the main issues and developments that emerged from the articles and concludes with some reflections on the way forward. The synthesis, like the ETFRN News, is organized into six sections:

- International policy;
- Country-level REDD experiences;
- Forest management practices;
- Climate adaptation strategies;
- Landscape restoration in practice; and
- Forest carbon business approaches.

International policy

Clabbers (1.1.) writing from the perspective of a climate negotiator, briefly outlines the history of the discussions under the UNFCCC on tropical forests. The topic of deforestation in the international climate negotiations seemed to be taboo for many years, but developing countries with a considerable forest cover pushed it back on the climate agenda. Since then, it has been discussed under different abbreviations, such as RED, REDD and REDD+. It is likely that some kind of arrangement on reducing deforestation and/or degradation will be agreed at COP 15. There are four main outstanding issues in Copenhagen:

- the scope of the instrument (i.e., RED or REDD+);
- the mechanism (should there be one financial mechanism for REDD+, or separate mechanisms for REDD and the "+");
- the finance mechanism (fund-based or market-based); and
- how countries should establish baseline reference levels for deforestation and degradation.

Whatever the outcome in Copenhagen, better protection and more sustainable use of forest resources will remain one of the main environmental and social challenges of the coming century. Pistorius (1.3) questions what REDD can or should mean for biodiversity. He argues that it would be shortsighted not to consider biodiversity and livelihoods needs; they should be addressed simultaneously and comprehensively, so as to generate multiple benefits for the environment and for the people who depend on forest resources.

Discussing the pitfalls and possibilities of conserving carbon in tropical forests Putz and Zuidema (1.4) emphasize that there are clear trade-offs between retaining biodiversity and maximizing carbon and timber yields, and that these trade-offs must be managed. They also state that most managed forests fall far below the efficiency frontier, with less than maximum biodiversity loss and carbon sequestration. Established forest management practices — such as forest fire management, reduced-impact logging, post-logging silviculture treatments and tree planting — can all help mitigate climate change and render forest ecosystems more resilient for multiple purposes. This calls for a system for monitoring and verification that goes beyond carbon storage by explicitly including the social and environmental principles and criteria of sound multiple-use management. This broader approach will remain difficult to achieve if participants in Copenhagen focus only

on carbon stocks in forests. Putz and Zuidema also highlight the need to connect REDD programs to efforts to control illegal logging (e.g., FLEG and EU-FLEGT).

Van Noordwijk and Akon (1.2) argue that the definition of "forest" could become a major bottleneck in the implementation of a climate agreement. The progression of concepts — from RED to REDD to REDD+ to REDD++ — reflects a tendency to include a larger share of total land-use change. The logical end point is to account for all land use: Reducing Emissions from Any Land Use (or across all land uses) or REALU. A comprehensive REALU approach can likely incorporate trees outside forests, agroforestry systems and community-based forest management. Recent analysis suggest that one billion hectares, or 20 percent of the world's agricultural lands, have at least ten percent tree cover. In the Southern Africa Peace Parks project, developed in a savannah environment, Termeer et al. (2.4) find that the existing definition of forest proved problematic when deciding what to include in carbon measurements.

Country-level REDD experiences

Westholm et al. (2.1) observe that REDD readiness activities encounter many problems in the first phase: defining the baseline for deforestation. Collecting relevant forestry and biomass data — necessary to determine forest carbon stock — is very time consuming. Furthermore, carbon measurement data is not always accurate and compiling the information can increase transaction costs (Termeer et al. 2.4; van Midwoud, 6.2).

Several authors emphasize the importance of local and indigenous community involvement in REDD. Guyana's Low Carbon Development Strategy (2.3) includes awareness and consultation sessions. The financial sustainability of REDD activities is also important: if opportunity costs of alternative land uses rise in the future, communities' commitment to REDD could cause them to forego profits (Westholm et al. 2.1; Benneker and McCall 2.2).

In a case study from Mexico, Benneker and McCall (2.2) show that existing forestry programs have the potential to reduce forest degradation and enhance carbon stocks inside and outside the forest. Governments must ensure that these programs continue to benefit local people when integrated into a REDD strategy. The authors note that in Mexico REDD payments based on reduced forest degradation and enhanced carbon stocks are more likely to benefit farmers and communities than payments based on reduced deforestation.

The article on international forest landscape auctions (Termeer et al. 2.4) outlines some important issues in attracting funds from the voluntary market. A lack of up-front financing and the costly and slow process of certification have contributed to the failure of this innovative approach. Land and user rights need to be clear and secure to attract external money. Opportunity costs for alternative land uses is another factor that determines the success of REDD projects. If alternative land use (for example, extensive cattle ranging) is very profitable, it will be difficult for carbon money to be competitive. An interesting example is Guyana (2.3), where a baseline study suggests an opportunity cost for avoiding deforestation of US$580 million per year.

Many promising REDD projects have depended largely on the voluntary market, which may put longer-term sustainability at risk (Termeer et al. 2.4). The current global economic crisis has already shown that companies are engaging in fewer voluntary carbon activities. An international R

Climate adaptation strategies

Two articles in this issue of ETFRN News deal specifically with forests and climate change adaptation strategies. Sonwa et al. (4.1) discuss a multi-stakeholder needs assessment to identify adaptation measures in the Congo Basin, a region where many livelihoods directly depend on forests. Bio-energy (including fuelwood), NTFPs for food and medicines, and water have been identified as forest-related priorities for climate adaptation strategies. SFM is seen as a way to achieve climate change adaptation and mitigation as well as poverty reduction and economic and social development. Some of the tools being used are vulnerability maps and the development of adaptation strategies using forest resources. Sonwa et al. make the notable observation that there are very few explicit references as to the role of forests in climate adaptation and mitigation strategies in Central Africa's existing climate adaptation strategies.

Kalame (4.2) reviews a program in the transition zone of Ghana to promote a taungya system as a climate adaptation strategy. The taungya system includes many of the elements of an adaptation strategy. Several challenges are mentioned, such as a lack of clear ownership agreements on trees and land between the government and other stakeholders; using accountability and consultation to ensure stakeholder involvement in the government-led programs; and meeting the livelihoods needs of farmers in the medium term. The existing Ghana Forest Strategy does not focus on climate change adaptation. Understanding existing forest policy activities and programs and their strengths and weaknesses is key to the formulation of international policy on forestry and sectoral policy on climate change issues.

Landscape restoration in practice

All five cases in this section are relatively small-scale efforts: four of them are financed from the voluntary carbon market, one from public environmental money — the Caucasus case (Schulzke et al. 5.3), which is financed by the German government. All of them affirm that carbon sequestration should not be the only criterion for planting forests, as forests have a number of other essential social, ecological and economic functions. In the Caucasus case (5.3) multipurpose forest management protects the soil from erosion, avalanches and flooding. Reforestation and restoration activities are aimed at establishing indigenous forest types, paying careful attention to the provenance of the planting material. The project also addressed the need for short- and medium-term benefits for local people in terms of forest products, income generation and employment.

Engels (5.2) describes how protection and restoration of the remnant *Araucaria* forests in southern Brazil is important not just for biodiversity but also helps to mitigate climate change. Maintaining and restoring the forest will diminish the impact of frost and drought on agriculture, particularly coffee and citrus crops.

Van 't Riet (5.4) describes the case of a community forestry project on Mount Malindang in the Philippines. Local people are managing the project, which proved to be very successful. Projects such as Mount Malindang not only help to sequester CO_2, but have

many other benefits, such as the protection of biodiversity and soil and — perhaps most importantly —improved living conditions for the local population. The author explicitly challenges the high costs of current CO_2 certification systems, which prevent small-scale projects from participating, and suggests that more people in low-salary countries be trained to do the work.

Another option for small-scale projects is to refrain from certification and rely instead on trust, as was the case in Costa Rica described by Westerink and Soto (5.5). Funding for the project came initially from biodiversity conservation sources, but more recently from voluntary climate funds. The flexible approach of the carbon funds provider — who has trust in both the Dutch and the Costa Rican parties — contributed to the success.

Analyzing the rural communities near the remnants of Mâta Atlantica forests in Brazil, Silveira (5.1) emphasizes that landscape restoration efforts can benefit from anthropological insights. A concrete example is knowledge of land heritage systems that can be used to promote forest restoration. Water security and fuelwood access can also motivate rural communities, especially women, to conserve and restore their forests (3.2, 5.1 and 5.5).

Forest carbon business approaches

Thoumi (6.1) calls for forestry carbon projects to be framed within an appropriate business strategy that is grounded in effective communication between science, civil society, government and the business community. One of the interesting aspects of this article is the concept of inter-generational equity. Economic discounting practices and current financial analyses are challenged, because of their assumption that production in the future counts less than production now. The generations who follow will still need forests and their services (and a decent climate). Perhaps forests and forest carbon should become an alternative investment asset class, wherein lower financial discounting rates are applied for reasons of sustainability and inter-generational equity.

Van Midwoud (6.2) reviews the experiences with forest and carbon certification of afforestation and reforestation (A/R) projects under the Clean Development Mechanism (CDM) and the lessons to be learned for REDD. After 12 years of CDM, more than 1700 projects have been registered; only six of them are A/R CDM projects. Van Midwoud mentions three major conceptual reasons for this: 1) high transaction costs; 2) lack of demand for the carbon credits of A/R CDM; and 3) the poor reputation of tree-planting as an instrument to combat global warming. The voluntary carbon market proved to be much more successful in enhancing A/R-projects as it provided a solution to these three problems of the compliance market. In order for REDD to become a success, methodologies and procedures must be more workable and less complicated than under the CDM.

Van Midwoud also notes some other lessons to make private sector involvement in REDD more effective and attractive. Credible institutional structures and good governance are needed, as is capacity building for the design and management of marketable forest carbon projects. These projects should adopt a multiple use approach in their design.

He also observes that the groups working on climate forest projects often differ from those working on other types of forest projects. This is unfortunate, since many of the management practices needed in climate forest projects are also required for sustainable forest management.

Some reflections on the way forward after Copenhagen

There is broad support for including forests in a future agreement on global climate change. Reducing deforestation and forest degradation through better forest governance and management will contribute to mitigating climate change. Better forest management may further help people adapt their livelihoods in the face of the inevitable changes in climate that will occur in the coming decades. The challenge after Copenhagen will be to translate goals and agreements into policies and practices that work. For that, political will is needed.

The forest community and the climate community are currently worlds apart. In the implementation of the Copenhagen agreement, these two communities need to be better linked to increase mutual understanding and develop shared visions and objectives for effectively combating climate change. The forest sector should increase its ability to engage effectively and strategically in the agendas of relevant sectors and to prove the importance of forests to other constituencies.

Adaptation and mitigation: two sides of the same coin

From a forest management perspective adaptation and mitigation can be seen as two sides of the same coin: what is good for adaptation is also good for mitigation and vice versa. A major lesson is that adaptation and mitigation objectives must be included more explicitly in regular forest management plans and countries' national forest programs.

SFM already addresses climate change objectives

Most authors agree that the measures needed to enhance the mitigation and adaptation potential of forests are largely the same practices and policies that have been identified for achieving SFM in the past. Climate objectives are most effectively and sustainably achieved if they are embedded in a multiple use forest management approach. No single author in this volume — including those from private forest enterprises, carbon certifiers and companies that buy carbon credits — argues that forests should be managed for carbon alone. Managing forests for multiple objectives also means recognizing the trade-offs that exist between, for example, timber production, carbon storage and biodiversity conservation. Managing these trade-offs to generate a mix of goods and services is the core challenge of SFM. Of course there is plenty of room for improvement through the application of effective management practices, most of which are already at hand.

The factors that prevent implementation of adaptation and mitigation measures are the same ones that drive deforestation and poor forest management. They are already well understood, but most of them are not easily addressed as they are tied to institutional capacities and governance.

SFM is already an important tool in the implementation of other Rio conventions such as the Convention on Biological Diversity and the United Nations Forum on Forests. A further definition of SFM, with clear criteria and indicators that address the multiple

Good governance

The importance of governance underpins the effective integration of forest and climate change objectives. Better integration of REDD and forest law enforcement and governance initiatives to create synergies and avoid duplication is one example. Countries and their policy and operational frameworks are the most logical level at which to integrate these multiple objectives. Capacity-building will have to go beyond technical issues and focus on the country's governance and institutional structures. In the end, political will, credibility, trust, transparency, equity and justice are the factors that ultimately define the functioning and impact of any system.

Local populations need to be involved in a meaningful way to create co-benefits for their livelihoods, biodiversity and other environmental services. Not addressing "people" and "planet" considerations is increasingly seen — by both the public and private sector — as a business risk.

Integrating climate change objectives in community-based forest programs creates additional benefits and livelihood opportunities. But community engagement in REDD schemes and the forest carbon market is not without risks, as it may also limit control over resources and future development options. To make these risks transparent and manageable is a prerequisite in the design of a program. Open and equitable participation by communities in design and decision-making is essential.

The role of forests must be clarified and articulated in National Adaptation Programs of Action (NAPAs). At present most political attention and financing is focused on REDD, and, in general, on climate mitigation. Only recently has the concern for the role of forests in adaptation gained ground; this emanates from the growing recognition that climate change will happen anyway. Moreover, climate change will affect the most vulnerable ecosystems and poorer regions. The people living in these areas usually contribute least to climate change, but may suffer most of its effects, as they usually lack the means to adapt. It is also well evidenced that trees and forests in these areas are an important safety net. Adaptation efforts will have to be closely linked to the poverty agenda.

REDD and other forest-based climate change mitigation measures are likely to be low-cost and effective in the short to medium term. Some stakeholders fear that forests may become a too-cheap mitigation option and corrupt the overall climate agreement. In most calculations, however, the costs of developing, operating and managing the institutional system required to produce credible and sustainable forest carbon credits are not internalized in forest carbon prices. If they were, forest carbon prices would become much higher and more realistic.

Endnote

Section 1

International policy

Rhacophorus

negotiations in their minds, other Parties reacted halfheartedly. But in December 2005, at Conference of the Parties (COP) 11 in Montreal, Papua New Guinea and Costa Rica — supported by the Coalition for Rainforest Nations — put the issue of compensating developing countries for reduced deforestation with carbon finance on the agenda. To many people's surprise, the proposal by PNG and Costa Rica had broad support. Forests were no longer associated only with removals, but also with emissions. It was obvious that emissions from deforestation, around 20 percent of the global CO_2 total, needed to be reduced in any effective approach to mitigate climate change. The Reducing Emissions from Deforestation (RED) debate was kick-started and Parties agreed to a schedule for dialogue. The dialogue focused on relevant scientific, technical and methodological issues and the exchange of relevant information and experiences, including policy approaches.

The scope of the discussion broadened gradually. Parties realized that forest degradation was another important source of CO_2 emissions. As of COP 13, in December 2007, agenda items included forest degradation and the second "D" was added to RED. At the same time a comprehensive negotiation process to enable the full, effective and sustained implementation of the UNFCCC through long-term cooperative action was established in the so-called Bali Action Plan. The scope of the REDD debate was even broader there. It included the role of conservation, sustainable management of forests and enhancement of forest carbon stocks — referred to as REDD+.

Outstanding policy issues

The technical workshops and expert meetings that have been held since December 2005 have helped to increase the mutual understanding of various methodological issues related to REDD+. It is now commonly understood that tools, methods and data are available and that the science is robust enough to monitor and estimate emissions from deforestation and forest degradation with an acceptable level of certainty.

The main outstanding issues are policy questions. Should there be one financial mechanism for REDD+ or separate mechanisms for REDD and for the "plus"? And should the finance be fund- or carbon market-based? Another issue is the general assumption that approaches will base their incentives on reference (emission) levels. The question then is how to establish those reference levels.

The REDD+ discussions are clearly linked to other parts of the negotiations under UNFCCC. The ways in which developing countries would be supported by developed countries to reduce deforestation and forest degradation, and the level of support, depend on the mitigation actions that developing countries are going to undertake autonomously. This in turn is related to the reduction targets for developed countries. Developed countries could, for example, agree to more ambitious reduction targets when they can use REDD+ credits for fulfilling part of their emission reduction obligations. The answers to these REDD+ questions will not be known until the final day of the Copenhagen negotiations.

1.2 If we cannot define it, we cannot save it

Introduction

In the discussions on reducing emissions from forests and other aspects of land use, the negotiators and their supporters appear to have assumed so far that "forest" is a clearly

The forest definition agreed on by UNFCCC in the context of the Kyoto protocol has three significant parts, only the first of which has received a lot of attention:

- Forest refers to a country-specific choice of a threshold canopy cover (10–30 percent) and tree height (two to five m);
- These thresholds are applied through "expert judgment" based on the potential to be reached in situ, not necessarily to the current vegetation; and
- Temporarily unstocked areas (without "temporarily" being defined) remain forest as long as a state forest entity thinks they will, can or should return to tree cover conditions.

Rules 2 and 3 were added to restrict the concept of reforestation and afforestation and allow forest management practices including clear-felling followed by replanting within the forest domain. They make direct observation of forest difficult.

This forest definition has a number of counter-intuitive consequences:

- Deforestation is not considered to have occurred in the conversion to oil-palm plantations, as such plantations meet the definition of forest;
- There is no deforestation in a country like Indonesia, as land remains under the institutional control of forest institutions and is only "temporarily unstocked";
- Swiddening and shifting cultivation can finally be removed from the list of drivers of deforestation, as long as the fallow phase can be expected to attain minimum tree height and crown cover;
- Most tree crop production and agroforestry systems meet the minimum requirements of forest; unpruned coffee, for example, can easily reach a height of five metres;
- The transformation of natural forest into fastwood plantations after rounds of logging is considered to occur fully within the "forest" category, out of reach of RED policies;
- A substantial proportion of peatland emissions are not governed by forest-related emission prevention rules if they involved lost forest cover and were excised from the "forest estate" before a cut-off date that has yet to be specified; integral protection of peat domes will likely have to deal with both forest and non-forest rules.
- Substantial tree-based land cover types fall outside of the current institutional and legal framework for forests and require broad-based implementation arrangements.

There is probably no single definition of forest that can apply in the continuum of landscapes with trees. From a biodiversity perspective, a cut-off between "natural" and "planted" forest may seem desirable, but there are many intermediate forms.

Leakage

Any attempt at partial accounting or selective policies for emission reduction within the broad land-use category will still require leakage to be considered, as attempts to reduce emissions in one place may well lead to increased emissions elsewhere.

Four forms of leaka[illegible]eeeeeeeeeeeeeeeeeeee

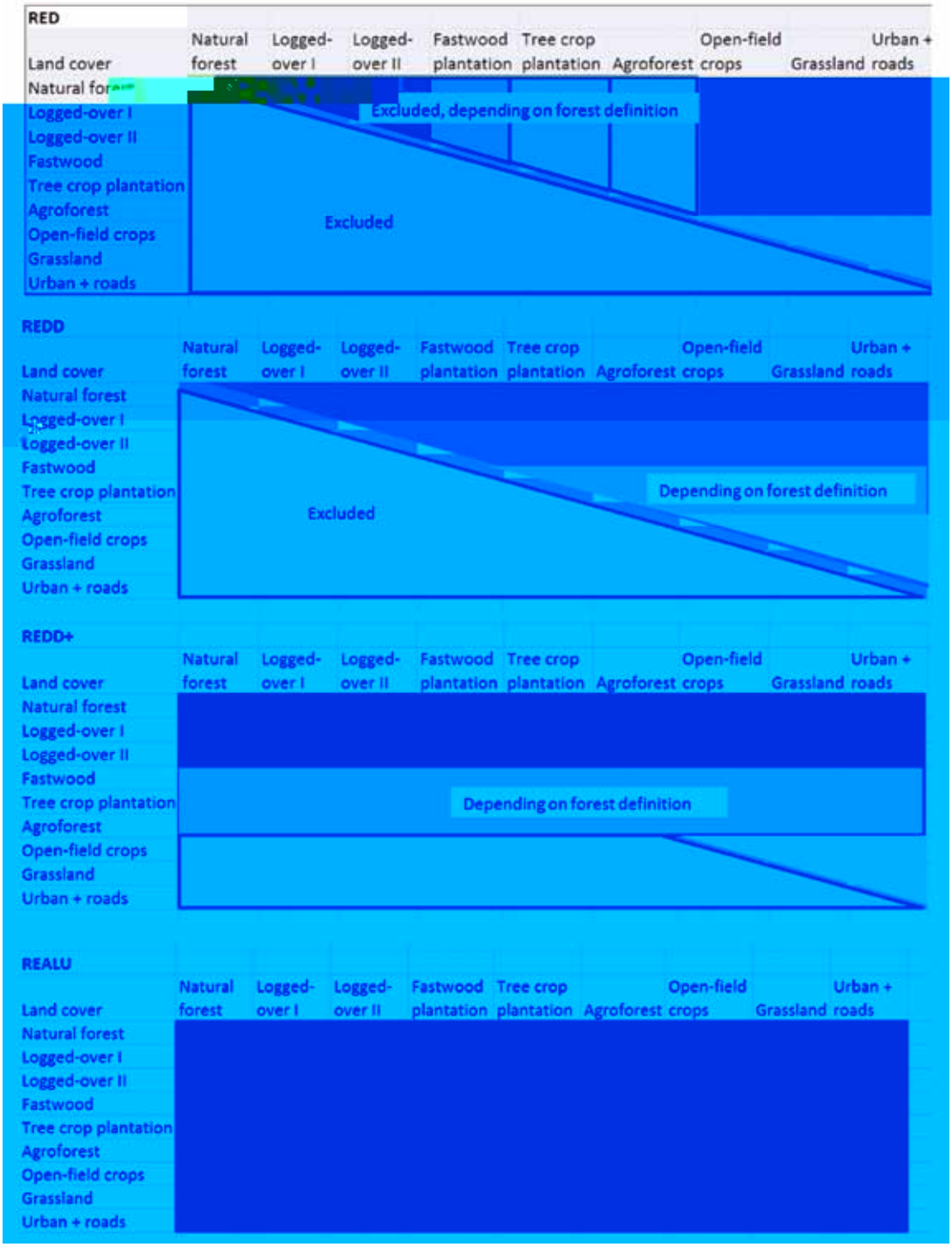
- REDD+ = RED plus restocking within and towards forest; in some versions REDD+ will also include peatlands, regardless of their forest status; details still depend on the operational definition of forest;
- REDD++ = REALU = RED plus all transitions in land cover that affect C storage, whether peatland or mineral soil, trees outside forest, agroforest, plantations or natural forest. It does not depend on the operational definition of forest.

From the perspective of efficiency as well as fairness there is very little reason to pay selective attention to forest rather than other land uses. A more comprehensive REALU approach is likely to allow trees outside forest, agroforestry systems and community-based forest management to be treated fairly in the rules, proportional to C storage achieved and emissions avoided. It will likely also further reduce emissions by boosting carbon storage in agricultural production systems and systems in between agriculture and forests. Recent analysis by the World Agroforestry Centre suggests that 1 billion ha, or one fifth of the agricultural lands of the world, have at least ten percent tree cover.

Accounting

There still are valid questions about how the accounting regime for Annex 1 countries should be applied to developing countries. In the simplest form, Tier 1 accounting, the data requirements are slight, but there is a substantial uncertainty margin about the estimates as default assumptions are used. Tier 2 accounting, which makes use of nationally-derived default values, is within the capabilities of any country that involves universities and research institutions in the relatively simple measurements. TAnv6

Figure 1. Parts of a land cover change matrix that are included in the emission calculations under various forms of RED/REALU rules



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1.3 Co-benefits on paper vs. multiple benefits on the ground

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Although the annual net deforestation rate is considerably lowered by afforestation and reforestation — mainly industrial monoculture plantations in China, India and Vietnam (FAO 2006) — such activities cannot compensate for the loss of primary forests. Nor can they disguise the fact that the conversion of primary forests has significant negative impacts on biodiversity, livelihoods and the carbon balance. This raises concern because the sustainable provision of ES is vital in light of demographic developments, the increasing impacts of climate change and persistent problems in supporting the basic needs of the world's population.

The mitigation of forest-related emissions is the most focused forest ES, making up for approximately 20 percent of all anthropogenic emissions (IPCC 2007b). This is on the one hand due to the important role forests play in the global carbon cycle and, on the other hand, to the increasing public and political awareness of the risks and consequences associated with climate change. Last but not least, the mitigation of emissions from forests is considered to be a relatively cheap option compared to technical measures (Stern 2007). However, mitigation of forest emissions is complex and is intricately linked to the issue of adaptation, because diverse and resilient ecosystems are a precondition for future mitigation under less suitable climatic conditions. In addition, adapted ecosystems are essential for effective reduction of disaster risks and for securing food and water supplies (CBD 2006; Gullison et al. 2007; IUFRO 2009).

Recognizing the failure of past efforts to curb deforestation in developing countries, substantial efforts have been made to tackle these emission sources by way of an agreement as part of the international post-Kyoto climate regime (Dutschke and Pistorius 2008). In this context, Bali decision 2/CP.13 paved the way for the negotiation of an international mechanism aimed at effectively Reducing Emissions from Deforestation and Degradation in developing countries (REDD). The idea of the mechanism is to provide performance-based incentives to developing countries that successfully reduce their national deforestation and degradation rates. Beneficiary countries would develop and implement national REDD strategies that address their specific circumstances. This allows national sovereignty to remain untouched and the large variability of drivers and underlying causes of deforestation to be addressed (Geist and Lambin 2001; Kremen et al. 2000).

Although the intention was to keep the mechanism simple, many technical and political questions arose in the context of the negotiation process (Dutschke and Pistorius 2008). Nevertheless, communities, environmental NGOs, project developers and other stakeholders have begun to implement a series of promising pilot activities and projects; many more are on the verge of being developed. Currently, most pilot activities are supported and funded in selected countries through new initiatives such as the World Bank's Forest Carbon Partnership Facility (FCPF), the UN REDD program and traditional bilateral development assistance. These pilot projects can be crucial in showing that curbing deforestation is feasible and that forests are beneficial for local livelihoods as well as for the conservation of biodiversity.

This article outlines the implications of the implementation and governance of sound REDD activities at the project level, despite the many unresolved issues and uncertain progress of the international negotiations.

State of the negotiations

Many UNFCCC Parties — which are also members of the Convention on Biological Diversity (CBD) — are aware that biodiversity and livelihoods of local communities may be affected by REDD and refer to these other effects as "co-benefits." In order to avoid further complications there is some consensus among the Parties to the UNFCCC that any REDD mechanism should focus on the storage of carbon as its main objective. Hence, if activities are multi-beneficial, the storage of carbon and its monetary valuation could be considered as the creation of a common currency for the delivery of other regulating and non-material ES such as the conservation of biodiversity, hydrological services or scenic beauty (Fry 2008; Wunder 2005). Carbon payments would provide as valuable an alternative to the use of provisioning ES as, for example, the harvesting of timber or non-timber forest products. Targeting only one ES runs the risk of compromising the multi-functional nature of forests at the cost of other ES and livelihoods.

Although indigenous peoples won much recognition in the REDD negotiations in terms of their rights, biodiversity is still considered hard to grasp, vague in definition and extremely difficult to measure and compare. This has important implications for project developers. They should keep in mind that REDD will most likely be an international transfer mecha-

Implications for the integrity of REDD projects

Multi-beneficial project activities

While reducing deforestation and forest degradation is generally beneficial for biodiversity, co-benefits do not simply happen. Project activities that generate multiple benefits include establishing new forest protected areas (FPAs) or improving the effectiveness of existing FPAs (UNEP/CBD/AHTEG/BD-CC-2/2/3 2009). FPAs can be considered cost-effective long-term measures that target several environmental objectives of a site, help to maintain the environmental stability of surrounding regions, and contribute to the Millennium Development Goals by supporting rural development and employment (Andam et al. 2008; Millennium Ecosystem Assessment 2005a). It is important to reiterate that FPAs do not exclude use rights; low-impact resource use for the benefit of the local people can be allowed in buffer zones to a certain extent, depending on the IUCN category assigned to the site. Although much global forest biodiversity is harboured within FPAs, the majority of it is still contained outside of areas designated for conservation.

Other multi-beneficial activities include the ecological restoration of degraded land and forest ecosystems (UNEP/CBD/AHTEG/BD-CC-2/2/3, 2009), which might become an eligible project activity if the scope widens to REDD+. The World Conservation Monitoring Centre (UNEP-WCMC) defines restoration[1] as the effort "to re-establish the presumed structure, productivity and species diversity of the forest originally present at a site. (In time, the ecological processes and functions of the restored forest will closely match those of the original forest)." Like FPAs, forest restoration makes a multi-beneficial contribution to both mitigation and adaptation because emerging stands of adapted native tree species which have survived the pioneer phase are likely to better adapt than monoculture systems to rapidly changing climatic conditions. The same holds for carefully managed secondary forests, which despite their extent, value and potential are largely ignored in present forest policies and practices (ITTO 2002).

Restoration activities are technical and silvicultural challenges, however, especially on eroded soils. At least initially they require intensive silviculture management. The introduction of sustainable management of forests and best practice guidance will be important, both in buffer zones of FPAs and in other forest ecosystems subject to human resource use. Project activities aiming at implementing restoration and introducing best management practices can help considerably to reduce the pressure on remaining natural forests, especially if these initiatives are planned and implemented in a participatory manner that respects the local population's resource and livelihood needs. In order to gain lasting local support, "participatory" means that the project objectives should be developed in a cooperative manner by all relevant stakeholders, rather than restricting participation to hearings and subsequent information campaigns on potential project consequences and expected benefits. The question is not whether participation guarantees acceptance, but rather how participation has to be structured in order to generate local support. Prior assessments of the local circumstanc-

es, demands and resources[illegible]

versity Standard (CCBS) or the Plan Vivo Standard could be followed. They have been developed to avoid malpractice in forest projects subject to voluntary carbon markets. The CCBS appears to be particularly suited to REDD due to its focus on the socio-economic and environmental benefits and evidence of their delivery. In addressing both socio-economic and ecological criteria, the CCBS provides flexible regulations and guidance for the development of a comprehensive project design.

Conclusions

Most recent initiatives to curb the loss of forests have not resulted in significant changes; deforestation is continuing at an alarming rate and is impairing vital ES at the global and at the local level. Without strong political will, international cooperation and new policy instruments, forest resources are expected to continue to decline for the next 30 to 50 years (Chomitz 2007). Postponing changes in global forest treatment may be fatal for coming generations because the value of the destroyed ES is tremendous and the loss of natural forest ecosystems is irreversible. Effective investments to reverse this depletion of natural resources can considerably reduce the future costs of adaptation. In this context, the REDD process created momentum for reducing emissions from forest destruction while simultaneously addressing other urgent environmental and development objectives.

There is as yet no political decision on REDD, and COP 15 in Copenhagen as well as its follow-up process may produce unexpected outcomes and compromises. Instituting better protection and a more sustainable use of forest resources will remain one of the main environmental challenges of this century. In the context of REDD or REDD+ and from a conservation perspective, concepts for a sustainable management of forests at the landscape level should pursue three main objectives: maintaining the natural character of remaining primary forests; the ecological restoration of degraded land and forest areas; and a careful use of secondary forests which reduces ecological impacts to a minimum and allows for subsequent recovery.

The reputation, permanence and overall performance of REDD will depend on its environmental and social integrity. Progress needs to be measurable and visible to maintain the willingness of industrial countries — and, potentially, private investors — to compensate for the loss of deforestation for development, especially in times of economic crisis. REDD pilot activities and projects can make an important contribution, at least to the progress of the political process. It is crucial that they show that it is possible to simultaneously and comprehensively address all three dimensions of sustainability and to generate multiple benefits for the environment and the people who depend on forest resources. Forests are worth more than the sum of their parts and in terms of adapting to climate change it would be shortsighted not to consider biodiversity and/or livelihood needs on the ground.

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Enjoying the climate change mitigation potential of improved tropical forest management while promoting biodiversity protection and enhancing social welfare will require a system of monitoring and verification that applies to more than carbon stocks. The challenge is to avoid burdening the new climate change agreement with too many restrictions that are not directly related to climate (

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Section 2

Country-level REDD experiences

In terms of international climate policy, the single most important issue being discussed (see, for example, FCCC/SBSTA/2008) is reducing emissions from deforestation and forest degradation (R

stress sustainable development in general, or poverty reduction and biodiversity in particular, as important potential co-benefits of reducing deforestation and forest degradation. There is no unconditional relationship between them, however; rather there is a need for preparedness in this area on the part of both the initiatives and the host countries.

Baseline determination and the participation and involvement of indigenous groups in REDD are the two topics that receive most of the attention. They are of crucial importance and will need to be addressed in some way by the UN decisions. This study focuses on the analyses of the four host countries according to two features: availability of baseline information, and procedures to ensure sustainability.

REDD initiatives

In the Bali Action Plan (UNFCCC, 2007), adopted at the 13th Conference of the Parties (COP 13) of the United Nations Framework Convention on Climate Change (UNFCCC) in 2007, Parties are encouraged to "explore a range of actions, identify and undertake efforts, including demonstration activities" to address the drivers of deforestation and reduce emissions. Since the meeting, a number of proposals have been presented on ways to create incentives and mobilize resources for REDD activities. Several pilot projects and initiatives have also been launched with the aim of developing methods for REDD.

This analysis focuses mainly on two of) initiative((DP(UNDR

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prepare countries for whatever outcome the negotiations may have. This means that on the one hand they must act quickly, but on the other hand they are prevented from taking quick action.

So far, most REDD pilot activities are at the planning stage and have not yet reached full implementation. A number of challenges and issues have already been identified. The large number of initiatives requires coordination in order to use resources efficiently and avoid duplicating efforts. Many countries host more than one initiative; it is crucial that they do not end up drowning in forest administration work in order to meet different requirements from different donors.

The task of getting countries ready for REDD is difficult, whether there are 37 (FCPF) or nine (UN-REDD). Reducing deforestation will require extensive institutional reform and capacity-building in most tropical countries. Weak institutions and a lack of governance in areas such as property rights and law enforcement are important contributors to deforestation. Corruption and a lack of institutional and human capacity, are other underlying drivers. These problems will not be solved easily. They require long-term commitment and political will.

Deforestation is also driven by a large number of external factors that cannot be dealt with only through institutional reform and capacity-building. These include political as well as economic factors — such as prices for timber or agricultural products — that affect opportunity costs for land. In the long run, any ambitious REDD scheme will have to take these factors into account, find methods for calculation and monitoring, and build systems for compensation, based not only on carbon stocks and changes in them, but also taking into account opportunity costs for land use.

Case studies

The four case countries — Bolivia, Cameroon, Costa Rica and Sri Lanka – were chosen to represent the range of characteristics of potential REDD countries and the extent to which the outcome of REDD activities can be expected to differ. Bolivia, Cameroon and Costa Rica are all part of one or more REDD-initiatives; Sri Lanka is not involved in any REDD initiative. The countries have been analyzed based on their readiness for REDD in terms of baseline preparation and sustainable development.

Readiness for baseline development

The readiness of the case countries for establishing baseline scenarios was assessed using three criteria:

- the availability of information and data sets;
- the availability of national forest inventories; and
- ongoing activities and developments with regards to REDD.

The analysis shows both differences and similarities in preparedness.

Due to non-existent inventories and poor monitoring systems the case studies lack reliable country-level data on forest areas and related carbon stocks, emissions and trends. Costa Rica has historical and current data on forest cover that can serve for determining a baseline scenario, but Bolivia, Cameroon and Sri Lanka will need more assistance in data collection. Even Costa Rica, which has conducted fairly extensive forest inventories, did not usually estimate biomass as part of its inventory. This kind of data is essential for reliably determining carbon stocks in different forest types. Large discrepancies due to a lack of accuracy in available data also make comparative analyses problematic.

Bolivia, Cameroon and Costa Rica all have systems in place for remote sensing inventories of forest area, but few field inventories have been made. This lack of field data is often due to remote and inaccessible forest areas in combination with limited financial and technical resources to conduct field missions. Further, the capacity to acquire and analyze forest data is often limited. In all the case study countries a lack of understanding of the drivers of deforestation, and inefficiencies in coordination among institutions involved in land-use planning, among other factors, also constitute obstacles to the formulation of a baseline and the eventual establishment of accurate REDD monitoring systems.

Readiness for sustainable development

The potential to generate and monitor sustainable development benefits was assessed using four indicators:

- tenure and property rights;
- institutions for participation and stakeholder dialogue;
- existing data and monitoring of indigenous peoples' and forest dwellers' dependence on forests; and
- institutions for conserving/promoting and monitoring biodiversity and other ecosystem services provided by forests.

The impact of indigenous and local community involvement on REDD processes is still unclear, but such involvement is generally seen as a prerequisite for a democratic and inclusive implementation that can potentially safeguard benefits for the poor. Participation does not guarantee that stakeholders' views are taken into account, however, especially if they conflict with other interests. Participation requires human and financial capacity. Those who lack capacity and resources risk not being heard, even where mechanisms for participation are in place. This is why many indigenous representatives argue that consent, not just consultation, should be included in the agreements.

The study shows that most countries still have a long way to go to strengthen institutions and build capacity for designing and implementing sustainable development policies. The case countries, like many other developing nations, lack fully defined property rights and the institutions for enforcing them. The most positive example is Bolivia, where a law recognizes indigenous peoples' land rights and rights to collective ownership (although implementation has been slower than expected), and there are mechanisms for involving relevant stakeholders. Indigenous stakeholders and actors in the forestry sector have been

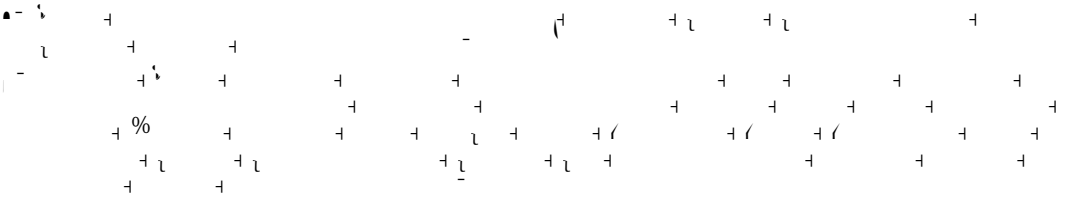
consulted in the development of a national REDD position (Bolivia 2008). The political position of indigenous peoples in Bolivia is exceptionally strong compared to most countries. Although the indigenous peoples are well organized and relatively powerful

Several issues are crucial in designing an efficient REDD system that leads to actual reductions of CO_2 emissions. An important aspect of baseline definition is what type of information it is based upon. Establishing baselines scenarios is not just a technical issue; it has profound implications for environmental integrity, cost efficiency and distribution of REDD funds. Cameroon, a country with a historically low deforestation rate, would be best served by taking future pressures on forests into account and not focusing merely on historical data. The country's REDD strategy is to be based on the estimation of future emissions from deforestation and forest degradation. Costa Rica, which is not a typical REDD country struggling to reduce deforestation and forest degradation, should try to obtain REDD funding for maintaining and further developing its national forest conservation program (included in the REDD+ discussions under the UNFCCC negotiations). Whether these different approaches will be allowed in a future REDD scheme still remains to be negotiated.

A great amount of work will be needed to get countries ready for REDD. All the case countries have a long way to go before credible emission baselines can be established and inclusive and equitable REDD processes can be implemented. Data from historical and recent forest inventories need to be compiled, systems for monitoring and assessment need to be established, institutions for forest law enforcement need to be strengthened and procedures for participatory processes must be put in place. This will require both financial and technical assistance; development cooperation can be an important part of this stage of preparations. It is also important that the focus on REDD not diverge attention and funds from other development goals. REDD investments should be additional to existing development cooperation, not in competition with it.

It should be stressed that although the focus on REDD can be an opportunity in terms of attracting investors' interest in forest issues, REDD is not the only option. It may be hard to include all countries in a REDD scheme because of the difficulties with establishing credible baselines and reliable systems for monitoring. A broader attention to sustainable forest management in general, including reforestation activities and tenure rights issues, could be both an alternative and a complement to REDD initiatives and possibly have relevance for countries that are not directly targeted by REDD or choose not to take part in it.

Endnotes



Further reading

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2.2 REDD strategies: A case study from Mexico

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Introduction

Worldwide, people involved in the promotion of sustainable forest management and forest conservation have high expectations of the possible inclusion of Reducing Emissions from Deforestation and Forest Degradation (REDD) in the international climate convention to be agreed to this year in Copenhagen (Parker et al. 2008). Ongoing discussions and research have paid considerable attention to the design of methodologies enabling countries to quantify carbon stocks, carbon sequestration and emission reductions. Involved parties have requested the inclusion of regulations that guarantee environmental integrity, biodiversity conservation, indigenous rights and poverty reduction, among other things (Seymour 2008).

Only under special circumstances can existing programs for community-based forest management and conservation be used as a suitable REDD strategy.

Less attention has been paid to the strategies that individual countries can use to reach the desired reduction in deforestation and forest degradation. Countries interested in participating in future REDD schemes are expected to become "REDD-ready" and to draw up their own strategies as considered appropriate under local circumstances. Some researchers question the capacity of national governments to influence deforestation rates in the first place. Deforestation is often triggered by macro-economic factors that are difficult to influence and not all governments have the capacity to implement intervention programs. Moreover, decision-making by national governments is influenced by multiple actors, interest and processes and is not based only on economic arguments as is implicitly assumed in market-based REDD proposals (Karsenty 2008).

Mexico differs from most developing countries in that property rights over land and forests are secure, and most of the land — estimates range between 53 and 80 percent — is owned by indigenous and agrarian ejidos communities (Klooster 2003; CONAFOR 2008). To reduce deforestation and forest degradation the country has to consider local people's interest and capacities. Mexico has a relatively well-established institutional capacity (Kaimowitz 2008) and considerable experience in implementing forestry programs.

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Mexico has been actively involved in discussions on REDD, participates in the Forest Carbon Partnership Facility (FCPF) of the World Bank and is currently elaborating a REDD readiness plan. A readiness plan includes the developmenthe

projects that are "additional to" the business-as-usual scenario represent a net environmental benefit.
- Leakage occurs when there is an increase in carbon dioxide emissions in one region or country as a result of a reduction in emissions by another region or country. Although national governments will have difficulty preventing international leakage, within countries or within certain regions they will have to demonstrate that reducing deforestation in one area does not cause additional deforestation in another area.
- Non-permanence involves the risk that emission removals by carbon sinks are reversed, because forests are cut down or destroyed by natural causes.

These three concepts have been discussed extensively in the literature (for example, Angelsen and Wertz-Kanounnikoff 2008) and are used to analyze the suitability as REDD strategies of the forestry programs discussed here.

Mexican REDD strategy

Mexico proposes to reduce forest related emissions by incorporating REDD in its existing forest programs. These initiatives — which include National Protected Areas, Wildlife Management Units, Sustainable Forest Management, Payment for Ecological Services and Forest Pest Control — are expected to reduce deforestation by 310,100 ha between 2007 and 2012 (De Jong et al. 2008). Communities or private forest owners are invited to participate in the program but their involvement is voluntary. Contracts between the forest owners and the Forestry Commission of Mexico (CONAFOR) will establish the activities to be implemented and the payment conditions. According to CONAFOR (2008), the amount paid for REDD activities needs to be attractive enough to compete with alternative land uses and pay for the activities needed to implement the project.

The authors have analyzed the following CONAFOR programs in terms of their suitability to be included as part of a possible REDD strategy:

1. a community forestry program (PROCYMAF);
2. payments for hydrological services (PSAH); and
3. payments for carbon sequestration (CABSA-carbon). In 2006, PSAH and CABSA were combined to create a payments for environmental services (PSA) program.

The Community Forestry Program helps communities to organize, plan land-use options and implement activities that bring economic benefits. Activities often build on existing management initiatives. Communities sell timber and other products on the market; regulations on forest use guarantee sustainable use and conservation of the forest (CONAFOR 2003; Bray, Merino and Barry 2007).

The Payments for Hydrological Services program pays land-owners (in general, communities) a fixed amount per ha for the water services provided by the forest on their land. Land-owners commit to leaving the forest intact and protecting it from illegal logging and forest fires. They signed five-year contracts, after which time they will have to find alternative buyers for the services provided by the forest (Gonzáles Guillén 2008).

The Payments for Carbon Sequestration program pays land-owners to develop a carbon sequestration project to sell this service on the market. Initially the government also paid for the carbon sequestrated by the projects.

Contribution to REDD objectives

contribute to a varying extent to the objectives formulated under REDD++: avoided deforestation, reduction in forest degradation and increase carbon stock inside and

REDD

REDD objectives	Payments for hydrological services	Payments for carbon sequestration	Community forestry
Avoided deforestation	+/—	—	+/—
Reduce forest degradation	+	+/—	+
Increase carbon stock in forest	+	+/—	+/—
Increase carbon stock outside the forest	—	+	—

Community forestry has been widely recognized for making a significant contribution to the management and conservation of communal forest areas in Mexico. According to Bray and Klepeis (2005, 214), "the institutional development that corresponds to reduced deforestation rates is rooted in community-managed lands that receive environmental NGO and federal support." Durán-Medina, Mas and Velázquez (2007) and De Jong et al. (2008) show that deforestation rates in communities and *ejidos* with forest management activities are lower than in unmanaged areas. PROCYMAF has contributed significantly to the strengthening of existing community forest management institutions and has promoted the creation of these institutions where they did not previously exist. These actions have led to a decrease of pressure on the communal forest areas for alternative land uses.

No studies have evaluated the effect of community forest management on forest degradation or carbon stock. Karky (2008) and Murdiyarso and Skutsch (2006) have shown that carbon stock in community-managed forests has the potential to increase over the years. Under the Community Forestry program in Mexico, communities are encouraged to extract and sell forest products. There may therefore be less carbon stock enhancement in community forests in Mexico than in countries where forest use is more restricted.

The payments for water services program (PSAH) is relatively new. It targets communities and *ejidos* with communal forests that have at least 80 percent crown cover, since these forests make a large contribution to the provision of water downstream. Most of these communities already conserved their forest, and initially most payments have been made to forest areas assigned to conservation purposes. Braña Varela (2007) showed that from 2003–06 PSAH allocated 4, 11, 7 and 6 percent of the payments, respectively, to areas with a high deforestation risk. PSAH has thus contributed in only a limited way to the reduction of deforestation.

The effect of the PSAH program on forest degradation may also be limited, since most payments are allocated to areas with a minimal degree of forest degradation (Gonzáles Guillén 2008). Communities have complied with conservation objectives; less than 0.01 percent of the nearly 300,000 ha paid for by the program was deforested between 2003 and 2005. These areas were mainly lost to forest fires, not land-use changes (Karousakis 2007). Management activities carried out by the *ejidos* and communities — such as fire prevention and control of illegal loggers — can be expected to have a positive effect on forest carbon stock, although there are no studies to confirm this.

Farmers and communities showed considerable interest in carbon sequestration projects but few project ideas were accepted and even fewer proposals were financed. The carbon sequestration potential of the CABSA program was further reduced after the introduction of Clean Development Mechanism (CDM) requirements in 2006 (Corbera, Soberanis and Brown 2009). Due to the limited number of proposals implemented the government program on carbon sequestration can be considered a failure. Other CONAFOR programs, which pay farmers for improving and establishing agro-forestry systems, have been implemented by a greater number of farmers and communities. These schemes could also be used to sequester carbon although they do not comply with CDM regulations either.

Carbon sequestration projects run by NGOs such as Scolel-Té and SAO show that carbon sequestration can generate income for farmers and communities. Scaling up these projects is difficult, however, due to the considerable technical and administrative assistance needed. Moreover, none of the projects has been able to comply with CDM regulations; evaluators consider these projects too risky to invest in due to the large number of actors and activities involved (Lövbrand, Rindefjäll and Nordqvist 2009).

All three programs have the potential to contribute to REDD objectives but none of them has exploited this potential fully up to now. PROCYMAF and PSAH have mainly been implemented in communities that were already conserving their forest. PROCYMAF did manage to increase the value of the forest to the communities and reduce the pressure on the forest for alternative activities. PSAH was able to enhance people's understanding of the value of their forest. This awareness has led to multiple local and regional negotiations on local payment schemes for water services. CABSA has had scarce impact on REDD objectives but it might have some potential if adapted to local production systems, as shown by other government schemes and NGO-run carbon sequestration projects.

Compliance with REDD requirements

Additionality

Both PROCYMAF and PSAH specifically target *ejidos* and communities that have maintained forest cover over time to benefit from the products or services provided by these forests. The fact that the communities still have forests to be considered by these programs means that they have maintained forest stock over time and that the forests are not at immediate risk of deforestation. Since studies on the effect of these programs in Mexico confirm that most communities and *ejidos* would have conserved their forests

anyway (Karousakis 2007), according to the additionality principle they would thus not be eligible for REDD payments for avoided deforestation.

PROCYMAF, PSAH and to some extent CABSA are more likely to contribute to the REDD objectives of reduced forest degradation and increased C stocks.

struggle over resources between the government and communities (Klooster 2003). This struggle continues when government decrees protected areas within community lands, which severely limits local access to forest resources.

Other factors can help assure permanence. The areas dedicated to carbon projects are generally small and tree products can still be harvested. The use of land for carbon sequestration is not as restrictive as that required by other programs and the investments made may even enhance agricultural production.

Analysis

The main objective of REDD is to reduce deforestation and forest degradation and to increase the carbon stock in biomass both in and outside of the forest. The three programs analyzed have the potential to achieve these goals. Their potential to reduce deforestation is considerably lower. Although forest management activities by rural communities are recognized to have reduced deforestation over time, they are unlikely to be able to demonstrate additionality over a short time span as will probably be required by future REDD schemes. Farmers and communities in Mexico are thus likely to benefit more from payments based on reduced forest degradation and enhanced carbon stock in their forest areas than on those for reduced deforestation.

Mexico is considering generating carbon credits at the national level through the implementation of programs for community forestry and payments for environmental services. It has been shown that these programs can contribute to REDD objectives. They do not, however, automatically generate carbon credits according to international regulations. The three programs are not targeted to mitigate carbon emissions or sequester carbon; rather, they are aimed at the management and conservation of remaining forest areas to prevent further deforestation and degradation and to preserve the multitude of environmental services provided by these forests. The unilateral focus on carbon sequestration in the discussions on the design of a REDD scheme, especially on the additionality principle, could severely limit the potential of developing countries to reward rural communities for their past and current forest management and conservation practices.

Although communities could receive REDD payments for reduced forest degradation and enhanced forest stock, these payments engender several complications:

- to enhance carbon stock in the forest, communities will have to limit the extraction of forest resources they need for survival. As Karky (2008) has shown for Nepal, people will not choose carbon payments over the use of forest products and are unlikely to be willing to stop harvesting forest resources;
- the amount of carbon saved through reduced degradation or sequestered through enhanced carbon stock is relatively small. Transaction costs to participate in a REDD program are likely to be high, as they are for CDM, and may absorb the biggest part of these benefits. The combination of these two factors may hinder participation in REDD projects for most communities;
- REDD conditions are expected to demand long-term commitments from communities, which is not in their interest. Studies on community-enterprise partnerships

have shown that communities may profit from partnerships with private enterprises but only when the contracts are short term and can be renegotiated easily (Vermeulen, Nawir and Mayers 2003); and

- a lack of flexibility in decision-making on land use reduces local people's capacity to adapt to changing circumstances, such as those caused by climate change itself.

Apart from these arguments, the permanence of land-use practices that absorb rather than emit carbon is most likely to be achieved by investing in systems that can guarantee the livelihoods of local people without depending on the international carbon market. Power relations between local sellers and international buyers are too unequal to expect contracts to equally reflect the interest of both parties (Brown and Corbera 2003). Moreover, the carbon market cannot guarantee a fixed or even minimum price for the carbon credits provided by communities; this creates additional insecurity.

Conclusions

The existing programs for community based forest management and conservation can be used as a strategy to comply with REDD objectives only under certain circumstances. If farmers and communities have to comply with international REDD requirements it is unlikely that they will be eligible. They do not comply with international requirements and it is likely that the CDM experience (which did not involve local people) will be repeated (Brown and Corbera 2003).

This could change when governments establish a national accounting system for carbon emissions and sequestration. Governments would receive international payments based on a general reduction in emissions and be free to allocate these payments where they consider them most effective, both economically and socially. The current programs that contribute to REDD objectives, even though they have difficulty complying with international requirements, could then constitute an effective way to reduce carbon emissions. The task of complying with international standards would be dealt with at the government level. Governments would have to formulate a national payment system to pay for forest conservation and management efforts at the local level. International requirements thus need to be translated into national requirements to enable local people to benefit from REDD payments. This observation is in line with Pokharel and Baral (2009), who urge the Nepalese government to "Nepalize" their REDD strategy. Although the Mexican government is expected to have the will and capacity to incorporate local circumstances, this might not always be the case elsewhere and may constitute a major challenge for most developing countries.

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2.3 Guyana's Low Carbon Development Strategy

Guyana is a tropical country on the northeast coast of South America and is part of the Guiana Shield. Forests occupy 75 percent of the total land area of 21.5 million hectares, and Guyana's forest industry is an important component of the country's economy.

Guyana is a net sink for carbon: it has a low deforestation rate of 0.1 to 0.3 percent according to the FAO. The country makes a relatively small contribution to global greenhouse gas emissions while absorbing a high level of carbon through the preservation of a large portion of its forests. Guyana thus avoids the emissions associated with development paths chosen by some other formerly forest-rich countries.

Guyana is trying to use its forests to mitigate climate change and is one of the first forested countries in the developing world to make a serious commitment to a strategy to promote a low-carbon development path.

In spite of its large extent of forest cover, Guyana is highly vulnerable to climate change, especially since its coast — where approximately 90 percent of the population resides — is significantly below sea level. Guyana is a developing country and its government recognizes the need for economic growth and the utilization of natural resources. Guyana is one of the first forested countries in the developing world to make a serious commitment to a strategy to promote a low carbon development path. Existing international agreements such as the Kyoto Protocol provide a source of revenue only to countries that favour projects that replant trees after they have been cut (reforestation) or plant new forests where no forest existed (afforestation). They do not reward countries such as Guyana that have kept their forests standing through effective policies and sustainable forest management practices.

On June 8, 2009, Guyana's President Bharrat Jagdeo formally launched Guyana's draft Low Carbon Development Strategy (LCDS). The strategy has several important components:

- ways in which Guyana can deploy its forests in mitigating climate change while gaining financial and other support for doing so;
- ways in which the country can move into a low carbon development path; and

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The **Office of Climate Change** is part of the Office of the President, Guyana.

- how the country can be further protected from the effects of climate change (adaptation).

The LCDS aims to enable overall national development in the process.

According to President Jagdeo, "the people of Guyana are willing to act and work with others with a similar vision to break the false debate which suggests that a nation must choose between national development and combating climate change. Instead we should be asking how we can forge prosperous low carbon economies where national development and combating climate change are complementary, not competing, objectives."

At the launch of the LCDS, the President said that the international community needed to address deforestation within the new climate agreement replacing the Kyoto Protocol: "This will require [first a] proper incorporation of incentives to reduce and avoid deforestation within the Reduced Emissions from Deforestation and Degradation mechanism, commonly known as REDD. Two, the new climate regime must establish REDD at the scale required – where forestry payments are not only included within the post-Copenhagen agreement, but are also capable of generating the amount of finances needed to outcompete the current international drivers of deforestation. And three, any REDD proposal must attract and sustain the support of the people of rainforest nations, including those who live in and depend on the forests."

Guyana is trying to use its forests to assist with climate change. Forests are excluded from the Kyoto Protocol, which expires in 2012, but countries like Guyana now argue that forests must be included in the successor agreement to be reached at COP 15 in Copenhagen in December 2009.

Including forests in the Copenhagen agreement will add greater value to them as a resource. A study carried out by the McKinsey Group estimated that the Guyana rainforest could provide revenues to the country of approximately US$ 580 million per year if exploited to its full potential. Guyana is therefore looking at receiving payments to maintain its standing forest, thereby avoiding deforestation, while at the same time providing biodiversity and ecosystem services to the world.

If the international community responds to Guyana's case for payment for preserving its forests, this money could be used for national development. One way by which Guyana plans to raise awareness in this issue is to present the LCDS at COP 15.

Since the strategy was launched, a large number of activities have been carried out to enable full involvement of the Guyanese people. One of the key elements of this approach is awareness and consultation sessions. The LCDS is presently being widely discussed across the country with key stakeholders and other interest groups to gather their comments and considerations. To support a high-level and effective process, the National Consultation and Awareness Process is being overseen by a Multi-Stakeholder Steering Committee (MSSC), chaired by the President. The MSSC meets weekly and includes representatives from government, youth, women, the private sector, indigenous NGOs, conservation

NGOs, forestry, mining and the International Institute for Environment and Development (IIED) which is providing independent advise to the process.

Since the launch of the strategy, 15 sub-national consultations have been held across the country, attended by 222 communities and 3,285 people (including the launch). An intense awareness and information dissemination campaign was launched at the same time. One element of this campaign was a series of awareness sessions that provided information on the LCDS and an opportunity for further and more specific discussion. Among those participating in the series were the forest producers and miners associations, women, labour, youth and community organizations and NGOs.

The LCDS process has received good reviews by local and international stakeholders. According to the World Bank's Guyana Country Representative, Mr. Giorgio Valentini, who attended the meeting of the national Toshaos (indigenous leaders) from all Amerindian communities in Guyana: "the process is very well managed, well designed, very open and transparent." Guyana is leading a group of 37 countries around the world that stand to benefit from the Forest Carbon Partnership Facility (FCPF), a Multi-Donor Trust Fund (MDTF) administered by the World Bank. A World Bank mission gave the strategy a "very positive assessment."

The government plans to continue the process of developing the LCDS and to set the stage for the way forward. The work to date and the leadership shown by Guyana needs support and commitment from the developed world, including the European Union and the United States. Norway has already committed to working with Guyana. Its efforts have to be matched by firm decisions in the Copenhagen agreement that will complement the programs to be instituted by Guyana and other developing forest countries. Guyana is clearly positioned to be a working model. The developed countries need to step up and give support.

Further reading

Guyana's Low Carbon Development Strategy. www.lcds.gov.gy.

2.4 REDD-projects supported by the HIER climate campaign

sub-national level. PPF is a non-profit organization that facilitates the establishment of transfrontier conservation areas (TFCAs), also known as peace parks. For the Peace Parks project, a Memorandum of Understanding was signed by PPF and the Zambian Ministry of Tourism, Environment and Natural Resources and between PPF the United Nations Food and Agricultural Organization (FAO).

The PPF Climate Change Program (CCP) is developing a toolbox using an iterative process in the Zambian component of the Kavango-Zambezi (KAZA) TFCA (Figure 1). The tools can be used for the implementation of climate change mitigation projects in land use, land-use change and forestry (LULUCF). They focus on REDD in developing countries, including the REDD+ option, which includes conservation issues. The development of the toolbox is phase one of a larger LULUCF program on climate change mitigation, and will be concluded in 2010.

Figure 1. Study area, Kavango-Zambezi Transfrontier Conservation Area

Since the exact details of a post-2012 REDD scheme have yet to be defined, the CCP has adopted an approach that aims to explore potential implementation methodologies of REDD projects at a sub-national level. The experiences from the project are being used to inform the approaches under development for a national REDD strategy, as Zambia is a pilot country for the UN REDD initiative.

Seven tools are being developed:

- scenarios methodology; and
- carbon trading platform.

The Dutch Postcode Lottery has generously donated €1 million towards the project. As well as establishing a Climate Change Unit, an ecological and spatial assessment of land-base climate change mitigation projects, a financial feasibility of climate change mitigation projects and a voluntary and compliance carbon market review preceded the development of the toolbox.

Various consultants have been appointed to inform and peer-review the toolbox. Zambian Steering, Executive and Technical Committees have been established. The Tribal Authorities in the area support the initiative; a system to work in partnership with them has been devised, and initial community meetings have commenced.

For the project area identification tool, existing databases were searched, permission to utilize data was sought and some layers have been loaded. There is a strong emphasis on mapping biological and social data spatially using GIS. The methodology to quantify current carbon stocks has also been devised. Land cover from remotely sensed data has been determined and biomass data from 50 sample plots has been collected. Information from Light Detection and Ranging (LiDAR) has been obtained for the plots. The relationship between land cover classes, field biomass data and LiDAR data will be evaluated. The monitoring of the methodology for future carbon stocks will be informed by the results of current carbon stocks quantification.

Fire frequency has been elucidated from remotely sensed data; in addition, stakeholder interviews were held concerning the use of fire and potential management options were developed. The fire fuel load — the amount of potential combustion materials, an important driver of fire size and severity — has been quantified for 2009. A management strategy is currently being written.

It is important to keep up to date with the latest policy negotiations, debates and scientific findings in the REDD arena.

As Zambia is a pilot country for UN REDD, and a national strategy is being formulated, it is important that the findings of the current study inform this process and vice versa. PPF has had several meetings with UN REDD Zambia and has submitted methodologies for carbon stock assessment and social baselines. PPF and UN REDD have agreed to collaborate closely in the future.

Some of the information required by the voluntary and compliance standards is difficult or costly to obtain. In addition, research has shown that using satellite imagery to calculate the above-ground woody biomass component of forests has greater uncertainty for low biomass values than for high biomass values. For example, savanna forests have an estimated mean biomass of 77 Mg ha^{-1} compared to closed evergreen lowland forests, with mean values of 216 Mg ha^{-1}. Measuring biomass and demonstrating changing values over time to a given level of accuracy may thus be more difficult in savanna forest systems.

Applying the standards to practical actions can also be complex; for example, classes in existing land-cover maps may not be directly transferable to the definition of "forest" set out in REDD.

It is extremely challenging to get all relevant stakeholders to participate in such projects and take ownership of them. The community workshops have taken the starting point as "what works" from the community perspective. Identifying the factors behind the successes — and failures — of existing initiatives assists in the development of appropriate and workable projects.

Conservation concessions in Indonesia

Deforestation in Indonesia is proceeding rapidly, due to legal and illegal deforestation and forest fires. The country therefore makes a relatively high contribution to GHG emissions. Deforestation and degradation of Indonesia's species-rich tropical Indonesian rainforests are a serious threat to global biodiversity and to the people whose livelihoods depend on the forests. Avoiding deforestation and degradation of the forests in Indonesia can thus help significantly in fighting climate change and protecting biodiversity.

De Vogelbescherming (Birdlife The Netherlands) is working in Indonesia with their country Birdlife partner Burung Indonesia. Their work on REDD focuses on obtaining forest concessions for conservation. Until 2004 it was not possible under Indonesian legislation to obtain a concession for nature conservation of a forest that was destined for production. Burung Indonesia's lobby ensured that the legislation was changed. This provides nature conservation organizations with the possibility, through a complicated juridical construction, to bid for concessions with the goal of protecting and restoring the forest.

Burung Indonesia wants to contribute to avoiding deforestation by protecting at least one million ha of forests through these conservation concessions and by developing a forest restoration program with the local communities.

Sulawesi

The organization is trying to obtain a concession of 70,000 ha in Gorantalo, Northern Sulawesi. It wants to protect this forest, which is in a relatively good condition, and g[illegible] l g[illegible]

out to determine the threat of deforestation to the forest, the risk of leakage and the amount of carbon per hectare.

araguay

IUCN NL, together with Guyra Paraguay, looked into the possibility of auctioning some forest sites in the Chaco, Paraguay. Unfortunately, it was concluded that Guyra Paraguay could not identify forest lands for auction within the timeframe of the project. This was mainly due to the land rights situation in the country, which is not transparent or stable. Although several indigenous groups (backed by the constitution) claim rights to the land of their ancestors, these claims often overlap or are for the wrong location.

Furthermore, expansion of cattle ranging is causing a high deforestation threat and a steep increase in land prices. In addition, land prices increase as soon as land-owners sense interest in their property. Nature conservation organizations find it difficult to compete in such a market, even if they are supported financially by the selling of carbon credits.

Belize

The International Tropical Conservation Foundation (ITCF) in Belize was able to deliver lands for auction. Land rights are straightforward in Belize and the government demanded only a small percentage of the royalties of the carbon credits sold. A carbon inventory was carried out according to CCBA guidelines and research revealed a serious deforestation threat from the expanding sugar cane for biofuels industry.

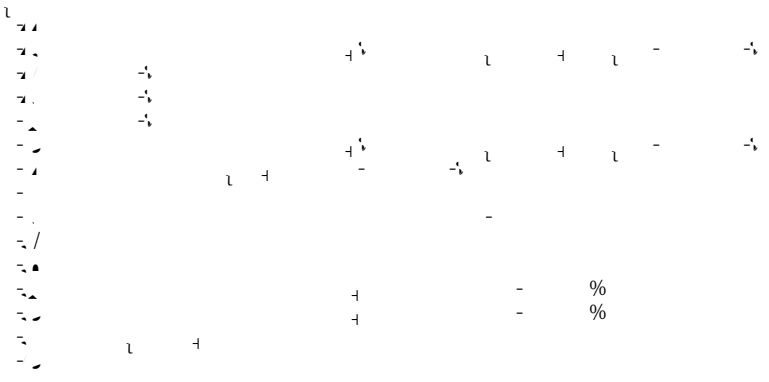
Unfortunately, the landscape auction project encountered some obstacles that led to its being terminated. The certification process needed more than nine months; this created a serious delay. Selling carbon credits without knowing that they will be certified is not appropriate. It was decided not to sell carbon credits and to present the project as charity in the framework of avoiding deforestation. Due to the global economic crisis, however, companies focused on their core activities and diminished their corporate social responsibility activities. Since the project did not produce carbon credits, companies viewed it as a donation that they could not afford. At the end there was not sufficient interest on the part of the corporate sector to raise a sufficient amount of money. The attempt to purchase forested land in Belize was cancelled, as was the inventory in Northeast India that had been planned with the Wildlife Trust of India.

In spite of the disappointing course of events the HIER climate campaign believes there is a future in linking private companies and local NGOs to prevent deforestation. As soon as the economy picks up again, companies will show interest, especially because the price of forest carbon credits is relatively low.

Problems that need to be tackled are the upfront financing required to purchase land and the slow and costly process of certification. This could be done by establishing a fund to finance the land purchases. More capacity is needed for the certification process; more local institutes need to be able to certify. Tailor-made certification can help decrease the high costs of this process, especially for small projects. A global monitoring institute for REDD is also needed.

Section 3

Forest management practices



3.1 Climate change: will it change how we manage forests?

Climate change has brought renewed attention and new ideas to forests and the forestry landscape. Novel initiatives are emerging that aim to manage forests specifically for climate change mitigation and adaptation. These new climate change-related objectives will potentially result in reinvigorated forest conservation efforts and alterations to forest management regimes. But how will the practical aspects of these new management approaches differ from those currently considered to be best management practices in forestry?

In climate change-generated activities in forestry, new actors must be cognizant of the lessons and constraints that have held back forest management in many parts of the world in the past.

Certainly, there are management actions that can reduce the long-term risks associated with climate change (i.e., adaptation strategies), but are they substantially different from other risk-reduction strategies, such as maintaining healthy and vigorous stands to reduce vulnerability to pests and diseases? There are obvious management strategies that could be implemented to maximize carbon sequestration in forests, but are they different from management aimed at, for example, maximizing timber productivity? And how does management for adaptation differ in practical terms from management for mitigation, or are there areas of overlap between these objectives? Finally, to what extent are forests around the world being actively and sustainably managed, such that management refinements can be considered appropriate or feasible?

Whether this new climate change-generated activity in forestry amounts to "making hay while the sun shines" or "selling old wine in new bottles" largely depends on whether or not the outcome of renewed interest is a step forward for forestry. If the outcome is to be more than just the hiring of an abundance of additional "experts" on forest management issues, participants must be cognizant of the lessons and constraints that have held back forest management in many parts of the world in the past. In defining the context and outlining the challenges that lie ahead, it is useful to look at forestry from the perspec-

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tives of climate change mitigation, climate change adaptation, sustainable forest management and current forest management.

Forestry and climate change mitigation

Box 1. Forest degradation, climate and ecosystem stability in Kalimantan: a vicious spiral?

The effects of forest loss and degradation have been observed to affect ecosystem-scale stability in Kalimantan, Indonesia, where protected lowland forests declined by more than 56 percent (more than 2.9 million ha) between 1985 and 2001. Several factors combined to increase the consequences of deforestation and forest degradation to the remaining forest (including intact forests within protected areas).

Recruitment of the commercially and biologically dominant dipterocarp tree species — which constitute more than 90 percent of the standing commercial timber in Kalimantan — has been severely disrupted by a combination of factors. These include intense and uncontrolled logging, forest clearance for plantation establishment and an overall reduction in the extent of remaining intact stands of dipterocarps and a resulting increase in the intensity of seed predation. The situation has been exacerbated by increasingly frequent El Niño-Southern Oscillation (ENSO) events.

The cycle of logging, forest drying, use of fire for forest clearance and increasing frequency of ENSO-related dry periods has established successive rounds of accelerating ecosystem degradation. Changes in the frequency and intensity of ENSO events, in concert with anthropogenic changes in climate conditions, may also be resulting in reduced or asynchronous seed production. These types of effects are likely to further compound impacts on ecosystems, economies and people, both locally and globally.
Source: Curran et al. 1999; Curran et al. 2004

In general, management to help forests adapt to climate change will involve maintaining forest health and ecosystem diversity and resilience. There is a particular need to develop responsive management systems and to improve ecosystem resilience. Other steps are needed as well:

- forest monitoring to quickly detect and tackle outbreaks of pests and diseases;
- effective fire management;
- restoration of forest functions after disturbances;
- reduced impact logging;
- increases in the number of locations where specific habitats are managed; and
- efforts to connect habitats and landscapes.

Seppälä, Buck and Katila (2009) also cite the need to apply adaptive and flexible management and institutional measures and to take advantage of opportunities as they arise. These measures are, however, not substantially different to those encapsulated within the concept of SFM. They are also closely allied to forest-related climate change mitigation insofar as failure of forests and forestry to adapt to climate change could mean that mitigation measures would be unsuccessful.

The term "adaptation" can also refer to using forests to lessen the effects of climate change. In this sense, forests can be used to protect coastal areas and watersheds against erosion, landslides and storms. Although emphasis on these uses is heightened because of climate change, the underpinning concepts of SFM are still essential. In general, given that the core objective of climate change mitigation is to reduce emissions of GHGs, it seems evident that adaptation activities will differ from mitigation activities only where interventions do not reduce emissions; for example, forest thinning.

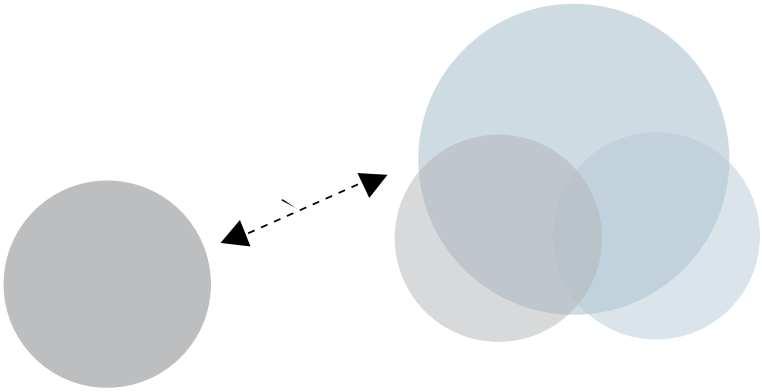
There is extensive overlap among SFM, forest management for adaptation and forest management for mitigation. Differences in emphasis exist but apart from a few exceptions, these approaches can, in many cases, be considered functionally equivalent.

Sustainable forest management and current forest management

Given the commonalities between forestry-related climate change activities and SFM, it is pertinent to ask whether the world's forests are sustainably managed at present. The extent to which appropriate systems of forest management are already in place will have a large influence on the extent to which forests can be harnessed to help mitigate climate change (Figure 1).

Figure 1.

Sustainable management of the world's forests



The following seven thematic elements, derived from regional and international processes on criteria and indicators, have been generally accepted as key components of SFM:

The Forest Resources Assessment (FAO 2005) used trends in variables connected with

tunity to support forests and forestry if effective methods of engagement with the sector and related sectors can be found.

Notwithstanding the overall goals of international REDD efforts, at many points along the

challenges still standing in the way of SFM creates highly unrealistic expectations of the forestry sector. If reducing deforestation and forest degradation were as simple or inexpensive as some proponents maintain, more progress would have been made before now. It is now widely recognized that impacts in forests and forestry are often the result of activities and decisions in other sectors. Although a turning point for forestry may be close at hand in a few countries, far more effort will be required in other places to redirect the pressures to which forestry is currently exposed. This will require significant inputs, not only at the national and international levels, but especially at the field level — and not only in forestry, but in related sectors where action to reduce pressure on forests is most needed.

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3.2 Community participation in sustainable forest management, Sri Lanka

Community participation in SFM is not only a beneficial factor, but an indispensible one in the fight against the

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This goal arises from many years of experience with failed centralized forest management approaches. These had to be redirected and reoriented, which resulted in the National Forest Policy (NFP). Revised in 1995, it recognized the importance of developing participatory approaches, particularly with local communities, who are of crucial importance because they possess valuable traditional knowledge and experience. This approach to forest management would optimize the benefits to these communities while ensuring the sustainability of the forest resources.

The NFP is still seen as a crucial and comprehensive policy document. One of the sectors of Sri Lanka's INC deals exclusively with SFM and recommends the implementation of the NFP, whose objectives include conserving forests for posterity, with particular emphasis on biodiversity, soils and water as well as historical, cultural and religious values. Despite NFP's focus on participatory approaches, INC focuses on large-scale projects. Numerous programs focus on participatory approaches to forest management and to climate change mitigation and adaptation.

The Small Grants Program for Operations to Promote Tropical Forests (SGP PTF) was carried out by UNDP in Sri Lanka from 2004 through 2007. This program complemented the existing Small Grants Program and was a landmark effort by the international community to strengthen the role of local people in forest management. Most of these have a direct link to climate change mitigation or adaptation. The main focus of SGP PTF is small, innovative, forest-related projects by non-governmental organizations (NGOs) and community-based organizations (CBOs), which could then serve as the basis for understanding and policy guidance.

The thematic foci of the program were participatory forest biodiversity conservation, development of alternative livelihood initiatives and enhancement of skills and capacities of local communities, SFM with community participation to ensure sustained delivery of better forest services and better delivery of forest goods, multi-sector partnerships, and promoting the development of an alternative forest resource base.

Community participation

People living in the buffer zones of forests have used their forests for generations and are a critical part of forest management. They have observed how climatic variations and long-term climate change affect the region, either in the forest itself or in the buffer zone. It is they who need to be consulted, and collaborated with, in order to ensure effective climate change mitigation and adaptation plans. There is to date only a slight interest in effectively engaging such communities to manage fast-dwindling forest resources, yet it is imperative to focus much more on community participation. Experience in Sri Lanka shows a high success rate in doing so, and new policies and programs increasingly include community participation.[2]

The Human and Environment Development Organization (HEDO) is a local NGO working in the Kegalle District on one of the SGP projects. They introduced micro-hydropower systems, using the water of the forest to generate electricity for several villages in the

buffer zones. Villagers formed small self-help groups, working as a team and discussing their needs. Alternative livelihoods were introduced and local products such as treacle and jaggery[3] were linked to the national market. Because of the electricity provided all villagers now see the value of the forest. They actively protect it from intruders, forming a social fence. No longer do they encroach upon the forest or cut valuable timber there. This clearly contributes to stopping deforestation, which is a crucial factor in climate change mitigation.

Mr. Peiris, the local operator of one of the newly installed micro-hydropower systems, and a kithul farmer[4] in the buffer zone of the adjacent, previously threatened forest. He says that the climate has become more extreme throughout the last few years. The small tea plantations using chemical fertilizers had started to dry out and spoil during the dry season; the home gardens, cultivated with organic fertilizer, would have no problems, even in the dry season. Mr. Peiris is one of the beneficiaries of the HEDO project. His life has drastically changed in the last few years, like that of the other villagers and of several neighbouring communities in the buffer zone. Not only has the project uplifted the peoples' lives and provided them with alternative and more sustainable incomes — while protecting the forest and working towards climate change mitigation and adaptation —it can serve as a lesson why community participation is crucial and how to achieve it.

Short- and long-term impacts

One important lesson can be drawn from the micro-hydropower project. As stated by Ravindranath (2007, 844): "especially from the developing country's perspective [...] climate change mitigation strategies will have a long-term global impact on greenhouse damage, whereas adaptation policies generally have a positive direct immediate effect for the countries and regions that implement them."

As a general outcome of Sri Lanka's SGP projects, it was noted that tea growers who switched to organic practices discovered that during droughts — which have reportedly become more frequent due to climate change —they did not experience a drop in yield, while conventional tea farming areas did. This is both adaptation and mitigation. While adaptation shows the immediate effect (no drop in yield during drought), mitigation is a slower process, slowly conserving biodiversity and organic matter in the soil. If coupled with agroforestry (that is, by planting trees in home gardens) it also supports CO_2 sequestration, thus lowering GHG emissions globally.

The success of these techniques has led the UNDP in Sri Lanka to earmark organic farming in home gardens and tea plantations as one of four areas to broaden beyond SGP. Furthermore, the project promoted organic practices in forests bordering tea plantations to reduce the chemical run-off into watercourses that originate from forests.

HEDO's approach to protecting and conserving the forest area was highly innovative. "They didn't mention anything about protection," says a kithul farmer who lives in the buffer

zone of the forest. He used to go regularly into the forest to cut timber and sell it on the market; this provided a good income. His fellow village members would also encroach upon the forest for small-scale tea cultivation. "HEDO told us: 'you can get profit from the forest,'" continues the farmer: "they provided us with electricity from the stream in the forest. Now we have light. Now we know about the real value of the forest."

The micro-hydropower provides more than lighting for the villagers' homes. Now most of

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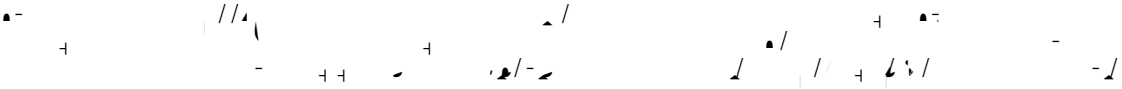
Endnotes



3.3 Experiences from Southern Sudan

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Introduction

The environmental situation is severe in Southern Sudan and especially critical in northern Upper Nile State. Deforestation, land degradation and desertification are proceeding at an alarming rate. Moreover, climate change challenges, declining biodiversity and continuing water shortage — as well as population pressure, overgrazing and a general lack of resources — are major obstacles to reversing the trend of unsustainable development and deteriorating livelihoods.

The current situation offers scant protection from unexpected natural events, and provides very limited capacity for adaptation to and mitigation against the effects of climate change. Furthermore, due to serious policy, institutional and market failures and environmental governance structures the area cannot cope with the current trend of increasing environmental threats. Policy reform, capacity-building and institutional strengthening for sustainable natural resources and environmental management are desperately needed to promote overall sustainable rural development, including improved livelihoods and environmental conditions.

SFM AND GOOD FOREST GOVERNANCE CAN REDUCE DEFORESTATION AND FOREST AND LAND DEGRADATION AND CAN CONTRIBUTE TO COMBATING DESERTIFICATION.

Sustainable forest management (SFM) and good forest governance are among the essential development priorities and can significantly contribute to the achievement of other development goals. SFM and good forest governance can reduce deforestation and forest and land degradation and can contribute to combating desertification. Thus, they are highly relevant to maintaining the adaptive and mitigative capacity of forests regarding climate change.

Maintenance and enhancement of forests and tree cover have a positive effect on carbon balance and water supply and on the overall capability of the natural environment to resist the various causes of degradation. If the land is totally cleared of forests and trees it becomes fragile and exposed to further degradation; this can lead to a serious decline

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in productive and life-supporting capacity and even desertification. This would seriously threaten sustainable rural development including economic, social and environmental aspects. In brief, establishment of SFM practices, jointly with appropriate forest governance structures, can reduce vulnerability to the impacts of climate change.

The LAMPTESS project

Landscape Management Planning and Training for the Environment in South Sudan (LAMPTESS) is a development project initiated by the new institutional cooperation instrument of the Finnish Ministry of Foreign Affairs. The project started in 2008 and aims to support development cooperation, especially in the fields of institutional streng-thening and capacity-building, between a higher education institution in Finland (VITRI) and Southern Sudan (Universities of Upper Nile and Juba), based on local development priorities. Partners in the project include the Government of Southern Sudan (GOSS) Directorate of Forestry, including its regional and local offices.

Activities so far have included an assessment of the current status of natural resources governance and management practices and identification of capacity-building and institutional strengthening priorities within the partner institutions and in the pilot villages north of Er Renk in the Upper Nile State. Multi-stakeholder consultation sessions have been held to resolve local land-use conflicts between different actors. Upcoming activities include capacity-building for the development of sustainable management practices and related teaching methods including training the trainers and extension projects. In addition, pilot areas will be established in the pilot villages to demonstrate sustainable management practices. Extension and training for more efficient use of wood for fuel, charcoal and construction will also be carried out by the Sudanese partners. Others tasks include institutional development and capacity-building for training and education about new sustainable livelihoods and local implementation of international commitments and obligations provided by Multilateral Environmental Agreements (MEAs) within the UN framework.

Initial experiences

To date, the project has shown that SFM and forest governance issues are closely connected to mitigation and adaptation efforts at all levels. Field missions to the villages north of Er Renk included interviews and group discussions with the local people. Project activities also included several interviews and discussions with professionals within educational institutions and forest administration as well as an assessment of the framework for overall forest governance. Based on this work, it was concluded that deforestation and forest degradation are significant problems, as are the overall decline of the productive capacity of the land and of environmental quality. Moreover, the local farmers and cattle-raising nomads or semi-nomads consider that more extreme climatic conditions exist; these have been intensified by the trend of environmental deterioration due to unsus-

tainable management practices and lack of good governance and resources. The current

3.4 Social housing in Curitiba, Paraná State, Brazil

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Introduction

Worldwide, the construction sector makes a huge contribution to greenhouse gas (GHG) emissions. The Brazilian government recently launched the Minha Casa, Minha Vida (My Home, My Life) program to support one million low-income families in buying their first house. All the houses will be built using iron and cement, which significantly increases this sector's contribution to a negative balance in national emissions.

This article argues that social housing built of wood is well suited and as safe, or safer, as houses built of other materials. In fact, using wood helps in the fight against global warming. The use of sustainably harvested wood in construction results in several benefits to society, economy and environment.

Wood used in the construction sector can help global climate mitigation efforts, and using more of this raw material can contribute to increased forest cover and help maintain biodiversity at the regional scale.

Deforestation and land-use change from forests to pasture, agriculture or human settlement release large amounts of stocked carbon. Using wood from sustainable sources helps to avoid these modifications of rural activities and to support market incentives for cultivating forestry carbon. Furthermore, increasing society's consumption of wood products results in larger stocks of carbon being transferred, which allows new trees to sequester even more carbon. Consumption of wood products is the fuel that enables the forest industry to keep cleaning the air.

Wood and mitigation

Global climate change is a natural phenomenon that is accelerated by human actions that generate GHGs. Levels of GHGs, especially CO_2, are increasing. Because of this human influence, the United Nations Framework Convention on Climate Change (UNFCCC) has created mechanisms for emissions compensation around the globe, resulting in today's Kyoto Protocol and voluntary markets. The construction and forestry sectors have signifi-

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cant advantages in contributing to reducing emissions by 2030: the construction sector creates 30–40 percent of all global emissions, and the forest sector could respond quickly to an increase in Certified Emissions Reductions (CERs) prices. Together they can be a major part of reducing the acceleration in global climate change.

Building wood-frame houses instead of traditional cement/iron structures creates several positive impacts:

- Trees sequester carbon while they are growing and harbour it for a period of time, depending on the end use. Used in construction, the carbon may remain stored in wood for hundreds of years.
- Increased afforestation may result in even greater benefits through absorption of CO_2. Areas planted with trees can take even more CO_2 out of the atmosphere.
- Using wood to replace emission-intensive raw materials, such as cement and iron, could increase the mitigation potential of wood products.
- Using leftover wood for energy and increasing the yields of forest stands further enhances the social, environmental and social benefits of using wood in construction.

Efforts are being made to include harvested wood products in the next negotiations for the post-Kyoto regime (beyond 2012), in recognition of wood's ability to mitigate global climate change. For Brazil, which has a large naturally grown stock of hardwoods — hardwood trees live the longest of all wood species — this signals a major opportunity. By adopting SFM practices it is possible to maintain, or even increase, the volume of carbon stored within living biomass while increasing the level of carbon stored within wood products. The use of industrial wood is connected with an increase in forest cover. All major consumer regions portrayed increments in tree vegetation over the last 25 years, while minor consumption often results in higher deforestation rates (FAO 2007).

German forests have tripled their standing-stock volume, from an average of 100 m^3/ha in 1750 (at the beginning of scientific SFM) to an average of 300 m^3/ha in 1950. From 1950 to the present, western and eastern European forests also increased their average yields, from 3 m^3/ha/year to 4.5 m^3/ha/year (Nilsson 2007). Brazil's natural forests are being harvested with the same natural regeneration silviculture systems used by Germany in the sixteenth century, driving them to a similarly degraded state. Using forest products intensively and extensively practicing SFM with artificial regeneration increases the average volume of a forest stand as well as annual yields. An intensification of production may have adverse effects on biodiversity and other forest environmental and social services, however.

Although the IPCC has coordinated discussions on potential accounting approaches and methods for estimating carbon in forest products, no agreement has yet been reached so far. This delayed the inclusion of forest products as legitimate carbon offsets under the Kyoto Protocol. Currently, the Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol (agenda item 5(b)) is working on definitions, rules and modalities based on decision 16/CMP.1; these will eventually determine procedures for using harvested wood products to generate carbon credits under the Kyoto Protocol.

The Chicago Climate Exchange (CCX) establishes basic specifications for carbon accounting for long-lived wood products, including the necessity of proving that those products will be in use or in landfills after 100 years and providing evidence that they came from sustainably managed forests, are certified and have their carbon rights retained through a sales contract (CCX 2009). In terms of the use of wood within construction as a strategy to fight global climate change, traceability and certification are as important as the need to improve technologies, enhance the application and increase the life span of such material. All these issues are addressed by this project.

Traceability has been addressed by several institutions around the world. The proposal from the Instituto Web Florestal (IWF) establishes an electronic system to support the legal accountability of forest resources and trace them along the production chain. It involves installing an electronic chip on each tree that allows it to be monitored within the chain of custody system and an overall monitoring centre, using software to follow the wood from the forest to final consumers. The wood can be audited at any point along the production chain and at any given moment, supplying technical, legal and tenure data and information.

The Brazilian Program of Forest Certification (CERFLOR) was developed within the framework of the Brazilian System of Conformity Analysis. CERFLOR aims to certify effective forest management practices in both native and exotic stands. In 2001 the Brazilian Association of Technical Regulation accepted the Principles, Criteria and Indicators for SFM of plantation forests and natural forests and the guidelines for auditors. CERFLOR is managed by the National Institute of Measuring and Industrial Quality and received international recognition, being associated with the Program for Endorsement of Forest Certification schemes.

Life Cycle Assessment (LCA) is an important part of the project's framework. LCA is the investigation and evaluation of the environmental impacts of a given product or service. The proportion of carbon in the logs that ends up in finished products and residues depends on various factors, such as species, site conditions, harvesting technique, log grading and efficiency of conversion in wood-processing plants (Ximenes 2006). It is important to understand the flows of carbon from harvested logs into different residues (bark, sawdust, off-cuts, shavings) and product streams. Different products have different service lives; domestic house framing typically has a long service life.

Disposal is a critical stage in the life cycle of forest products in terms of their ultimate impact on emissions. The methods of estimating parameters for accounting for carbon along the production chain may include factors such as national industry averages of volume of forest products manufactured and fate of the products after disposal. These are critical factors in determining the level of long-term storage in forest products.

The construction sector

The construction sector worldwide employs 111 million people, 90 percent of them in small firms (less than ten persons) and 75 percent in developing countries (UNEP 2009).

By around 2025, the world will need another 11.5 billion m^2 of space for residences, six billion m^2 for industries and 5.4 billion m^2 for commerce. On the planet, 70 to 75 percent of the population — approximately four billion people — live on less than US$3,000 per year, moving US$5 trillion.

In the UNECE region, covering 56 states in Europe, the Commonwealth of Independent States and North America, buildings (by and large in the residential sector) are responsible for more than a third of total energy consumption. Demographic, economic and cultural changes will only increase the pressure of housing on energy consumption and will be accompanied by even higher levels of GHG emissions. On the other hand, evidence suggests that it is the building sector, particularly the residential subsector, which could generate some of the greatest energy savings. Using wood is an essential part of this savings, especially for low-income populations. In Brazil there is a deficit of close to eight million homes — 84 percent of which are required by low-income families — and demand for another 27 million new units by 2025. The sector's investments will increase from today's US$97 billion to more than US$263 billion in 2030.

Wood is a feasible alternative for construction. It is a renewable raw material, well adapted to the framing process (its dryness and ease in assembling reduce the time required by approximately 30 percent), with a good ratio of weight-to-mechanical resistance. It can be immediately placed at structures and is a lightweight and environmental friendly option when compared to other building items. In addition, Brazil has a large forest resource base of both natural and exotic species and excellent conditions for implementing a sustainable supply of harvested wood products.

Despite these comparative advantages, however, wood is still rarely used in construction. The main reasons for this include lack of tradition of this kind of construction, lack of knowledge on the part of professionals involved in construction about the material and its qualities, and lack of research and development in technologies capable of meeting the needs of the population. There is a noticeable lack of good projects for wood-building systems that can offer functional and technological quality. Research has covered, among other topics, monitoring the quality of the construction process and evaluation of thermal and acoustic comfort. Modular construction can increase the versatility and feasibility of this alternative for the whole population. In addition, wood produces residues along the production chain can be further used or used for energy production.

Worldwide, forest sector products contributed an estimated US$207 billion to international trade in 2007. In Brazil the sector is robust. It generates around US$20 billion per year in revenues, with US$9.3 billion exports in 2008, close to six million ha of plantations and 1.6 million jobs (Rochadelli et al. 2008). In Paraná state, in southern Brazil, the sector produces almost 35 million m^3/year (57 percent used for energy, 43 percent for industry), which corresponds to eight percent of GDP; it also creates as many as 750,000 direct and indirect jobs (Krugger 2008). The state government initiated a program for the timber-producing sector that is responsible for planning the next 100 years of developments

within the sector. The main goal of the program is to overcome barriers to the production and use of industrial wood within the state and to support implementing strategic policies to this end.

Case study: social housing

In Paraná there is a deficit of 314,200 homes; Curitiba, the state's capital, has a deficit of 50,000 homes. In order to estimate the contribution of increasing the use of wood in house construction, a comparative study was conducted. It involving a 52-m^2 model built using traditional methods by the Paraná State Housing Company and an alternative model from the Wood Products Laboratory of the Brazilian Forest Service (LPF/SFB).

The LPF/SFB model resulted in an emissions reduction of 12,1 tCO_2eq/unit. Just by replacing raw materials associated with high emissions, it elevated demand of forest biomass by approximately 60 percent and generated another 8 tCO_2eq/unit for energy production with the use of solid residues. In addition, the use of residues avoided methane emissions at landfills. In terms of CERs, the cumulative effect of increasing SFM production or reforestation, replacing raw materials, producing energy from residues and avoiding methane emissions from landfills resulted in an estimated 83 tCO_2eq/unit. This amounts to US$830 per house in terms of carbon credits.

The Paraná State government's *Ouro Verde* reforestation project aims to establish 400,000 ha of forest plantations. A list of regionally occurring species was drawn up and was compared to the raw materials needed for the LPF/MMA wood-frame house model, to determine which tree species could be used in construction. Based on that study, a list of 25 species[1] was produced for Paraná state's regions 1 and 2. These regions are located in the central-southern part of the country and are home to 99 municipalities with the lowest incomes in the state. For Curitiba and the metropolitan region, 16 species[2] were recommended. Most of them are grown in agroforestry and silvipasture systems; this project aims to increase their plantation area within the region, taking advantage of pasture and degraded areas surrounding municipalities.

By implementing a diversified forest resource base and using those trees as industrial raw materials in the construction of social housing, the proposal links forest plantations with biodiversity, emissions reduction, economic development and social integration. This requires a massive inclusion of local and global actors.

The issue of fire was also addressed. Rio Sagrado, a private company that produces a substance used in fighting forest fires, has joined the initiative and will supply fire combat planning for each house unit and condominium, according to governmental and bank regulations. This will increase assurance and secure people's investments.

Governance and wood promotion

The *Ouro Verde* reforestation project proposes a new governance model for establishing the 400,000 ha of forest plantations. The *nidade Gerencial do rograma* (Managerial Program Unit), composed of members from several federal, state and local institutions, will support

the state government in developing the program. As part of the program, over the next 100 years, the state will organize seminars and training and offer technical assistance to increase municipalities' awareness of the necessity of planting forests for industrial wood production. The state will also provide services to municipalities, cooperatives, associations, industry, schools, universities and others, to facilitate the process of informing the public, talking with investors and submitting documents to finance institutions.

By using a larger number of species in social housing construction, and linking the silviculture program with the state's and municipalities' demand for these houses, the strategy supports a positive cycle involving forest plantations and industrial wood consumption and the state increases its ecological footprint (which is in general considered to be negative). The state government is already planning the construction of the first social housing project with wood-frame construction; 300 houses will be built within the Curitiba metropolitan region.

The Standardization of Solid Wood Industrial Residues on Commercial Volumes project creates a new technological alternative for managing residues in order to increase their aggregate value. This technology also involves using larger volumes of wood from the same tree, reducing the generation of solid wastes and enriching product assortment. With the use of residues to add value, new jobs are created and artistically crafted works can be made. Social inclusion is essential to assure sustainability.

Under the UNFCCC, parties report the carbon sequestered by forests in their national GHG inventories if they have the necessary data. It is essential to obtain public recognition for the long-term storage of carbon in forest products in Brazil, and to involve traceability, certification and life cycle assessment in the approach to the process. Adopting these practices will recognize the role of forest products in mitigating GHG emissions, and consequently further promote the use of forest products in the country and the overall image of the sector globally.

The Sustainable Originated Wood Utilization Network, or RUMOS (*Rumos* means "directions" in Portuguese), is a newly formed institution involving several Brazilian organizations. It was established to inform the public about the social, economical and environmental benefits of using wood. Its objectives are aligned with similar initiatives all over the world.[3] RUMOS is initially focused on Brazil and its integration with BRIC (Brazil, Russia, India and China), but its members look forward to meeting with the other networks, and would participate in a global network for promotion of wood, if one were formed.

Integrating wood promotion networks provides a forum for discussions and coordination of a global system for accounting and certifying forestry carbon. This could bring the sector to a new level of participation at international agreements, increasing the strength and influence of its common proposals.

The architectural models and wood-frame houses already exist, the carbon estimates are accurate and being validated and the state is implementing the first social housing

projects constructed of wood. Network statutes are under review, with headquarters located at the *Escritório Verde* (Green Office) of the Technical Federal University of Paraná.

Conclusions

Building high-quality houses with wood can both mitigate the construction sector's contribution to global warming and increase forest sequestration of CO_2. Furthermore, increasing the number of wood species used in house construction can contribute to tree diversity.

There is work to be done on transforming public and professionals' understanding of the role of wood and forests in global climate change, and on promoting a cultural rehabilitation of wooden houses within society.

An accounting system is needed that traces forestry carbon from stands to finished products, and allows participants to estimate wood products' contribution to reducing emissions from land-use change and increasing carbon sequestration at forest sites. Such a system could be used to promote the role of wood and its use in fighting global climate change.

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Endnotes

- *Pinus* - *(Araucaria angustifolia)* *(Mimosa scabrela)* *(Croton celtidifolius)* *(Vernonia discolor)* *(Anadenanthera colubrina)* *(Schinus terebenthifolius)* *(Sebastiania commersoniana)* *(Gochnatia polymorpha)* *(Peltophorum dubium)* *(Cabralea canjerana)* *(Myrsine ferruginea)* *(Apuleia leiocarpa)* *Inga* - *(Cordia trichotoma)* *(Didymopanax macrocarpum)* *(Balfourodendrum riedelianum)* *(Prunus sellowii)* *(Alchornea triplinervia)* *(Phytolacca dióica)* *(Vitex cymosa)* *(Ocotea porosa)*-
- *(Tabebuia chrysotricha)* *(Vitex cymosa)* *(Piptocarpha augustifolia* *(Araucaria angustifolia)* *(Ocotea porosa)* *(Apuleia leiocarpa)* *(Prunus sellowii)* *(Cordia trichotoma)* *(Ocotea puberula)* *(Peltophorum dubium)* *(Didymopanax macrocarpum)* *(Cabralea canjerana)* *(Anadenanthera macrocarpa)* *(Paragonula americana L.)* *Pinus* - *Eucalyptus* -
- *Plan Bois-Construction-Environment* : : *Centrum Hout* : : *Centre Interfédéral d'Information sur le Bois* : *Holzabsatzfond* : *Vivir con Madera* : *Promo Legno*

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3.5 Indigenous community participation in India

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Background

Forests are vitally important in supporting national economic activities and providing livelihoods portfolios for many people in India. Forests are the frontline of mitigating climate impacts by reducing exposures to scourging heat, dust storms and floods. For more than a decade, the country has experienced extreme weather conditions: from heat waves to cyclones, from droughts to floods. Orissa and Bihar states have experienced classic examples of climate change events.

Several indigenous communities make their living within vulnerable environments — in mountainous areas, forests and dry areas — and are often the first to discern and suffer the effects of climate change. Local communities have a large body of knowledge of and experience in coping with climatic variability and extreme weather events.

Local communities have always had to adapt to variations in their climate. To do so, they have made changes based on their resources and knowledge accumulated through experience of past weather patterns.

Introduction

Forest ecosystems in tropical India are important repositories for vital livelihood resources and ecosystem services; at the same time, they constitute major wildlife habitats including corridors for migration. The biodiversity of tropical forests is threatened by climate change and extreme climatic events, and by a range of human activities, such as over-exploitation of fuelwood, food, medicinal plants, overgrazing, water catchments and river channel destructions. Such activities have resulted in habitat modifications and the loss of endemic species and have endangered other species.

Tropical forests weave through most of the Indian landscape and provide shelter for other ecosystems. They are currently experiencing rapid deforestation and degradation with significant reduction in forest cover and fragmentation across the landscape.

Few studies have strongly emphasized the vulnerability of Indian tropical forest biodiversity to various climate change scenarios, and the resulting direct consequences on wildlife

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populations and the livelihoods of humans. Livelihood adaptation strategies are needed that match local resource-use patterns without jeopardizing the forest ecosystem's resilience to climate change.

Indian scenario

Scientists believe that the fluctuating weather conditions in India suggest that the country is reeling under climatic chaos. India is among the top ten countries of the world with the highest GHG emissions. According to the World Resources Institute, in 2005 India's total GHG emissions were 1.8 billion metric tonnes equivalent of CO_2, about 4.9 percent of global emissions. India's carbon dioxide emissions alone were 1.4 billion tonnes in 2008, or about 1.3 tonnes per capita (Ministry of Environment and Forests 2009).

Projected impacts of climate change in India

Global assessments have shown that climate change is likely to have a significant impact on forest ecosystems (Ravindranath et al. 2006). It will probably affect forest biodiversity through changing biome types and shifting forest boundaries. This in turn will affect the supply of forest products, as well as the livelihoods of forest-dependent communities, who use forest resources for fuelwood, building materials and income.

Deforestation

Forests provide a range of ecosystem services that are generally underestimated or left out of estimates altogether. Forests are a major part of climate mitigation strategies through carbon sequestration and the provision of products that substitute for fossil energy and materials. Furthermore, forests contribute significantly to regional climate regulation and to continuous water supply in small- and large-scale water cycles. These regulating services of forests, including their mitigating functions, are essential for climate adaptation strategies.

Forest fires

In India there is no comprehensive data to indicate the loss of forests to fire in terms of area burned, volume, value or regeneration. The global phenomenon of the greenhouse effect has resulted in a relatively longer summer. An extended spell of dry weather, coupled with the absence of winter rains, led to a rise in temperature; this made the forests more susceptible to fire. According to an assessment by the Indian Forest Protection Division of the Ministry of Environment and Forests (MoEF), 3.73 million ha of forests are affected by fires annually in India. During the 1990s several forest fires occurred in the hills of Uttar Pradesh and Himachal Pradesh, affecting an area of nearly seven million ha. The fires caused huge timber losses, soil erosion, loss of employment, drying up of water resources and losses of biodiversity and soil fertility. These fires caused a major change to the micro-climate of the region in terms of soil moisture balance and increased evaporation. The dense smoke from the fires affected visibility up to 4,300 metres (Bahuguna and Singh 2003).

Land degradation and desertification

Climate change leading to warming and water stress could further exacerbate land degradation, leading to desertification. The National Action Program of the MoEF aims to address the problem of land degradation linked to climate change. Climate-sensitive sectors (forests, agriculture and coastal zones) and natural resources (groundwater, soil and biodiversity) are already under stress due to socio-economic pressures. Climate change is likely to worsen this situation. Countries such as India with a large population that depends on climate-sensitive sectors and has a low adaptive capacity must develop and implement adaptation strategies.

Water resources

The hydrological cycle is likely to be altered and the severity of droughts and the intensity of floods in various parts of India will likely increase. Further, a general reduction in the quantity of available run-off is predicted (Ravindranath et al. 2006). At present, changes in cropping pattern and land-use pattern, overexploitation of water storage and changes in irrigation and drainage are modifying the hydrological cycle in many regions and river basins in India (Mall et al. 2006).

Agriculture

Simulations using dynamic crop models indicate a decrease in yields of crops in various parts of India as the temperature increases. This is offset by an increase in CO_2 at a moderate rise in the temperature and at higher warming; the negative impact on crop productivity is projected due to reduced crop durations (Ravindranath et al. 2006).

Coastal regions

Global warming and the consequent changes in climate patterns will have a severe impact on fisheries, with far-reaching consequences for the food and livelihood security of a sizeable section of the population (Surinder 2008). A country paper compiled by the Delhi-based Tata Energy Research Institute (TERI) and the Ministry of Environment (MoEF) in 2000 projected that a one-metre rise in sea level could displace as many as 7.1 million people who depend on the sea for their livelihood (TERI 2004). Studies also indicate that a rise in sea surface temperature of two to four degrees C could increase cyclone intensity by 10–20 percent. This would displace coastal residents and devastate low-income rural areas in India.

Climate change and awareness among indigenous communities

Most people, including policy- and decision-makers — especially in developing countries — have little if any knowledge of climate change, its implications and ramifications for their day-to-day activities and for the nation as a whole. Education, training and awareness are therefore of utmost importance in the formation of environmentally aware and enlightened rural communities.

Discussions, debates, public talks, open discussions, research seminars and local workshops, organized by various organizations, help to encourage and stimulate interest in

climate change and its environmental impacts among the population. Past learning, personal experiences and regular observations have shown people some of the rapid changes in climate, and their consequences. Increasingly warmer weather, erratic rainfall, droughts followed by exceptionally heavy rains, coastal erosion, landslides, dwindling numbers of certain animals and plants, and reduced yields in agriculture and fisheries are some of the observations people comment upon.

Combating climate change through community participation

Indigenous peoples are among the first to suffer from increasingly harsh and erratic weather conditions. In general they also lack empowerment to claim goods and services to which other population groups have greater access. Indigenous communities are not just victims of global warming; they also have a critical role to play in supporting global adaptation to climate change (Laub 2008). Several indigenous populations possess a singular knowledge of plant genetic diversity and have the skills to breed varieties that can cope with stressed environments. This may be needed to fight plant and animal diseases.

Kumar Nanda and Sutar (2001) studied the management of forest fires through local communities in selected tribal districts of Orissa state. This research on community-based fire management (CBFiM) was undertaken in the belief that forest-dependent communities would be sufficiently interested to protect forests and prevent or manage forest fires, because of the importance of forests to their livelihoods. It was found that most forest protection initiatives emerged only after the dependent community had started to notice a scarcity of resources. Since the state's Forest Department lacks infrastructure and has scarce budgetary allocations, it was also suggested that it would be useful to encourage community-based initiatives as the most feasible way to manage forest fires.

Local coping strategies: Betul (South) forest division, Madhya Pradesh state

In India, Joint Forest Management Committees (JFMCs) have been established at the village level to involve people in forest protection and conservation. JFMCs are also responsible for protecting the forest from fires. The Indian Institute of Forest Management has taken up a research project on forest fire management with the help of communities in Betul (South) forest division, Madhya Pradesh. The district, on the Satpura Plateau, is one of the state's marginally located southern districts; it has a mostly tribal population. Betul district is covered by dense teak and miscellaneous forest and is affected by forest fires every year.

Primary information for the project was collected through pre-tested structured questionnaires as well as focus group discussions in the selected areas and JFMCs. During the field visits and observation (2006–08), a quantitative assessment evaluated people's participation in sustainable fire management, damage caused by fires, and fire extinguishing methods before and after formation of JFMCs.

Every year the forest department organizes firefighting training for their staff with the help of local villagers, particularly before the fire season. Before the formation of forest committees one or two training sessions were held with the staff and villagers. After the

formation of JFMCs in each forest divisions (2004–08), training was intensified for staff along with JFMCs. Awareness workshops were organized and people were educated on the adverse impacts of forest fires on their surrounding environments and forests. Local NGOs were also engaged to promote skills and expertise in fighting fires in the Betul division.

As shown in Table 1, forest ranges with more forest committees per unit of area had fewer forest fires than other forest ranges. The Multai forest range is slightly humid and possesses more waterbodies (seasonal streams, small rivers, etc.) than other forest ranges. This, along with an absence of Mahua trees (*Madhuca latifolia*) in the area (which are the main cause of intentional fires due to flower collection) means that it has fewer forest fires. Moreover, the Multai and Tapti forest committees' awareness level, knowledge of extinguishing fires and effective fire management is very high as compared to other committees. This also reflects an effective participatory approach that enables the community to cope with fires. Thus, community participation plays a vital role in fire management with the support of the forest department.

Table 1. Forest area and fire incidence in Betul division after formation of JFMCs

Variables	Forest ranges (Betul- South Forest Division)						
	Amla	Athaner	Bhaisdehi	Multai	Sawal-mendha	Tapti	Total/ Mean Value
no. of JFMCs	39	34	47	68	51	64	303
total forest area (in ha)	11,810.6	12,256.2	14,281.3	19,566.0	15,719.0	11,922.2	85,555.9
avg. area (in ha) per committee	302.83	360.47	303.85	231/17	308.22	186.28	282.36
per capita area/JFMCs member	1.10 (± 0.12)	1.27 (± 0.19)	0.62 (± 0.08)	0.46 (± 0.06)	0.71 (± 0.11)	0.45 (± 0.09)	0.64
avg. forest fire incidences per yr (2004–08)	3.60 (± 0.36)	3.00 (± 0.40)	2.80 (± 0.31)	2.00 (± 0.13)	4.0 (± 0.67)	2.60 (± 0.26)	18.00
avg. forest fire incidences/per committee	0.46 (± 0.03)	0.44 (± 0.11)	0.29 (± 0.15)	0.15 (± 0.06)	0.39 (± 0.27)	0.19 (± 0.09)	0.29

Conclusions and recommendations

Community participation can work wonders. Attempts are being made by way of peoples' committees to manage natural resources in a more and more eco-friendly manner. Experiences and practices in community-based climate change mitigation show the positive impact of this participatory approach to climate change. The involvement and participation of local communities in climate change reduction programs should be the highest priority, since they are most affected by climate change and, more importantly, they are the first

responders to a climate change event. In the absence of any specialized skills, they rely on traditional coping and survival mechanisms to respond to the event before they start receiving any outside help.

Community participation is a vital part of the fire management supported by the forest department. The Betul case study shows that because of people's awareness and effective participation, fewer forest fires were reported, which is a good indicator of forest fire control. After JFMCs were formed in the area, the community members were trained in firefighting methods. Awareness-raising and other interventions by the forest department encouraged villagers to curtail fire incidences in a forest area that was otherwise prone to fire. Community members were successful in convincing people gathering non-timber forest products not to ignite fires. The condition of the natural forest has changed considerably since the formation of JFMCs. This example can be replicated in other parts of the country.

Awareness of climate change among the local communities constitutes a resource base for non-formal education and should be encouraged. Discussions, public talks and seminars, organized by various organizations, help to encourage and stimulate interest in climate change and its impacts on local people's livelihoods.

Readiness measures — such as continuation and improvement of forest inventories and the training of local people — are vital components in dealing with climate change. This should be an ongoing, regular function of government departments at all levels in active collaboration with local and indigenous peoples.

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Section 4

Climate adaptation strategies

4.1 Adaptation for forests and communities in the Congo Basin

Introduction

Climate change is considered to be one of the major threats to sustainable development because of its impacts on health, infrastructure, settlements, agriculture and food security, and forest ecosystems. An increasing frequency of extreme events such as increased temperatures, drought conditions and intermittent floods are expected to stretch natural systems. Climate change constitutes an additional burden on top of poverty, disease, illiteracy, weak institutional capacity, war, unstable political governments, poor infrastructure and other global environmental change issues (such as land-use change, land degradation, desertification and biodiversity loss), which limit development in Sub-Saharan Africa and countries in the region from realizing major global targets such as the Millennium Development Goals (MDGs).

THE CHALLENGE FOR THE CoFCCA PROJECT WAS TO INCREASE BOTH PUBLIC AND POLICY-MAKER AWARENESS OF FORESTS' CONTRIBUTION TO THE DEVELOPMENT OF LIVELIHOOD ADAPTATION STRATEGIES AND TO USE FOREST GOODS AND SERVICES IN A WAY THAT DOES NOT JEOPARDIZE THEIR RESILIENCE TO FUTURE CLIMATE IMPACTS.

In recent years, a number of global assessment reports, such as the Millennium Ecosystem Assessment 2005, the Stern Review 2007 and the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC 2007) have all emphasized the vulnerability of Sub-Saharan Africa to climate change impacts and the region's inability to cope with projected climate change scenarios. Numerous factors underscore the vulnerability of the region to climate change impacts. One notable aspect is that the livelihoods of the poor majority (especially women and children) are highly dependent on climate-sensitive sectors such as agriculture, fisheries, pastoral practices. Local people also depend on forests for household energy, food security, water supply, herbs and tree bark as the first line of primary healthcare. These livelihood activities also contribute a significant proportion of the gross domestic product (GDP) of countries in the region. This reveals the fragility of national development to climate uncertainties,

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and the unpredictability of successfully implementing sustainable national and economic development plans.

The negative effects of climate change are likely to have the worst impacts on the poor. Most of them live in developing countries, and in Sub-Saharan Africa most of them are women and children. Women — who are likely to be hit hard by climate change —already shoulder the burden of providing household livelihoods, and are among those most vulnerable to climate variability and change, particularly as they are highly dependent on natural resources. Household livelihoods and food security are also likely to be vulnerable under the changing climate since both production systems and forests, which are a vitally important part of food security in the region, are intricately dependent on the climate system. This makes it imperative for climate change and climate variability measures to be taken seriously and for adaptation to be integrated into project development planning in both the private and public sectors in Sub-Saharan Africa.

Unfortunately, the importance of forests in the Congo Basin region — besides timber export value — is under-represented in some major national development planning processes, such as those on climate change response and poverty reduction strategies. This could largely be due to inadequate capacity in using the available evidence that documents how forests sustain the poor. The challenge for the Congo Basin Forest and Climate Change Adaptation (CoFCCA) project was to increase both public and policy-maker awareness of the contribution of forests to the development of livelihood adaptation strategies and to use forests goods and services in a way that does not jeopardize the resilience of the forests to future climate impacts. This would ensure the continuous provision of these goods and services, which contribute to adaptation, improving food security and reducing poverty.

Forests and Central African communities

Congo Basin forests constitute the second largest rainforest after the Amazon; its interconnected tropical forest represents 18 percent of the remaining global tropical rainforest (Anonymous 2007). The Congo Basin forests also hold 70 percent of the total plant cover in the African continent. Six Central African nations share the 1.5 million square miles of the Congo Basin forests: Gabon (17.7 percent); the Republic of Congo (12.4 percent); Cameroon (11.8 percent), the Central African Republic (3.4 percent), Equatorial Guinea (1.3 percent); and, with more than 50 percent, the Democratic Republic of Congo (CBFP 2006).

The forest area per capita is 2.9 ha, compared to a global forest area per capita of 0.8 ha. More than 78 million people inhabit this region, 62 percent of whom still live in rural areas (FAO 2005). Despite the vastness of the area's natural resources and the riches of the Congo Basin forests — on which people depend for their everyday needs (Ndoye and Tieguhong 2004) — the level of poverty in the region is still very high (Tieguhong and Ndoye 2007). A significant majority of the local communities sustain their livelihoods by direct use of forest ecosystem goods and services for household consumption, including food, fuelwood and medicinal plants. They also generate income from the trade of many forest goods, especially non-timber forest products (NTFPs).

In addition to supporting local communities the Congo Basin forests also contribute to the national economies of the countries that share them, especially through timber exports. In 2004, 49.4 million ha (36 percent) of the forest was under logging concessions (Karsenty 2005). The logging sector contributes 10–15 percent of regional GDP and is a major source of government revenue, foreign exchange and employment (Collomb 2003). It contributes up to 18 percent of GDP of the Central African Republic (CAR) (Demarquez and Petrucci 2005), and about 20 percent of the foreign exchange earnings of Cameroon (MINFOF 2005). The development of the Congo Basin region cannot be successful without the sustainable management of its vast forest resources.

Adaptation for forests and people

The Congo Basin forest also provides major regulatory services for local and regional weather and ensures the cycling of water, which is a critical resource for adaptation and is also projected to be severely affected by future climate change (Anonymous 2007).

As well as the wildlife habitats and biodiversity preserved in these forests, more than 29 million people, mostly indigenous people of about 150 distinct ethnicities, live in the Congo Basin forests (Anonymous 2007 and CBFP 2006). They are totally dependent on the forests for habitat and resources for livelihood, which further increases their vulnerability to climate change impacts. As an ecosystem providing livelihood opportunities (e.g. water, household energy, foods and medicines) for such a large number of people living in extreme poverty, the forest remains an indispensable asset for supporting poverty reduction strategies and serving as a starting point for adaptation. Unfortunately, the value of forests to local livelihoods is not fully captured in national development plans in the Central African region. In a review of some national documents, such as the first national communication reports submitted to the United Nations Framework Convention on Climate Change (UNFCCC), very few references were found to the potential contribution of forests to climate adaptation and mitigation strategies.

For decades, deforestation (through the conversion of forest lands to other land uses) has been the second major source of greenhouse gas (GHG) emissions, after fossil fuel combustion (IPCC 2007). There has been a global decline in deforestation; Sub-Saharan Africa is the only region where it has increased. Deforestation in the western and Central African region of the continent — including the Congo Basin forests —accounts for most of this loss of forests. The huge implication of this in terms of climate change is not just carbon emissions; more importantly, it is increasing the vulnerability of forest ecosystems.

Consequently, there is a need to study climate change impacts and their implications for indigenous and traditional communities in the Congo Basin Forests. It is also important to understand the adaptation strategies these people have developed over time, particularly in marginal areas and ecosystem boundaries. The natural resource base affected by climate change needs to be evaluated in order to plan for the special adaptation needs of women and the elderly, and of minorities and under-represented groups who are the most poor and most vulnerable.

Given this lack of data, planning climate change response becomes very challenging, but it is absolutely fundamental and urgently required. Planning national climate change adaptation involves the integration of scientific knowledge and monitoring, and estimating future scenarios in order to formulate policy (Nkem, Idinoba and Sendashonga 2008). The goal of the CoFCCA project was to provide an innovative framework that incorporates forest ecosystem goods and services from sustainably managed Congo Basin forests into climate change adaptation strategies. These strategies contribute to poverty reduction and biodiversity conservation in a way that enhances resilience to future climate impacts. For a region where livelihood and national development are highly linked to natural resources, an effective pro-poor approach for climate change adaptation is fundamental in sustainability and poverty alleviation (CoFCCA 2008).

The CoFCCA initiative

The Congo Basin Forests and Climate Change Adaptation (CoFCCA) is a three-year project of the Center for International Forestry Research (CIFOR). Based on CIFOR's previous research on dry landscapes in West Africa, the initiative was developed with the idea of learning from the Tropical Forest and Climate Change Adaptation (TroFCCA) project of the Center for International Forestry Research (CIFOR) and the Tropical Agricultural Research and Higher Education Center (CATIE) and using its approach to understand the vulnerabilities of the forests and the dependent communities of the Congo Basin to the multiple impacts of climate change, both present and future. The project covers three countries within the region (Figure 1): Cameroon, Central Africa Republic (CAR) and the Democratic Republic of Congo (DR Congo).

Figure 1.
Map of Congo Basin countries
(project countries are Cameroon, Central Africa Republic and Democratic Republic of Congo)

The project's main objective is to contribute to the development of policy-oriented adaptation strategies that also ensure the sustainable use of forest resources. This is to be done in the following ways:

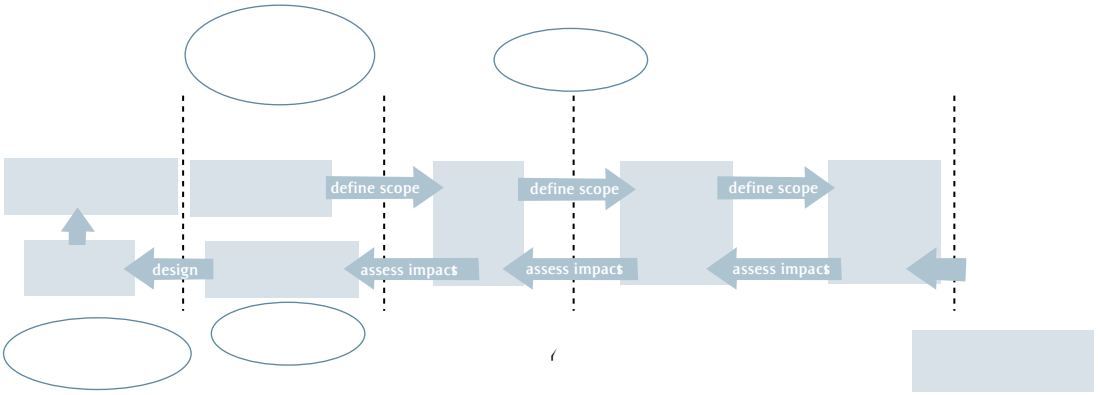
- identifying and prioritizing forest-based sectors through a regional science-policy dialogue;

- assessing the vulnerability of gender and minority groups including indigenous communities;
- developing adaptation strategies that emphasize the links between climate change, forest ecosystems and livelihoods, with the goal of mainstreaming them into national development policies; and
- contributing to capacity building for communities and technical staff.

Conceptual and analytical framework

The methodology was intended to link variables related to vulnerability (such as impacts, exposure, sensitivity and adaptive capacity) across different levels (policy, landscape, ecosystems and species), so that a streamlined assessment of vulnerability could be undertaken. It was expected that forest-based sectoral methodologies developed in the TroFCCA project could be adapted for use in the region, especially where sectors with similar priorities exist (Table 1). The methodology should be seen as a chain of events that start from the development policy and return to it while incorporating adaptation as a component of development (Figure 2).

Figure 2. Methodological framework approach of CoFFCA



Other sustainable livelihood approaches developed by CIFOR, including criteria and indicators for sustainable forest management, were used in the CoFCCA project. Starting with a national development policy, the project will assess the vulnerability of sectors and areas where forests play a significant role. After the assessment, the project would return to the national policy with a clear idea of how to incorporate adaptation. The methodology to assess the vulnerability of tropical forests to climate change will follow similar approaches, leading to a clear identification of adaptation priorities for the Congo Basin forests.

Preliminary results

In July 2007, CIFOR organized a brainstorming workshop around climate change adaptation and the Congo Basin forest. This workshop led to the implementation of the CoFCCA project. One of the main achievements of the project is creating an awareness of the forest and climate change adaptation debate within the region by emphasizing the role

of the Congo Basin forests in adapting to climate change impacts. The initial focus as far as climate change is concerned has been mitigation. In many regional policy debates and scientific literatures (for instance, the State of the Forest in Central Africa 2006), climate change adaptation is not an urgent priority.

Another key achievement involved developing baseline scenarios on climate change impacts, vulnerability and the adaptive capacity of the Congo Basin forest ecosystem. Several working groups (or task forces) were put into place within the project to study specific factors:

- the magnitude of climate change in the region;
- the impacts of climate change on forest ecosystems; and
- the effects of climate change on local communities and the communities' adaptive capacity.

Technical reports on the baseline situations are available and are being reviewed. A review of the climate change vulnerability of indigenous peoples in the Congo Basin reveals that their adaptive capacities are shaped by parameters such as accessibility to information, ability to acquire new skills and access to markets. During a kick-off meeting where several stakeholders involved in climate change and forest-related activities within the region were present, the science-policy dialogue led to the adoption of a number of forest-related sectors that are considered to be more sensitive and/or vulnerable to climate variability and change in the Congo Basin.

Sectors were prioritized at two levels, national and regional. The resulting priorities determined the research emphasis in developing adaptation strategies (Table 1). The sectors include bio-energy (wood fuel), NTFPs for food and medicinal purposes, and drinking water (CoFCCA 2008).

This analysis was pivotal in setting the stage for the rest of the project activities (CoFCCA Annual Report 2008). Other objectives are gradually building around these prioritized forest-related sectors. The results of the ranking process emphasized the importance of ecosystem provisioning services and demonstrate regional livelihood dependence on the forest for these ecosystem goods and services. The potential impact identified so far is the possible delineation of common areas of interest by several countries for collective adaptation action, with broad consequences that could be managed by a regional framework such as the Central African Forest Commission (COMIFAC).

A workshop was organized with the aim of using the Participatory Action Research (PAR) approach to evaluate the vulnerability of local forest-dependent communities and look for appropriate solutions in the Congo Basin to develop adaptation strategies at the local level. At this level, the target is to see how priorities resulting from the science-policy dialogue match communities' priorities. Contributing to capacity building, especially at the local level, is one of the objectives of the CoFCCA. Since uncertainties still remain as to the magnitude and direction of many climate change variables — such as degree of exposure, sensitivity, impacts, vulnerabilities, resilience and adaptive capacity — building local capacity and capability of students and researchers is critical. Within the project,

a number of graduate students and researchers were awarded fellowships to undertake vulnerability assessments in all the project countries. Some assessments are concentrated on landscape dynamics and modeling impact scenarios; others have focused on ecosystem goods and services, and their provisioning under a changing climate.

Table 1. Project priorities

DR Congo	Cameroon	CAR	Regional
food (NTFPs)	food (NTFPs)	agriculture and animal husbandry	food (NTFPs)
energy (firewood, charcoal)	water (potable, quality, quantity, availability, access)	water (potable)	water (potable, quality, quantity, availability, access)
water (potable)	research	biodiversity	energy (firewood, charcoal)
health (medicinal plants)	energy (firewood, charcoal)	health (medicinal plants)	health (medicinal plants)

Looking ahead

Incorporating climate change adaptation into forest policy (and vice-versa) in the Congo Basin requires information and scientific knowledge. From an epistemological viewpoint, this information will be central to mainstreaming adaptation into policy processes. At the regional level, the challenge for CoFCCA will be to identify constraints on and opportunities for climate change adaptation. Vulnerability maps of the prioritized forest-related sectors will be developed. PAR activities initiated at the local level focused mainly on the evaluation of tools for impact and vulnerability assessments, which involved knowledge sharing and learning opportunities for current and future adaptation strategies.

Results from the various research projects will be useful in shaping future climate change adaptation strategies at the local and national level. The project will provide capacity-related support by increasing collaboration with national universities and research institutes. This is particularly important for increasing the scientific knowledge and expertise of tropical forest ecosystems and climate change adaptation in national research priorities. A regional perspective on adaptation, based on a comparison of research findings from the different countries, will be integral to designing a regional political framework in which adaptation would be embedded. In addition, collaborating with an existing regional political institution such as COMIFAC should give more visibility to the outcomes of the project.

Conclusions

With the CoFCCA project, an awareness of forest ecosystems and climate change adaptation is gaining momentum in the Congo Basin. It is accepted that forest ecosystems and forest-dependent communities and their livelihoods are vulnerable to climate change. It is also understood that the vulnerability of forests will lead to the vulnerability of the

people who depend on the forest. Capacity-building is in force to expand the relevance of adaptation within the region. To date, the project has prioritized forest-related sectors and has started to develop methodologies to assess vulnerabilities. The next steps include developing vulnerability maps and adaptation strategies using forest resources. This implies a constant iterative science policy dialogue among stakeholders in the region.

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4.2 The Modified Taungya System in Ghana's transitional zone

Introduction

Taungya is an age-old forest plantation practice in many parts of the world. Land is cleared and initially planted with both food crops and tree seedlings (which, when grown, are harvested for timber). It has been practised in Ghana since colonial times to restore degraded forest lands, ensure a supply of commercial timber and produce food crops. The practice stopped in 1984 because it was not effective or equitable; the communities involved had no tree ownership, financial benefits or decision-making power in management.

Climate change adaptation in forest management may be new as a concept, but some adaptation activities such as reforestation already exist in Ghana and other countries.

The taungya practice was reviewed and in 2002 was relaunched as the Modified Taungya System (MTS). The government of Ghana, through the Forestry Commission, came up with a new approach that took into account financial benefits for farmers and other stakeholders involved and transferred ownership of the trees from a single entity (the government) to multiple owners (farmers, local communities, government and land-owners). MTS is an approach to the allocation of economic benefits and resources. It encompasses not only the planting of food crops and economic trees on a piece of land, but requires continuous care and application of necessary inputs throughout the project life.

The Tropical Forest and Climate Change Adaptation project (TroFCCA) project (Box 1) analyzed the extent to which climate change adaptation actions are compatible with Ghana's current forest policy objective, strategy and programs, including the 1994 Forest and Wildlife Policy. MTS was identified as one of the existing programs that could be considered either as an adaptation strategy or supportive non-climatic policy in the context of current national forest policies.

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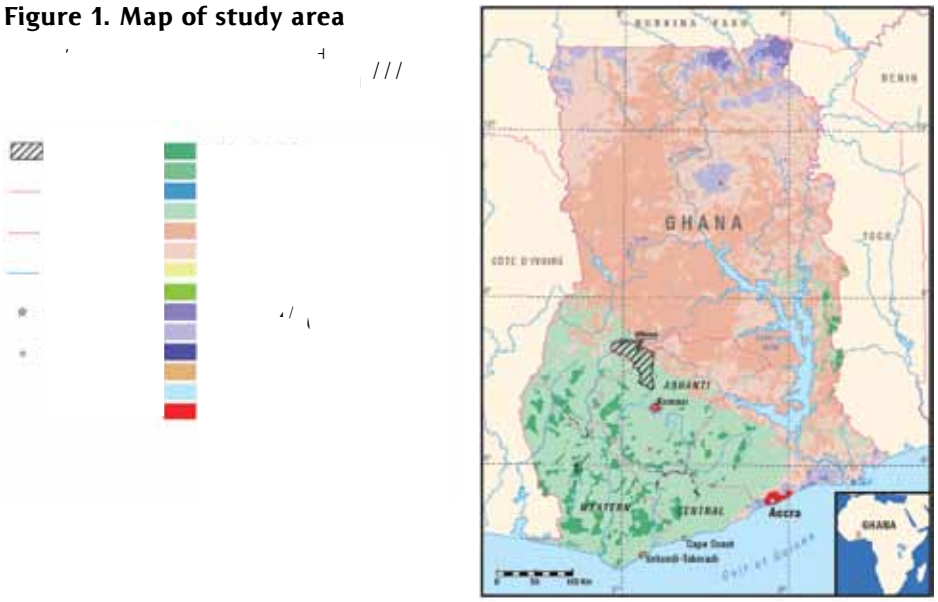
Box 1. The TroFCCA project

This article is based on a study conducted in communities in three forest reserves in the Offinso Forest District, which crosses the Ashanti and Brong-Ahafo regions of Ghana (Figure 1). These communities include Adaa, in Opro forest reserve; Nkwaankwaa and Asempaneye, in Afram forest reserve; and Anhwerekrom in Asufuo forest reserve. The Brong-Ahafo region is located between the central and northern parts of Ghana. In this transition zone, forest is quickly becoming wooded lands due to climatic factors such as increasing temperatures and decreasing precipitation, which result in frequent forest fires and drought events. Non-climate drivers include increasing deforestation activities — logging, charcoal production, expansion of agricultural lands and mining activities — which leads to forest degradation and desertification. Ashanti region has more degraded forest, although reforestation activities under MTS have slowed the gradual but constant southward change in vegetation from forest to wooded lands.

Figure 1. Map of study area



Compatibility of climate change adaptation and MTS

Climate change in Ghana is often manifested in extreme events of precipitation, sea-level rise and temperature increase, leading to droughts, floods, forest fires and desertification. These climate impacts increase the vulnerability and threaten the sustainability of livelihoods and ecosystems, especially in the country's north and transitional zones. Under the United Nations Convention on Climate Change (UNFCCC), Least Developed Countries (LDC) such as Mali, Burkina Faso and Niger are required to submit a National Adaptation Program of Action (NAPA). Ghana is not considered an LDC and thus is not required to submit a NAPA. Ghana remains vulnerable to the impacts of climate and other changes where adaptation is a necessity.

Based on NAPA documents and component 4 (formulation of an adaptation strategy) of the UNDP Adaptation Policy Framework, an adaptation strategy has several minimum requirements:

- supporting livelihood activities and opportunities;
- reducing the vulnerability of human/natural systems to climate and non-climate stresses;
- cost-effective climate change response activities;
- sustainability of adaptation response activities;
- mainstreaming of climate change adaptation policy objectives and measures into sectoral and development agendas;
- finding synergies with other development goals and multilateral agreements; and
- monitoring, evaluating and continually improving adaptation activities (Table 1).

Drawing on Ghana's First National Communication (GFNC) to the UNFCCC and the NAPAs of other African countries such as Burkina Faso and Mali, reforestation and afforestation activities have been included in Ghana's efforts to reduce the vulnerability of socio-

ecological systems to climate and non-climate stresses. Reforestation activities in Ghana (such as MTS) take into consideration most of the elements of an adaptation strategy, although they lack a clear forest policy objective that targets climate change adaptation (Table 1).

MTS provides major services including firewood and food crops, for both subsistence and commercial uses. Other services include improvement of soil fertility, control of water and soil erosion, regulation of water quality, and prevention of desertification. In the study area in northern Ghana, 30 percent of farmers face frequent flood and drought events and rapid desertification. Migrating south to and settling in the transitional zone of Ghana is an adaptation action that provides them with agricultural lands. Using MTS has improved their food and energy security with less environmental destruction.

Conclusions and recommendations

In practice, MTS in the transition zone of Ghana seems to incorporate most of the elements of an adaptation strategy. MTS is not perfect; addressing its challenges and shortcomings is essential, as it is for any adaptation strategy. An adaptation strategy is a dynamic process that needs constant monitoring and adjustments to ensure its effectiveness, efficiency and sustainability.

MTS as a potential adaptation strategy

Large, long-term government-led forestry programs may not easily succeed as adaptation measures without effective and genuine involvement by all stakeholders, with clearly defined roles.

Clearly understood tree ownership (by farmers and local communities) and the integration of immediate livelihood concerns to ensure food and energy security are important for forestry-related adaptation measures and are key to the short-term success of MTS.

Most of the farmers are not land-owners and most of them, especially those over 50, do not care greatly about benefits from the sales of the timber products in the long term. Some of them feel that they will not live to reap these benefits. Other farmers, however, expect their next of kin to benefit.

Climate change adaptation in forest management may be new as a concept but some adaptation activities such as reforestation already exist in Ghana and other countries.

Government's priorities can influence the implementation and success of an adaptation strategy. The government of Ghana seems to have a strong interest in revenue-generating forestry activities with high financial returns and has given a high priority to the implementation of plantation development program in its forest policy strategy.

Table 1. Comparison of elements of climate change adaptation and features of MTS

Elements of an adaptation strategy	Elements of the Modified Taungya System (MTS) in Ghana	
	status	comment
clear policy objective and strategy on climate change	absent	Ghana's 1994 Forest and Wildlife Policy (FWP) has no climate change objective. MTS is, however, part of an existing forest policy strategy under the national plantations development program. Reforestation is also recognized as an adaptation measure in Ghana's first national communication to UNFCCC.
reduced vulnerability and increased adaptation to climate change impacts	present	MTS lessens drought and bushfires, and acts as a buffer in Ghana's transitional zone, which faces increasing desertification and natural resource degradation. MTS also support the livelihoods of communities involved.
long-term goals	present	Taungya plantations have a continuous rotation period of about 25 years and Ghana's Forest Policy has a 25-year forest management plan.
short-, medium- and long-term benefits	partially present	The cultivation and harvesting of food crops (maize, plantain, cassava, yams and other vegetables) provide short-term benefits to communities. Medium-term benefits remain unclear and difficult to obtain. Long-term benefits include be the sales of timber with financial benefits for communities, farmers and the government.
support for development goals independent of climate change	present	Timber production from plantations is potentially the future major contribution of the forest sector to Ghana's gross domestic product. Crops cultivated under MTS contribute significantly to food security.
cost-effectiveness	present	MTS generates more than enough financial resources to cover investment costs by the government and farmers.
non-financial benefits	present	MTS helps to rehabilitate degraded forest lands. It also provides household subsistence food and other non-market environmental services such as soil fertility, prevention of soil erosion and regulation of water yield around catchments.
support for other conventions	present	MTS supports desertification control and, to a lesser extent, biodiversity promotion due to the use of few tree species, such as teak, cedrela, mahogany and ceiba.
continuous monitoring and improvement	partially present	Forest officers continuously monitor plantation activities and use the feedback for improvement. Forest officials and communities are arranging to legalize the agreed benefit-sharing scheme. Continuous efficient management of plantations after about six years until maturity remains challenging due to insufficient working materials and incentives for farmers.

Recommendations to enhance MTS as an adaptation strategy

Tree-ownership agreements in MTS between the government and other stakeholders should be documented as stipulated in the *Timber Resources Management Act* of 2002. Before logging takes place, ownership should be legalized by means of written consent by communities as required by the Voluntary Partnership Agreement (VPA) between Ghana and EU, signed in September 2008. This will help prevent illegal logging and future disagreements about sharing benefits from the sale of the timber products. Clear ownership will also support farmers' adaptation to stresses, including climate change.

To ensure that farmers are active in the running of MTS, both in decision-making and tree management activities, there must be continuous transparency and accountability on the part of the Forest Commission for all the stakeholders of MTS.

The government of Ghana should integrate an objective for climate change adaptation within the MTS, especially in the transitional zone of Ghana where MTS is making an important contribution to reducing the vulnerability of the socio-ecological system to both human and climatic stresses. This will entail the formulation of a clear adaptation policy objective or legislation to match the already supportive features of MTS.

If the government of Ghana does formulate any adaptation policy, it should incorporate the mitigation potentials of reforestation. This will provide a holistic and comprehensive approach to the various adaptation and mitigation roles of reforestation as a climate change strategy.

Exploiting innovative options such as the carbon credit potential of MTS may generate additional income and benefits that can be used to address the management, silvicultural and livelihood needs of MTS.

Although forest policy implementation is generally very weak in most African countries, some aspects of MTS are promising in terms of addressing livelihoods, resource governance and environmental protection. Understanding existing forest policy activities and programs and their strengths, weaknesses, opportunities and threats is key to the formulation of any international policy on forestry or any sectoral policy on climate change issues (adaptation and mitigation). Knowing how and where to intervene — rather than making an umbrella recommendation to revise and develop new forest policy that will address new agendas with new terminology but often with almost the same practices — will allow a realistic policy intervention to be designed.

Section 5

Landscape restoration in practice

Araucaria

Araucaria

5.1 Cultural practices and Sustainable Forest Management in Brazil

Forests are a stunningly complex ecosystem. Good forest governance requires a range of aspects to be integrated, such as laws and regulations at national and international levels, governments and civil society institutions, and forest-dependent actors such as local populations and corporations.

In recent years, national governments, NGOs and international organizations have launched several initiatives to deal with issues of global concern such as the massive deforestation of large areas of the planet and mechanisms for good forest governance. Strategies to implement successful Sustainable Forest Management (SFM) have long been discussed by the international community. An important step is being taken by the United Nations Forum on Forests, which is leading negotiations on an agreement between country members regarding the financial mechanisms for the implementation of SFM. Despite these efforts, however, forest loss continues unabated. This has crucial implications for global climate change and environmental security.

Forest dwellers have cultural practices that are correlated to forest conservation and affected by climate change. Cultural features should be considered when climate change mitigation and adaptation strategies are being negotiated.

Forests are of particular interest to climate change policy-makers, given their strategic functions at the local, national and global level. These include keeping the earth's climate in balance, acting as global sinks for carbon emissions and providing habitat for biodiversity conservation. Forests also have economic, social and cultural importance for local and national economies and livelihoods. Climate change mitigation and adaptation are part of forest services and need to be better assessed.

Rural communities

Auguste de Saint-Hilaire, at the invitation of Portugal, made incursions through Brazil from 1816 to 1822; at the time, Brazil was still a Portugese territory. Saint-Hilaire portrayed ona da Mata as a region covered by gigantic forests and inhabited by a "barbaric" indigenous population. ona da Mata ("forest zone"), named after its vast natural vegetation, has a long history of land exploitation and deforestation. It is located in Minas

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Gerais, a state that was a major supplier of gold and precious minerals to Europe. Large coffee farms replaced forests in this mountainous landscape. Today, smaller properties are owned by families who live on subsistence agriculture and cattle-raising. Its isolated forest fragments reveal a pattern of over-exploitation.

Muriaé is home to the largest conservation unit of Minas Gerais, Serra do Brigadeiro State Park, with 32,500 ha. Rosário da Limeira municipality is situated in the park buffer zone.

In Buracada, Santa Catarina and Pedra Alta property sizes vary between 15 and 20 ha and each community consists of 35–50 families. Iracambi Atlantic Forest Research and Conservation Center, however, owns 500 ha comprised of forest patches in different stages of regeneration, a farm, research center facilities and 70 ha of a Private Reserve of Natural Patrimony (RPPN).[1] According to Robin Le Breton, Iracambi's research director, it is crucial to consider existing conflicts within the territory and to recognize the need of local communities to be included in the search for solutions. Projects must address economic alternatives and pursue conservation purposes, and — a new phenomenon — consider climate change impacts to local communities.

The Iracambi forest corridor project

Iracambi is studying alternatives for forest corridors, including economic alternatives for land-owners. These are mainly aimed at evaluating crops to be planted, possible uses of eucalyptus and assessing appropriate locations in the community for project implementation. An ongoing project called Forest Future allows people to adopt a forest plot.[2]

It is common knowledge that the Brazilian Atlantic Rainforest has been heavily exploited; only seven percent still remains. What many people do not know is that some local populations have practices, which, if incorporated in natural resource management (NRM), could strengthen conservation efforts by increasing the number of restored forest fragments. These practices support the goals of Iracambi's forest corridors project: to reduce forest fragmentation while increasing income generation for local people.

Given the importance of forests and their impacts at local, regional and global levels, it is necessary to put into practice conservation projects that combine climate change mitigation strategies with meeting the needs of local populations. Communities have developed their own patterns of using water resources, firewood and land. By assessing local cultural practices it is possible to reconcile different forest needs. It is crucial to combine research with local knowledge; this will enhance forest governance.

Land heritage system

Studies of the heritage system of rural families in the region indicate that local NRM should be taken into consideration when developing forest governance practices. Forest-dependent communities, river-dependent communities (*ribeirinhos*) and other populations — also known as "traditional communities" — are those most affected by climate change.

The project identified a few larger forest fragments and properties where natural regeneration was taking place. Research was carried out on a local practice regarding land

heritage, particularly property division among families and its implications for forest fragmentation and consequently, to NRM strategies such as forest corridor management. There are three main aspects of the land heritage system, which involves either donation while the patriarch or matriarch is alive or land division after he or she has died:

- heirs receive equal portions of land;
- the land closest to the farmhouse, as well as the farmhouse itself, is given to the youngest heir, which protects him or her if the parents pass away when he or she is very young; and
- the remaining land is divided according to the proximity of each heir's house to the parent's property. Beneficiaries who live in other communities or nearby cities are likely to receive portions of land located farther away from the farmhouse.

On at least four properties, forest fragments were regenerating as a consequence of this system. By asking the population about the history of these properties, two trends of forest fragment conservation were discovered:

- Forested land: since most land farther away from farmhouses is forest — legal reserve or land unused by land-owners (due to a lack of money to work the land and/or lack of need to work it) — it is bequeathed to heirs who live in other communities or big cities. It ends up abandoned; as a consequence, spontaneous ecological restoration occurs.
- Grassland or old coffee plantation land: usually the plot is abandoned and forest regeneration begins. Once the vegetation reaches a certain size, it becomes difficult to obtain a government licence to exploit it.

Mapping family heirs and interviewing local populations on heritage patterns can help identify which land fragments will be given to heirs who live outside the community or are more likely to be subdivided between heirs. Gaining this information makes it possible to identify which land plot under major threat will be eligible to be acquired through land division; this increases the project's success.

Water security

Water is a renewable resource but a finite one. Forests can affect water quality and quantity and protect watersheds. Local inhabitants are aware of altered rainfall cycles; this might be due to climate change. Intensified summer rainfall has led to inundation of valleys and subsequent agricultural losses. Deforestation has also affected water springs.

Water security is a main concern for the local people. Apart from household consumption, people use the river for rice irrigation and for recreation. People depend heavily on local water resources, such as springs located in nearby forests, and are the first ones to be affected by declining water levels.

Sharing water springs is a cultural practice in local communities. If a family owns a portion of land where there is no water spring, they negotiate with a neighbouring family for access to their water spring. This practice has increased due to the declining number of springs. Moreover, the river that was once two to three metres wide is now only one

metre wide. Deforestation leads to water scarcity; conversely, forest restoration may lead to greater availability of water and water security in times of climate change.

When questioned about the positive impacts of forest fragments on their property or nearby land, women reported having easier access to firewood. Although some families own gas stoves, most still use firewood for cooking and for heating water. In some communities families reported that they had to purchase firewood from city markets since it was getting scarce.

Recommendations

Forests are a fundamental factor in the planet's climate regulation. Forests also provide wood for human use and habitat for flora and fauna species, many of which have not yet been identified or catalogued. Not surprisingly, the management of forests and its numerous functions are often a source of political, economic and social disputes.

Turning forest areas into parks at the federal, state or regional level is one approach to forest conservation. Conservation of forests can directly affect the livelihoods of forest-dependent populations, however, by prohibiting access to forest resources in areas previously being used by surrounding communities. Local practices and natural resource uses should be assessed and discussed with the affected populations. Practitioners can use this information to design better NRM frameworks that incorporate local people's land use.

NRM needs to take into consideration that more land for forests may mean less land for local communities to cultivate, and therefore less income. When local population practices, and local culture as a whole, are considered during NRM design the effectiveness of conservation projects is strengthened. It also gives the local community a sense of being respected, which is important for the support of conservation goals. Moreover, respecting local knowledge and practices has proven to improve project results. In the case of the Iracambi project, creating a network within the local population facilitated research.

Applied anthropological research approach is crucial and has a positive impact on the quality of information. Although a relationship of trust takes time to grow and brings a higher level of complexity — which might require more time and money for conservation research — such research is a decisive tool for designing conservation strategies that address the needs of both conservation and local populations.

Climate change impacts on forest-dependent populations also need to be considered. Local populations have developed a culture around their forest resources and are likely to suffer from climate change impacts such as changes to water regimes and water scarcity. Conversely, some cultural practices may have positive impacts on forest conservation, as was the case with the land division system. Cultural features should be taken into consideration when climate change mitigation and adaptation strategies are being negotiated.

Forest corridor management requires a long-term commitment from both the community and the institution coordinating project implementation. Chances are that the owner who inherited a portion of land with forests may not even be able to obtain legal permission to

exploit the forest; this may reduce livelihood revenue. By determining which heirs are not likely going to cultivate, it is possible to determine which fragments have the potential to be incorporated as part of a corridor. This would help a forest corridor project attain a better rate of success in implementation.

Another possible approach for the establishment of a forest corridor is to assess the potential earnings from alternative uses for the land. When compared to the revenue obtained from traditional use, this would give local communities information about future income if they choose to be part of a forest corridor project. Similarly, such an assessment could broaden funding possibilities for conservation programs, such as Iracambi's forest corridor or Forest Future.

In terms of water springs and firewood access a possible solution is hidden within the problem. If deforestation decreases water and firewood access, it can be assumed that an increase of forest fragments will also increase the availability of these resources. This argument could be used to convince local people to conserve and extend their forest fragments. More importantly, it is an approach that meets community needs with the benefits of forest fragment conservation. This was evident when community members were asked about possible positive impacts of forest fragment proximity and women mentioned firewood, most likely because they are usually the ones in charge of gathering this resource.

Nonetheless, this approach is not a "recipe for success" on how to proceed, either for good local forest governance or to minimize climate change impacts. Recognizing the complex situation in NRM and the different functions fulfilled by forests, however, it could be a way to design approaches that reconcile economic, social, cultural and ecological forest values. Investigating natural resource use through a cultural perspective and recognizing that it is constantly evolving leads to a better comprehension of NRM projects. It is necessary to acknowledge the local culture in a study area. This helps to increase the practioners' know-how and allows alternative strategies to be conceived for forest conservation, governance and climate change mitigation.

Endnotes

(Reserva Particular de Patrimônio Natural)

Further reading

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5.2 Brazil's Araucaria rainforest: climate change and reforestation

Ancient conifer rainforest in Brazil

Trees of the genus Araucaria are ancient conifers and have been called "living fossils" (Hampp, Breuninger and Mertz 2000). During the Permian period these trees were widespread, but after fragmentation of the Gondwana continent their descendants survived only in the extreme western and eastern margin of their original distribution. Most of the 20 remaining Araucaria species occur in far eastern regions; only two taxa are left in South America (Golte 1993; Mecke, Mille and Engels 2005):

- Araucaria araucana is distributed in the Chilean Andes; and
- Araucaria angustifolia is found in the south of Brazil and adjacent areas of Argentina and Paraguay (Rambo 1960).

Protecting the remnants and partial restoration of *Araucaria* forests can help to decrease the effects of climate change in southern Brazil.

Only the latter species has formed large forests; these once covered the coastal mountains of the Mata Atlântica at latitudes between 18° and 30°S (Figure 1). The Araucaria rainforests once extended over 250,000 km² in the range of the South Brazilian states of Rio Grande do Sul, Santa Catarina and Paraná (SOS Mata Atlântica 1998), mainly on sites at altitudes of 300 to 1,800 metre above sea level and reaching a width of up to 800 km. In Sao Paulo forests covered about 80 percent of the land; in Rio Grande do Sul they covered 50 percent.

Threats to Araucaria angustifolia

Adult Araucaria trees dominate the canopy of this ecosystem (see photo above), unique in tropical and subtropical ranges. After 1950 the Araucaria forests were subject to massive clearings, due to timber logging, agriculture and settlements.

Farmland formerly dominated the countryside of Araucaria woodlands. On this land traditional small-scale agriculture was combined with timber harvesting. This allowed generations of descendants of immigrants, who arrived during the 19th century from Germany and other European countries, to live from the sustainable use of their land. Once the trees were cut down, the local wood-processing industry collapsed.

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Figure 1.
South Brazilian *Araucaria* rainforest (shown in green) about 50 years ago
scattered distribution only north of Sao Paulo

The local climate also began to change and the farmers' standard of living decreased rapidly; many left their homes. Some people managed to find new farmland in the north, for instance in Mato Grosso or even far away in Amazonia. The reform of landed property, often discussed, is still unresolved in Brazil, leading to the *sem terra* ("landless") movement and occupations of unused *fazendas* (farms), and creating severe conflicts. Most of the rural population migrated to the fast-growing cities, increasing the urban problems of joblessness and lack of housing. The socio-economic turbulence resulting from massive forest clearings remained widely unresolved until now.

Only fragments of the originally continuous woodlands are left. In the state of Paraná, for example, no more than one percent is left of the *Araucaria* forests, which formerly covered more than seven million ha; the tree was often called the Paraná pine (Mertz et al. 2003). Meanwhile, the Mata Atlântica has become a Biosphere Reserve and was declared a highly endangered hotspot region that requires immediate protection measures (UNESCO Natural Science 2007).

As recently demonstrated, climate change causes considerable pressure for the remnants of *Araucaria* rainforests. Conservation of the tree species *Araucaria angustifolia* is necessary; an increase of ambient temperatures and changes in the atmospheric circulation were modeled to predict the expected climatic impact (Silveira Wrege et al. 2007). The alarming consequences of continued climate changes to the environmental conditions in southern Brazil and in particular to the survival of the important *Araucaria* rainforest ecosystem are well documented.

Araucaria rainforests and climate change

The large area of *Araucaria* rainforest within the biome of the Mata Atlântica developed during the past 5,000 years as part of the dynamic vegetation changes caused by the increasingly humid climate of the southeastern Neotropics (Behling 2005). Open land with at least seasonal bare ground has replaced the rainforests and alarming climate changes have been observed. The forest's function as a water reservoir has been lost, and the diminished biodiversity has reduced the stability of woodland ecosystems. Records of surface temperatures reveal an extreme warming in the range of 2.0–3.5°C, particularly in localities without permanent vegetation cover (Hamza, Cavalcanti and Benyosef 2007), with a subsequent rise of hot air into the upper atmosphere. This leads to storms sucking

in cold Antarctic airstreams, which now extend far north, and to resulting frost periods in the tropical state of Minas Gerais, which can kill coffee crops (Blomberg 2000).

In northeast Brazil, the Atlantic rainforest has been cleared since the introduction of sugarcane cultivation in the 17th century (Coimbra-Filho and de Gusmao Camara 1996). Because large areas there have thin *cerrado* and *caatinga* vegetation, the impacts of climate change are less evident, manifested mostly in more frequent heavy rainfall in usually dry regions (Rao et al. 2006).

Natural reforestation in the Pró-Mata project

At the time of the first United Nations Conference on Environment and Development (UNCED), in June 1992, the Pontifical Catholic University of Rio Grande do Sul (PUCRS) in Porto Alegre, together with Germany's University of Tübingen, established an *Araucaria* forest protectorate on the previously woody Serra Geral of Rio Grande do Sul. The 5,000-ha area was named Pró-Mata (Engels 2003). The area was destined for research and conservation and would attain the status of a nature reserve, owned and administered by PUCRS. Support came from the local municipality of Sao Francisco de Paula, from companies (especially A. Stihl), the GEO foundation in Hamburg and the University of Tübingen. As well as intensive studies on fauna and flora, experiments on natural reforestation were initiated in cooperation with the University of Applied Forest Science at Rottenburg (Engels and Heinle 2003). About 30,000 seedlings of *Araucaria angustifolia* and *Ilex paraguayensis* ("*erba maté*) were planted by graduate students from Rottenburg. The concept, then new, was to plant young trees right into existing secondary vegetation (*see photo, left*), which consisted mainly of *baccharis* bushes and mimosa trees. During the last 12 years the young *Araucaria* trees reached heights of five metres and more. The project was part of the SHIFT program financed by the German Ministry of Education and Research. The final report was published in 2002 (Heinle 2002).

The intent of the program was to accelerate the regeneration process of natural *Araucaria* rainforest considerably and, at the same time, to avoid the costs and negative effects of removing the existing vegetation. As far as is known, this attempt at reforestation in secondary vegetation of pioneer plants had previously not been tried in Brazil. The key factor was to not clear the land by cutting and burning the shrubs, but to make use of the existing biomass. This provides a humid environment that allows the young *Araucaria* trees to grow. In addition, because of the abundance of green leaves in the diverse shrub vegetation, the *Araucaria* needles are not the only available forage for leafcutter ants, which usually attack monoculture plantations of *Araucaria* (Zanuncio 1993). Most importantly, the seedlings are not trying to grow on bare soil, with all its negative effects.

Forest politics in Brazil

Since 2006 the Brazilian government has improved its legislation on nature conservation and initiated reforestation programs. Sustainable use of forests and protection of native vegetation are now regulated by public laws 11.284 and 11.428. The National Biodiversity Program (PRONABIO) was initiated by decree in 1994, but financial support for its initiatives was provided only recently. A worldwide increase in understanding the importance of forests to the global climate had already brought about some change in public opinion on the relevance of reforestation in Brazil. It is hoped that the measures now planned by politicians will be successful in reducing the negative and already alarming effects of climate change, particularly the damage to the formerly vast rainforests.

Warnings about the negative consequences of the loss of Brazilian woodlands was expressed again and again, particularly by NGOs such as SOS Mata Atlântica (1998). Only recently have the federal and state institutions responsible for environmental issues held discussions with these private organizations. Support is required not only from national sources, but from international agencies like the World Bank; this could effectively initiate reforestation activities. This will only take place if the problem is tackled at the local and regional level, which is, in fact, intended by the new federal legislation. Winning the support of the public will be a challenge for politicians and will be a key factor for the success of the green movement, with the goal of maintaining an acceptable living space for the growing Brazilian population.

Conclusions

Rio de Janeiro, Paraná and Santa Catarina states were once completely covered with Atlantic rainforests. Most of this indigenous ecosystem has been destroyed. Protecting the remnants and partial restoration of Araucaria forests can help to decrease the effects of climate change in southern Brazil. This will diminish the impact of frost and drought on agriculture, especially reducing harm to coffee and citrus crops.

Furthermore, investment in planting Araucaria trees will yield long-term interest; there is shortage of this valuable timber on the market. Experience from the Pró-Mata project shows that reforestation with existing secondary vegetation is not only less expensive than conventional clearing of the land, it confers environmental benefits, prevents damage from fauna and flora and saves time in obtaining an effective vegetation cover. It does all this without negative consequences to the local climate. This approach should be included in the official recommendations of measures.

More research is needed on deforestation's effect on climate change. The findings will likely support more reforestation activities and, it is hoped, will halt deforestation. Increased engagement on the part of the media will increase public support for the importance of forests in reducing global warming. This will subsequently influence decision-makers in policy and economy. More information on environmental requirements is needed, and it is strongly recommended that corresponding initiatives be undertaken. The importance of a green environment, especially woody landscapes in tropical countries, in

maintaining the quality of living space for the population should receive much more ttention than it does at present.

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5.3 Restoration of forest landscapes in Southern Caucasus

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Mitigating the impacts of climate change

Within the framework of the program, "Mitigating Impacts of Climate Change through Restoration of Forest Landscapes in Southern Caucasus," financed by the German Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), forest ecosystem restoration activities have been implemented on more than 1000 ha in the Southern Caucasus countries of Azerbaijan, Armenia and Georgia since autumn 2008 (WWF CauPO 2009).

Forests play a vital social, ecological and economic role in the Southern Caucasus. The livelihood and the well-being of many people depend on their access to forest products and the delivery of environmental services through the forests.

CARBON SEQUESTRATION SHOULD NOT BE THE ONLY CRITERIA FOR PLANTING FORESTS, AS FORESTS HAVE A NUMBER OF ESSENTIAL SOCIAL, ECOLOGICAL AND ECONOMIC FUNCTIONS APART FROM CLIMATE REGULATION.

However, forests in the region face severe threats, notably illegal logging, over-exploitation and overgrazing but also uncontrolled infra-structure development. The energy crisis that resulted from the collapse of the Soviet Union caused excessive fuelwood harvesting, which resulted in severe degradation and destruction of forests.

In terms of the negative impacts of climate change, the Southern Caucasus region is already experiencing increasing temperatures, shrinking glaciers, sea-level rise, reduction in and redistribution of river flows, decreasing snowfall and an upward shift of the snowline. Other problems include flooding, landslides, forest fires and coastal erosion, with significant economic losses and human casualties as a result. These trends in the region will continue with large-scale changes in ecosystems. In addition, many species with specialized habitat requirements will likely decline (Sylvén, Reinvang and Andersone-Lilley 2008).

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Climate change increases the need for forest restoration, both to help forest ecosystems cope with existing changes and to help them adapt to changes in the future by increasing areas of natural healthy forest ecosystems (Biringer and Hansen 2005).

To counteract the negative development mentioned above, the project objectives are as follows:

- forest ecosystems in selected pilot areas should be successfully regenerated or rehabilitated for increased carbon storage and enhanced resilience against climate change and put under sustainable management regimes.
- project experiences should be incorporated by governments of the partner countries when they revise their respective forest policies and strategies. These improved strategies should be increasingly applied during implementation of afforestation or forest rehabilitation schemes.

To achieve these ambitious goals, suitable locations were selected on the basis of prior consultation with the local residents and in close cooperation with the countries' line ministries. The sites chosen in 2008 for project activities had the following characteristics:

- former forest areas;
- representative of areas in the country of special ecological and social importance; and
- little competition with other land-use systems.

The areas chosen (Table 1) would receive two benefits of forest restoration: carbon sequestration and an improved capacity on the part of ecosystems to adapt to climate change.

Some areas were totally deforested; others had shrub vegetation and low-density forests located within the project sites. This notwithstanding, the process was very similar for all sites:

- at the beginning of the project possible locations were screened in collaboration with local villagers and government representatives;
- the sites were visited;
- after consultation with representatives of the local population to determine the boundaries, a GPS-supported site survey was conducted;
- using GIS technology, maps were produced, which enabled further criteria such as accessibility, cadastral information and shape of the areas, to be appraised — which along other things supported the optimization of fencing, in particular in terms of minimizing the length;
- the areas were delineated according to soil type and physical geography; and
- vegetation type and condition, threats and land use were documented.

The potential natural vegetation/forest type was identified based on the site's climate and soil. This allowed the carbon sequestration potential to be roughly estimated. All findings were visualized in maps.

Table 1. Descriptions of project sites

project site	description of forest land	treatment area (ha)
Armenia: Lori Region, Northern Armenia Lesser Caucasus	Hayantar forest land, community forest land or former Kolkhoz forest land; all deforested before 1990, mainly barren hilltops	500
Azerbaijan: Ismailli, Seki and Kakh districts in northwestern Azerbaijan	State Forest Department land, stocking density 0–30 percent, 150 ha deforested before 1990; 200 ha after; mostly flat terrain, large percentage of floodplain forests (seasonally flooded)	350
Georgia: Kharagauli	Former kolkhoz forest; mountainous, on steep slopes, eroded; deforested with some shrub vegetation; before 1990 the deforestation process was very slow and was mainly caused by grazing; in the early 1990s, the deforestation process accelerated due to intensified grazing and illegal logging	25
Georgia: Chiauri area, near the border of Azerbaijan	Destroyed floodplain forests along the Alazani River	150

It became clear that areas of similar circumstances and similar future needs could be identified. A strategy was developed for each project site that aimed at a restoration of stable, natural forest ecosystems.

At this stage of the process intensive consultations with the local villagers were necessary to identify their needs and to match them with ecological issues. In some cases people favour exotic tree species like *Robinia pseudoacacia* or *Eucalyptus* sp., which do not have a very high ecological value (WWF CauPO 2008).

For the time being all land belongs to the government. Various options for future land ownership are under discussion in each country; these include transfer of management to communities, transfer of use rights and maintaining the status quo.

Sylviculture measures include planting, direct seeding and natural regeneration. As pointed out by Holz and Placci (2005, 250), "The art of restoring a forest landscape consists, to a large extent, of the strategic selection, combination and adequate use of different methods for each stage and for each case."

The Southern Caucasus project incorporates both passive and active restoration, since all chances for natural regeneration should be supported as much as possible. It has been decided, therefore, to keep all remnants of succession. The demand for seeds and seedlings could be identified based on the natural composition of species.

Indigenous species, preferably a mix of species, will be planted so as to restore natural species composition. The planting density will be comparatively low (3000 seedlings/ha) to allow for additional natural regeneration. This will also support interim community uses

(haymaking, inter-cropping). Longer-term benefits for local communities are access to forest products (both timber and non-timber).

Fences and guards were required. Although the local population supports forest establishment, the young forest has to be fenced, particularly during the initial phase of regeneration, because of the way livestock is managed (uncontrolled grazing by cattle and sheep).

Wherever feasible, project activities will use community-based forest management approaches. Labourers for field activities will be recruited from adjoining communities. This will have two benefits: it will create local income; and it will raise awareness about the project and the envisaged results. Labourers will also help to distribute information to others about the project background and objectives.

Chiauri site, Georgia

At the Chiauri site in Georgia, reeds and other species, which proved to be of low ecological value, covered the whole area. This vegetation cover had occurred after the destruction of the floodplain forest and the subsequent restoration of the natural flooding regime. The forest had died completely when the area was flooded for several years as a result of the Kabali River being gradually filled with soil and stones brought down by the river from the mountains. A few years ago, the government cleaned the riverbed because the artificial reservoir created problems such as malaria and flooding. The hydrological situation was evaluated in the context of this project; this provided relevant information about the ability to restore a natural floodplain regime and associated forest ecosystems.

The first clearing of the area (manual cutting of the grass) was done in spring 2009. This had to be done carefully, because during the site inspection, a significant number of seedlings of various tree species had been observed in some parts of the restoration area. These seedlings can be used as a nucleus for natural regeneration and will be maintained. Cutting the vigorous grass cover prevented its competing with the new growth. Manual clearing was also preferred due to the high number of stumps and dead trees from the former forest and the risk of soil compaction. The standard procedure would have been to plow the whole area.

The cut vegetation remained on the field. This mulch was intended to suppress the competing grasses and to retain moisture, which would prevent the soil from drying up. The fire risk from the cuttings is low, as the area (a floodplain regime) is generally quite humid, with high precipitation levels (800–1,000 mm per year).

About 90 local villagers were hired for the work. Various techniques were tested; the best option was the use of special forest scythes. This scythe has a short blade, but is stronger than the ones used in agriculture for cutting grass. Precise cutting, which leaves young trees standing, is possible using this technique. Preliminary assessments in June 2009 showed that many specimens of indigenous poplar were sprouting. Previously covered by the grassy vegetation, they now had better access to light. This means that huge areas can

rely on natural regeneration to restore the natural ecosystem of floodplain forests. They will be removed from the area of artificial regeneration activities scheduled for October 2009.

Conclusions

During these preparatory activities, it became apparent that a thorough site survey was necessary to develop a tailor-made silviculture strategy. Carbon sequestration should not be the only criteria for planting forests, as forests have a number of essential social, ecological and economic functions apart from climate regulation.

Establishing a species composition close to the natural ecosystem will help to overcome stress factors such as bark beetles and fungi. Although these are natural to the ecosystem they may become more prevalent due to climate change.

It has also become apparent that people living near the project sites had certain expectations with regard to project results. Although there will be long-term perspectives regarding the environmental services provided by the re-established forests — such as erosion control, improved generation of ground water, and protection against avalanches and mud slides — the short-term goal is income generation through employment.

An effective communication strategy was also very helpful. The local population had to be informed that many activities would lead to some restrictions at first (e.g., loss of grazing areas), but in the long term would be beneficial. The use of questionnaires (at the Kharagauli and Chiauri project sites) about existing knowledge regarding climate change impacts helped to raise awareness and involve the local people.

At both sites, the respondents revealed a high level of awareness; for instance, almost everyone recognized that climate change was already taking place. Increasing air temperatures as well as the frequency and duration of droughts were named as most obvious effects of climate change. Reduction of agricultural yields and drying-up of forests were most frequently mentioned as examples of impacts of climate change. Forest restoration was most frequently mentioned as a means to combat climate change. Many aspects of the environment are changing, and in the perception of farmers these are due to climate change.

While implementing the restoration processes the demand for forest reproductive material (seeds and seedlings) could not be satisfied completely. Site-specific solutions include the need for site-adapted forest reproductive material of suitable provenance. The shortfall of high-quality seedlings was not surprising, given that the material available in the nurseries reflected the existing, pre-project demand. To overcome this bottleneck, direct seeding of oak will be used to a large extent, as the production of high-quality seedlings takes two years.

Recommendations

The project dealt with the establishment of the forest, not the funding for its management. Future activities must be agreed to by all parties and conducted or supported by the forest owners. After establishment of the forest relatively little financial support is needed for management activities. Nevertheless, efforts will be made to identify additional financial opportunities for supporting the management of the newly established forests.

Forest restoration in the Southern Caucasus should first concentrate on the improvement of silviculture (species composition, forest protection, etc). Silviculture methods should fully support site-specific solutions, and should include ecological aspects as well as socio-economic perspectives. The preferred method would involve the lowest possible input to reach the projected silviculture goals. Therefore, measures that make use of natural processes such as stimulating succession would be preferred.

Multiple objectives — the forest's protective function against soil erosion, avalanches and flooding — should be applied in restoration activities rather than focusing on carbon sequestration alone. The ecological situation will not allow the storage of carbon at a level similar to that in tropical forests, but assessment of the carbon sequestration potential can help to demonstrate the climatic impacts of project activities. The carbon impact of the restored forests will be assessed. Assessment approaches will vary slightly at the different sites according to their specific situations (area, location, length of deforestation, etc). This variation should not undermine the comparability and transferability of the results.

Since high-quality seedlings will always be needed for use in the restoration processes, some attention should be paid to the nursery sector. The best option to safeguard access to material of high genetic value (site adaptation) and good quality will be a close cooperation with the forest tree seed sector. Contracts for raising seedlings of specific characteristics should be made in advance, so that the nurseries will be in a position to deliver the materials requested when needed. The use of forest reproductive material of unknown stock or unsuitable provenance (in terms of altitude and ecological situation) will worsen the situation and create additional threats to the forest ecosystem. Unfortunately, the problems sometimes become apparent only in the middle of the life cycle of a forest (e.g. production of unsuitable pollen leading to genetic deterioration of the population of the species). Particularly in the Southern Caucasus, where species have a natural distribution ranging from sea level to high altitudes, thorough documentation of the seed source is an essential step to increase the resilience of ecosystems.

One aim of the project is to develop strategies for forest restoration based on practical findings within the region. Therefore the standard procedures shall be assessed, new measures will be tested and, as a result, best practices will be confirmed.

For more information

The project is implemented by the WWF Caucasus Program Office, which can provide more detailed information (iosepashvili@wwfcaucasus.ge).

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5.4 Reforestation of Mount Malindang, Philippines

In the beginning of this century, Alterra, a research institute at Wageningen University, carried out extensive biodiversity research on the slopes of Mount Malindang on the island of Mindanao, the Philippines. The area was subject to extensive illegal logging in the last century, and the remaining biodiversity had become endangered (Figure 1). The volcanic mountains in the region harbour several endemic species that are rarely found in other areas.

The scientists involved in the research spent a great deal of time in the area with the local population and observed that both the local people and the local governmental institutes were interested in reforesting the area. As usual, however, there was a lack of money.

Trees for Travel, a foundation working in the area of climate mitigation by means of reforestation projects, became involved. The foundation raised the necessary funds by offering individuals, companies, governments and other bodies the means to offset their CO_2 emissions resulting from the consumption of fossils fuels used during traveling and other activities. These funds support several projects, particularly in tropical countries. The projects mainly involve reforestation, but also incorporate renewable energy initiatives such as biogas installations for households.

This project shows that success is nearly guaranteed when local people, local government and related institutes are not only involved in the project, but basically run it. On the slopes of Mount Malindang one tonne of CO_2 can be stored for €7.50.

Trees for Travel feels that reforestation should be more than just planting trees. The local population should benefit, either by being employed in the project or being able to earn money from forestry products. Nature should of course benefit in the way of improved biodiversity, reduced erosion and improved water quality. The challenge was to establish a project for Mount Malindang that involved all these aspects, including the wishes of the local population and government. One of the crucial points was the good relationship and trust with the local people that had already been established by the scientists of Alterra. They were able to negotiate effectively between the local people and Trees for Travel.

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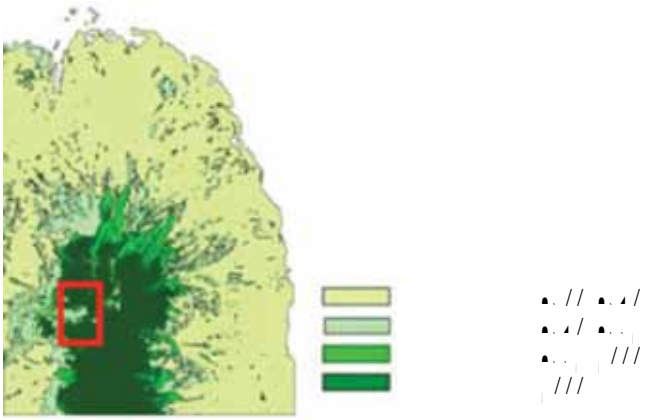
Figure 1.
Rate of deforestation on Mount Malindang in the 20th century



Project design

In mitigation projects one of the issues to consider is certification of the CO_2 sequestered, or in the case of renewable energy, prevented. This work is still being done by certifiers from the Western world and they ask Western rates for their services. This means that a forestry project needs to be around 1000 ha to be cost-effective for certification. When starting a new project, however, it is usually not wise to start big. In addition, Trees for Travel was not able to fund the planting of 1000 ha of forest at once. The decision was made to start small by planting trees without certifying the CO_2 sequestered. Calculations were made of the amount of CO_2 that would be contained by the forest when fully grown, and of the CO_2 in the current vegetation of grasses and ferns. Even though there will be no CO_2 certificate available for the time being, the amount of CO_2 that will be sequestered can be estimated. Participants can have trees planted for them on the slopes of Mount Malindang, knowing they will sequester CO_2, and also knowing that no money will remain in Europe for the expensive certification process. In the future, if enough baseline data is available, participants can still decide to have the CO_2 certified.

Another important aspect of mitigation projects is how to guarantee the survival of the forest. It is known that native people log illegally, even in protected areas, to earn money. On the other hand, some native people are enthusiastic about replanting their forests, for instance, the Green Belt Movement in Kenya.

Although the slopes of Mount Malindang are sparsely populated, the local people also want to make a living and since they are far from cities and employment opportunity, logging would seem to provide an easy way to earn money. They indicated, however — as did several local government institutes — that they would like to replant the slopes. Not only do local people appreciate the forest, they also understand the negative effects of logging.

Erosion is a very clear example. The area receives about 2,500 mm of rain a year; previously the forests would cause the rain to infiltrate the soil, but the current grass/fern vegetation is not capable of continuing this process. This results in soil being washed away

and land being flooded. At the foot of the volcano many agricultural areas have severe problems because of these floods. Watercourses are also subject to the negative effects of the soil particles that are dissolved in the floodwater.

Three incentives were decided on for the local population:

- 20 percent of the area planted will be community forest. In this area the local people can decide which tree species they want to plant. If they decide on species for construction lumber, they would have to replant one tree for every tree harvested. The other 80 percent will consist of a species composition resembling the existing forests and will be considered protected forest in which no logging is allowed.
- The local population, through their barangays (comparable to a municipality), will receive a disbursement each year when the planted forest and the remaining forest uphill is healthy. A fund has been established to guarantee these payments for 30 years. The idea is that after 30 years the forest will be well established and the local people will be able to make money from the usufruct of this protected forest. This means that they will be able to collect seeds and fruits and other products whose harvesting will not harm the forest. The community forest will also be productive by then, providing them with income.
- All the work will be done by the local people and they will be paid for this work. They have established the tree nursery and are responsible for collecting seeds and seedlings. They take care of the seedlings in the nursery and transplant them. They also carry out the maintenance of the newly planted areas during the first few years, including weeding and replanting when necessary. The people get support and training from the local forestry service and the local government for all these activities.

Another important aspect is control. Even though the CO_2 sequestered will not be checked, a control system should be in place to verify the number of trees that are planted and growing. The local population has been trained in the use of GPS. This means that they can indicate exactly where the trees have been planted. Contacts have been made with a university in the capital; a scientist from the university will visit the area once a year to check the planted area and the health of the trees. The species composition will also be checked; it is important that the right species are planted to match the original forest of the mountain slopes. The Dutch scientists who have been involved in setting up the project visit the project twice a year to be of assistance in technology transfer and to be the eyes and ears for Trees for Travel. On every visit they do a random check of planted areas.

The local institutes, together with the barangays, have established the Protected Areas Management Board (PAMB), on which they work together. Board members meet regularly and write a report of every meeting, which is submitted to Trees for Travel. There are some enthusiastic photographers and filmmakers in the group, who document the work being done.

Implementation

In the area that will be reforested, two main forest types are planted: submontane dipterocarp forest and almaciga (*Agathis philippinensis*) forest. A submontane dipterocarp forest is a forest that grows in tropical semi-mountainous areas in which the species *dipterocarpaceae* dominates (meranti is an example of a dipterocarp). Almaciga is a type of conifer that is endemic to the Philippines. Both forest types will be restored through the planting of about 34 mainly endemic species, which will include some fruit trees.
The planting will be done with the local forest management organization and the local population.

The first collection of seeds and seedlings started in 2008. The whole community was involved, and quickly set up a tree nursery to accommodate the seedlings. In the spring of 2009 the first 50 ha were planted. For the protected forest this was done by clearing lines in the grass/fern vegetation. The planting took place on public land. The community forest was also mainly planted on public land except in two *barangays*, where it was planted on privately owned land. Arrangements are made with the land-owners to guarantee continuous and sustainable use in future (the owner will get ten percent of the yield).

One of the tree species that the local communities chose for their 20 percent community forest was rubber (*Hevea brasiliensis*). Since the demand for natural rubber is growing worldwide this would provide the villagers with a good source of income. Unfortunately, the rubber trees did not grow very well in the area, so another economically productive species has to be chosen.

Since no CO_2 certificates will be sold from the project, funding for the project has to be sought in other areas. Most of the participants of Trees for Travel want to offset their emissions, and organizations that have to report on their effect on the environment need to show certificates with CO_2 credits. Finding other sources of funds has taken some time, which means that the project could not grow as quickly as was hoped.

The local population is enthusiastic and would prefer to plant 100 ha per year, but Trees for Travel can provide funding for only 50 ha. Depending on how the sale of the trees proceeds this amount can grow or, depending on circumstances, decline.

One setback is negative media attention for forest projects, which influences general opinion. The positive forest projects hardly get any attention. Interestingly enough, everybody agrees that forests are an important part of climate issues, in mitigation and in adaptation. When it comes to planting forests with climate money, however, the opinion suddenly changes. It is hoped that progress will be made in the REDD discussion leading to Copenhagen at the end of 2009.

The enthusiasm of the local population has caused them to start other projects too. A worm farm has been established; this makes excellent compost that can be used in the tree nursery and on farmland. A group of tourists who visited the area for mountain-climbing was positive about the project and decided to fund a water system which runs on hydraulic power and allows people to easily water the tree nursery and agricultural fields.

A small battery is also charged by the system to provide some light at night.

Local people have also build a bunkhouse near the tree nursery. They sometimes use this when they work on the nursery and it is too late to walk home. The bunkhouse can also provide a place to stay for the more adventurous tourists who visit the area.

At the top of the volcano, in the part of the forest that is still standing, some species, mainly ferns, are found that have not yet been described scientifically. The involvement of the local university in the project has stimulated interest in these species and it is hoped that in the coming years these species will be named officially. The threatened Philippine tarsier (*Tarsius syrichta*), a primate thought to have disappeared from the area, has been found in the forest. The newly planted forest will provide habitat for these species and others.

In 2009 the first payment was made from the established fund for the planting and protection of the forest. The *barangays* have established the way in which the payment will be spent. Instead of giving the money to individuals who had been involved in the project it was decided to use the money for the common good of the communities.

Conclusion

This initiative shows clearly that when local people, villages, local government and related institutes are not only involved in a project, but basically run it, success is nearly guaranteed. The enthusiasm of all the partners has been overwhelming. It is hard to believe that it is difficult to find funding for these types of small-scale but very successful projects, when millions are available for underground CO_2 storage. The IPCC (2005) estimates the cost of CO_2 storage below ground at €0.03–0.09 per kWh, which equals €48–144 per tonne of CO_2. On the slopes of Mount Malindang one tonne of CO_2 can be stored for €7.50.

Projects like the one on Mount Malindang not only help to sequester CO_2, but have many other positive aspects, such as the protection of biodiversity and soil and, perhaps most importantly, the improved living conditions of the local population. Looking at the Millennium Development Goals it would seem to be a logical choice to support these kind of projects by using, among other sources, climate money.

The CO_2 certifying system also needs to be reviewed to allow small-scale projects to participate. The best way would be to train more people in low-salary countries to do the job, at a rate that corresponds to local salaries and project costs.

The people on Mount Malindang continue their work, and people from nearby areas are lining up to join the project. It is hoped that more people will see that these types of projects deserve support.

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Further reading

More information about the project can be obtained at info@treesfortravel.nl or www.treesfortravel.info.

5.5 Planting trees to save the forest in Costa Rica

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Introduction

In 1999, after ten years of carrying out small reforestation projects together, two volunteer organizations, Arbofilia and the International Tree Fund (ITF; Box 1), decided to develop an ecological corridor in Costa Rica. They knew that this was a little ambitious but decided to take it step by step. The idea started from the need to reconnect forest fragments in an area that is a biodiversity hotspot. Another goal was for the forest to deliver products and services to the local population and a large downstream area. Drinking water and CO_2 sequestration were also discussed. This became reality sooner than expected. Drinking water systems were constructed for two villages. Ten years later, some 300 ha of forest have been protected and planted, and the project is still growing.

In 2004, the first trees were planted on behalf of a small, innovative insurance company, Ideële Verzekeringen. The company sells "green" car insurance, promising their clients they will compensate for their $C0_2$ emissions. Arbofilia and ITF plant the forest that will eventually contain the necessary biomass, based on the number of cars insured per year. The insurance company pays the costs of land purchase, planting and maintenance.

Certification involves a great deal of accounting and administration. This may create a barrier for very good SFM projects, especially local initiatives.

This SFM project is increasingly being funded from carbon services. This is the way it should be: carbon sequestration should contribute to funding SFM, instead of making carbon sequestration projects sustainable. The corridor also reveals the benefits of small-scale projects that are based on the initiative of local organizations, and the value of taking local practices into account when institutionalizing CDM and REDD.

The Carara Ecological Corridor

Carara is a rainforest reserve that has never been cut down. It has great biodiversity, even more in combination with adjacent areas. Unfortunately, less than half the original Carara forest was given national park status. In the 1950s, the government encouraged the colonization of the slopes of the Potenciana range to relieve population pressure on the Central Highlands.

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Box 1. The International Tree Fund and Arbofilia

Potenciana is a small mountain range with cloud forest on its peaks; its highest mountain is Turrubares, at 1800 m. On the other side of Carara is mangrove and deciduous forest. A transect of only 15 km includes these forest ecosystems and their transitions: mangrove, dry forest, rainforest, montane forest and cloud forest. This diversity in forest ecosystems is not the only reason for the huge biodiversity. At Carara, species from the north (Mexico) meet species from the south (Colombia); for instance, bee species, tree species and epiphytes from both systems are found there.

The Carara Ecological Corridor aims to reconnect all these ecosystem types to facilitate the migration and exchange of plants and animals. The Scarlet macaw is an example of an animal that uses several ecosystem types: mangrove for breeding, and montane and rainforest for feeding.

The project began by buying land and replanting it with as many indigenous tree species as possible, from rainforest to cloud forest. Land purchase was not easy. The intent was not to ban agriculture and people from the region: it was felt that a sustainable co-existence is possible, and that people can benefit from the forest. The project looked for the steepest slopes, the most remote pieces of land, and water springs. The owner had to be willing to sell and the price had to be reasonable. Project planners needed to be opportunistic and change the route of the corridor more than once. They faced competition from teak planters and coffee investors. The economic crisis was an advantage when it came to the price of land.

Planting is going very well. This is surprising, given that it is being carried out in a wide range of circumstances and with a great number of local tree species. Sometimes rainforest species are planted on bare grassland. In other cases montane species are planted in secondary shrub on very steep slopes. Sometimes cloud forest species are planted on exposed ridges.

These are some of the approaches that Arbofilia developed:

- Make use of the knowledge of the local people when collecting seeds. They know when rare tree species bear fruit and where the seed trees are.
- Create family tree nurseries in the same climate zone as the planting site and as near to it as possible. The families can take care of the trees, they are always there, and they can earn money from selling the trees to the project.
- Use horses to take the seedlings to places where cars cannot go (most of the sites). If the journey is not too long, remove the soil from the roots to be able to carry more plants. Cover the roots directly on the planting site. Plant in the rainy season.
- Make use of weeds and secondary vegetation; they provide shade for the seedlings. On bare grass, sow fast-growing pioneer tree species to provide shade. In secondary growth, cut lines on the contours and plant the seedlings along the lines; otherwise they will be difficult to find. Carry out maintenance weeding along the contour lines.
- The pioneer trees are important in providing the first forest-like structure and climate for forest animals, such as birds. Remember that animals disperse most tropical tree species; encourage natural regeneration. Plant some tree species with fruits that are known to attract animals.
- When the pioneer trees compete too much with the planted trees, prune them. Use the pruned branches as mulch. On the degraded slopes, the project used fertilizer (reluctantly, as it was preferred to work organically) to enhance growth and improve survival, and to help the trees to outgrow the weeds fast (this saves years of maintenance). As in most tropical soils, there is a phosphorus deficit.

The aim was to help the natural forest restore itself and to preserve it forever. This is important when carbon sequestration is one of the goals. Natural forest stores the highest amount of biomass and thus carbon. When developing the first carbon project with Ideële Verzekeringen, it was agreed that the project would plant/restore a certain number of ha per tonne of CO_2 emissions: not a number of trees, a number of ha. Not all the planted trees will survive, but the project can ensure that a hectare eventually develops into a forest that will resemble the natural ecosystem.

ITF chose this approach instead of measuring yearly growth, because it is easy to measure and check a number of ha. ITF did not want to burden its counterpart in Costa Rica with tree administration. ITF did not need to, because harvesting in the project's forest is not permitted. If trees are harvested, then the carbon balance must be determined.

The same approach is still followed now that the project is working with a larger insurance company (Delta Lloyd). They do not demand a measurement of yearly growth either; they are not working for carbon credits, so the project can work without a certificate.

Worldwide climate change also affects the Carara Ecological Corridor. The cloud forest is particularly vulnerable. The forest produces the clouds and depends on them. It is known that climate change makes the clouds rise, resulting in smaller cloud forests on the mountain tops. Cloud forests cannot move along with shifting climate zones, because they are already at the top of the mountain.

On the Potenciana mountain range, the cloud forest is seriously fragmented. This has already led to some climate change there. Old people remember that it never used to be dusty. Now there is dust in the dry season. There used to be water in the streams year-round, but now only one stream at cloud forest altitude has water in the dry season, and it is the one coming from the project's forest. It feeds the water system that Arbofilia built for 40 families. The cloud forest has some valuable timber species, such as a range of oaks and Mexican elm.

Forest patches where too many trees have been cut simply die. It is imperative to reconnect the cloud forest patches and replant the mountain ridges where the clouds are formed to make the cloud forest more robust. The project received a grant for this purpose from the privately funded HIER climate awareness program in The Netherlands, through IUCN's Netherlands Committee.

The Carara Ecological Corridor is situated near the coast. Its streams feed a number of major rivers that in turn are indispensable to a large area of rice fields and the country's most important fishing grounds. The water from the forest will be even more important in future. Moreover, it is expected that drought will strike the Costa Rican lowlands more often. It seems, however, that this is not yet commonly understood by the authorities in Costa Rica. In a meeting with an officer of a national park authority, project staff suggested the idea that it is probably cheaper to protect the cloud forest than to deal with drought problems that have developed downstream. Most of La Potenciana does not have even the lowest level of protection status, although an extraordinarily large part of Costa Rica — 25 percent, ten percent of which is national park — is under some protection regime.

Funding

Since the project began in 1999, funds were sought through written proposals to organizations; these were not always granted. Slowly, however, funding organizations began to know the project and ITF developed good relationships with IUCN's Netherlands Committee, among others. After some time, organizations started to approach ITF with requests to write proposals. More recently, ITF has been approached by companies that either wanted it to sequester carbon dioxide or give shape to sustainable entrepreneurship in some other way. Climate and carbon have developed into serious themes in fundraising for forest protection and reforestation.

Previously, ITF applied for funds from the perspectives of biodiversity, drinking water protection and poverty alleviation. It basically still does the same thing: protecting and restoring forest, and has been clear and honest about this with all its funders. ITF told Ideële Verzekeringen that it would not carry out a carbon project; instead, it would plant trees for biodiversity and water protection, and as a side effect the growing forest would sequester carbon. This made the company even more enthusiastic about the project.

Obviously, trust is an important characteristic of the work, both between ITF and Arbofilia, and between ITF and funding organizations. With Delta Lloyd, the execution of the fieldwork started only one year ago. The initial results still need to be presented and evaluated.

Conclusions

It is possible to carry out reforestation with a wide range of indigenous tree species, even in the cloud forest zone.

Water turned out to be an important theme to create awareness among the local population about the value of the forest. People know about the direct relationship between water and trees. The locally hired labourers for planting and maintenance and the family tree nurseries helped to create support for the project. Local people were also trained to coordinate the fieldwork.

At one point, project coordination could no longer be done on a voluntary basis; a full-time coordinator was needed. For this reason, Arbofilia started a company, together with the field coordinators, for project implementation. Previously, reports were written by ITF volunteers based on data from Arbofilia (with many good photographs — that helps!). In time, the project coordinator should do that as well, which will relieve the volunteers' workload.

When buying land, having a trustworthy local partner was essential. Arbofilia did the research, the negotiations and the legal work. They know the land-owners and the negotiation culture, and the land is registered in the name of Arbofilia. Although that system has worked perfectly well, a form of joint ownership is being prepared for a sustainable future.

The costs of land are part of the agreement with the insurance company. It seems logical to look for land with room for a lot of trees, but most farms have some grassland, some degraded forest and some primary forest. The exact number of ha in each category is hard to establish in the very rugged terrain (with the move to hired staff, however, the project is now working seriously on mapping). ITF explained this to the insurance company and it was agreed that the purchased forest would also count as CO_2 compensation. Since burning and illegal logging are common in the area, it was felt to be justifiable to count forest protection as avoided emissions.

Working without a certificate is possible if the funding organization is not obliged to work with carbon credits. In this case, the insurance company sells a product instead of compensating for its emissions. For the insurance company, carbon sequestration is voluntary. Project partners agreed to work without certification and to keep the reporting simple and transparent. An employee of Delta Lloyd or a customer should be able to fly to Costa Rica and see for himself or herself if the trees are there.

SFM can be the point of departure for a truly sustainable CDM project. Integrating carbon sequestration can be an additional opportunity for financing SFM.

Recommendations

Acknowledge the potential of smaller, locally initiated projects. Big is not always more effective or more sustainable. Big often implies an expatriate manager. Big is seldom locally initiated. Bottom-up initiatives, with the support of the local population, are worth considering. The planted forest should also benefit the people living in and around it. This may seem complicated and fragmented for organizations that need to deal with large amounts of carbon money. Intermediate funds may be a good option in that case. IUCN's Netherlands Committee started such a fund to bridge the gap between companies that want their carbon projects to be smaller initiatives and incorporate SFM.

Local initiatives may provide an opportunity for governments as well. In Costa Rica, there are many private wildlife reserves and conservation initiatives, some of which have a very good relationship with the Ministry of Environment. There are examples of private initiatives that received formal protection status.

Do not make the administrative burden too heavy, and respect cultural differences. In the West, the culture is increasingly bureaucratic, characterized by growing individualism and facilitated by a writing and accounting culture. This is not common everywhere in the world. In the Third World, cultures may be more oral, there may be a stronger sense of community and people may have different concepts of time. CDM and REDD are being institutionalized and rules are created, but the debate seems to be dominated by Western culture. Projects need to take care not to impose their values and norms on other cultures, especially when it is their land that is at stake. Certification, for instance, involves a great deal of accounting and administration. This may create a barrier for very good SFM projects, especially local initiatives. The awareness of cultural differences is the reason that ITF has visited all its projects to see the results since it started more than 20 years ago. As an organization of volunteers, ITF can do that without excessive overhead costs.

Look for alternatives for land purchase. In the Philippines and Costa Rica, there are experiments with private law agreements such as servitude. If agreements can be made with the land-owner (such as a local farmer) to tolerate the forest or reforestation on part of his land, and to maintain the forest for a certain number of years in return for financial compensation, this may be an elegant and socially sustainable way of organizing REDD and CDM.

Section 6

Forest carbon business approaches

6.1 The forestry carbon business

Over the past four years, working with teams all over the world, the author has advised, originated, commercialized and developed forestry carbon projects for stakeholders primarily focusing on the "emeralds on the equator," the planet's tropical forest legacy that is currently being deforested at a rate of 13 million hectares (ha) of forests annually. This deforestation results in roughly 20 percent of all global greenhouse gas emissions (GHGs) (Thoumi 2009).

These lessons have been learned in the past four years about how to structure forestry carbon projects:

- forestry carbon requires effective communication between science, civil society, government and business using a rational convergence model.
- forestry carbon needs an appropriate business strategy.
- forestry carbon projects need to focus on creating inter-generational equity.
- forestry carbon is an alternative investment asset class.
- forestry carbon as an asset develops from real property rights.
- forestry carbon involves financial discounting and financial analysis.

FORESTRY CARBON PROJECTS ARE WORKS IN PROGRESS AND ONLY THROUGH PERSEVERANCE AND EFFECTIVE COMMUNICATION, COMBINED WITH LEADERSHIP, CAN FORESTRY CARBON PROJECTS BE DEVELOPED THAT EFFECTIVELY MITIGATE CLIMATE CHANGE.

The rational convergence model and effective communication

Successful forestry carbon projects have four components that form a "rational convergence" business strategy (Figure 1).

Scientists say that "the land dictates the rules" of the project. In other words, projects must be based on an understanding of the local ecology, hydrology, biodiversity and geology of the land. Because of this interdisciplinary approach, projects must be managed with enough flexibility to adapt to unforeseen events and outcomes.

Local communities and their proxies in civil society, such as international non-governmental organizations, say: "local communities are the gatekeepers of a project." This means that carbon forestry projects need to work within the local community to gain support.

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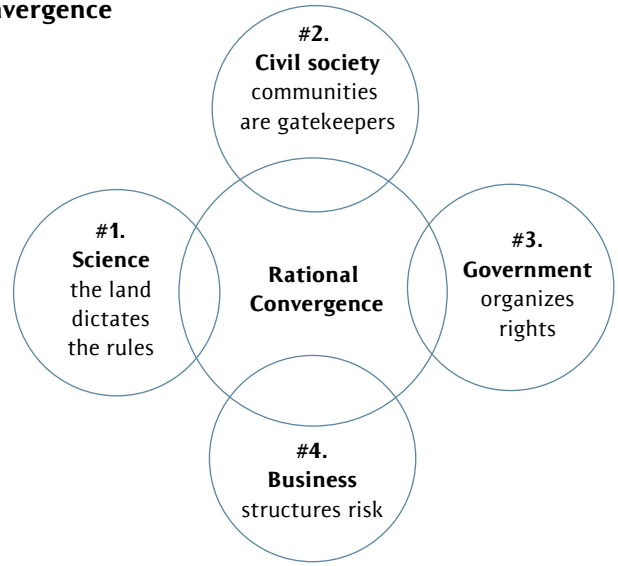
Local communities are the catalysts for project success. In being engaged through employment, knowledge dissemination and strategic feedback loops, the local community will have a stake in ensuring project success and they will participate in mitigating project risk.

Figure 1. Rational convergence



Governments "organize rights" and say that we need to work within their existing legal frameworks to develop a carbon project. Yet these frameworks change over time and different legal criteria may exist at different levels of government, whether local, provincial, national and international. Internationally accepted best practices may be preferred since this may mitigate the project's legal risks in the absence of sufficient local, provincial and national laws. A successful project should have fee simple or fee simple absolute land title that is acknowledged by the appropriate governmental agencies. Fee simple title is, in common law countries, the most complete land ownership possible; the land is owned in perpetuity and the title can be changed to allow for carbon rights. This strengthens permanence.

Although businesses such as international project developers "structure risks," forestry carbon projects succeed when they focus on mitigating risks, as opposed to maximizing profits. This is because the forestry carbon market is dominated by quality over quantity; higher-quality credits receive a price premium based on risk mitigation measures, such as improved co-benefits such as biodiversity and community engagement. In the compliance market and the voluntary market the price per tonne varies depending on these co-benefits. In other words, by spending time strategically analyzing the quality of the credits that can be produced, the project owner will be mitigating his or her business risk.

It is important to understand the stakeholders' situational and psychological profile: focusing on whether they are cautious, methodical, individualistic and/or spontaneous. Psychological profiling helps assess how each stakeholder or group of stakeholders will communicate with the other stakeholders.

It is also important to understand each stakeholder's financial, community and biodiversity perspectives:

- attitudes toward the project's net atmospheric, environmental and social returns and risks;
- legal and regulatory concerns;
- tax implications;
- time horizons;
- liquidity concerns; and
- specific project co-benefits such as biodiversity and community development.

Because all stakeholders have different attitudes, particularly to risk-and-return performance measures, it is important to focus on feasible project management returns when communicating with them. Many forestry carbon projects have succeeded by applying the Rational Convergence model. A project manager needs to demonstrate that the project is improving local livelihoods, improving biodiversity and sequestering carbon and is financially viable in the long term.

Appropriate business strategies

Professional individuals are needed with significant experience within the fields of natural resources, community development and business; they require an intrinsic capacity to be innovative in achieving a goal that is often both opaque and moving. The successful strategic approach to forest carbon project development includes three stages: planning, screening and implementation.

lanning

Each project should be managed so as to be real and measurable and permanent. It should demonstrate co-benefits, be transparent and credible and should have the clear and prior consent of owners. It must be legal and must minimize business risk and sovereign risk, be assured of completion and be marketable and liquid.

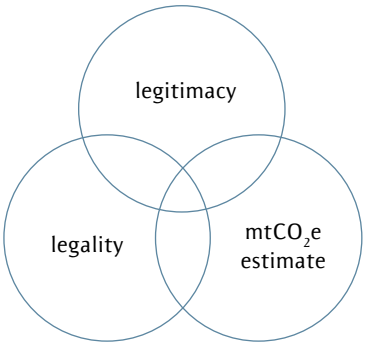
Screening

Each project should be screened for aspects related to legitimacy, legality and estimates of carbon credits and other benefits (Figure 2). A project may be locally legitimate yet face illegitimacy claims from other sources. Varying interpretation of laws at the four levels of jurisprudence — local, provincial, national and international — can create confusion for the project owner. This is why it is important to focus the project strategy on the intersection of legality, legitimacy and carbon credit estimation.

Implementation

Each project should be developed with a complex approach to implementation, validation and verification, monitoring, adjustment and sales. This implies that projects need to iterate towards a successful outcome.

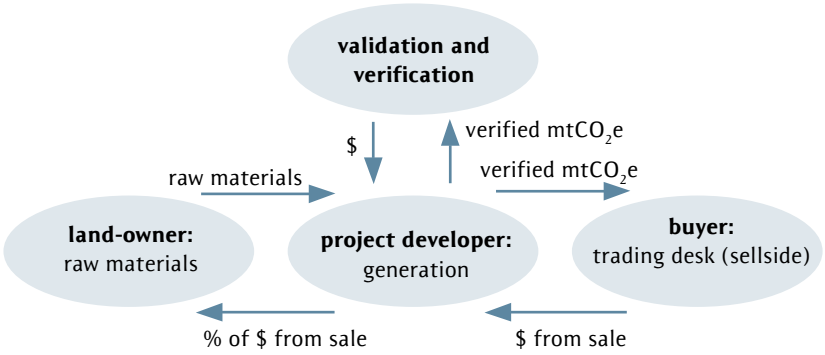
Figure 2. Screening tool



Generation of forestry carbon credits

Market participants need to understand the project's financing. Projects generally use one of two options: 1) the direct sales process, where carbon is sold directly to an emitter (Figure 3); and 2) the indirect sales process, where carbon is sold to a broker or agent who then sells it to an emitter (Figure 4).

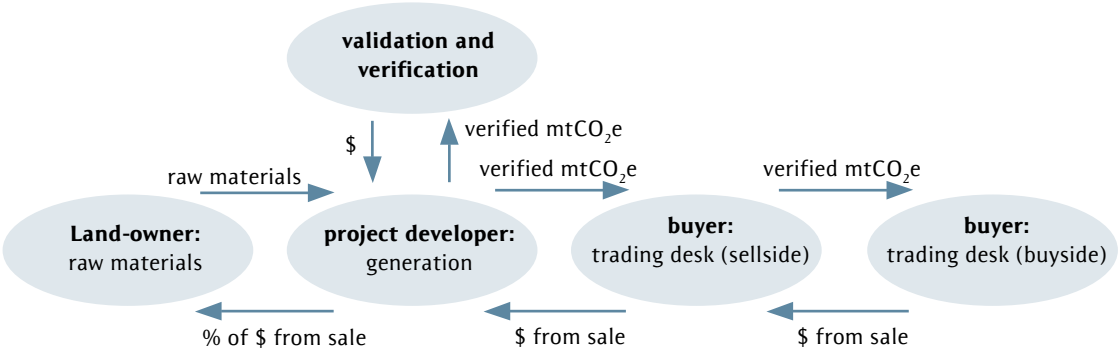
Figure 3. Direct sales process, forestry carbon



The first stage in the process is the sourcing of raw materials. Project owners need to have clean and clear title to their land, and this title needs to be registered with the appropriate authorities. Project owners also need to have clear and prior consent to own and sell the carbon rights from the trees on their property.

The second stage of the process is generation, including validation and verification. Project developers, such as MGM International, assemble all the components that are needed for high-quality, long-lasting carbon credits. The project developer delivers the technical documents to a third-party certification mechanism for independent verification. After verification, the new carbon credits are issued and listed in a third-party independent registry where transactions can occur.

Figure 4. Indirect sales process, forestry carbon



The third stage is sales. Buyers have five reasons to purchase credits: compliance with regulated markets; pre-compliance with regulated markets; investment for a financial return; offset of carbon neutral products; and public relations. Buyers currently making purchases in the market include corporations, lending institutions, funds, private investors, government agencies, wealthy individuals and LLCs.[1] Recent sales of forest carbon include a range of buyers:

- 600,000 U.S. tons purchased by Pacific, Gas and Electric (Lake County News 2009) for an estimated price of US$9.71 per ton and a total price of US$6 million (Mercury News 2009). Tonnes are ex-post (i.e., after the carbon offset has been generated) under the Climate Action Reserve mechanism.
- 500,000 tonnes purchased by the Huayi Electric Apparatus Group for US$8.00 per tonne and a total cost of US$4,000,000. Tonnes are ex-post under the ISO 14064:2 mechanism (ERA Carbon Offsets 2009).
- 520,000 tonnes purchased by the Norwegian government for roughly US$14.00 per tonne and a total cost of US$7,308,000. Tonnes are ex-post under the New Zealand Permanent Forest Sink Initiative and were sold as AAUs. AAUs are assigned amount units created under the Marrakech Accords (Asia Pacific News 2009).
- 500,000 tonnes purchased by The World Bank for an unknown price from the Ibi Bateke Carbon Sink Plantation Project (World Bank 2009).

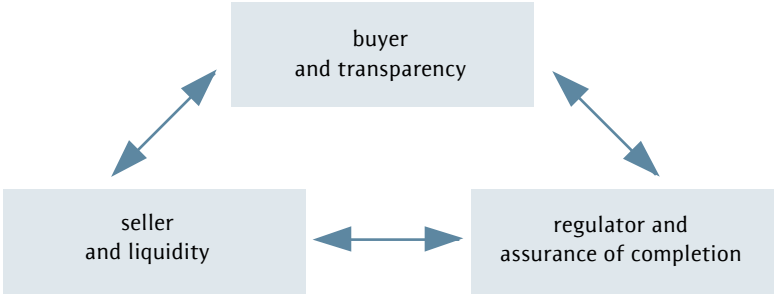
Buyers need transparency so they can price comparison-shop. Sellers need to be able to sell their tonnes quickly, efficiently and effectively. Regulators need a market that provides assurance of completion (Figure 5).

Creating inter-generational equity

Forestry carbon needs to focus on creating intergenerational equity. Thematically, one can split businesses into two groups: those that create value and those that appropriate or take value (Afuah 2009). Since forestry carbon projects should directly improve carbon sequestration and indirectly improve ecosystem services such as water quality and filtration capacity, biodiversity and pollination services and soil quality, it is possible to discuss forestry carbon assets as value creation projects, since the sum of the whole at the end of the process is greater than at the beginning. Furthermore, since forestry carbon projects

proceed over an extended timeframe, sometimes as long as 100 years, it is clear that one can discuss forestry carbon projects in the context of intergenerational equity.

Figure 5. Buyers' needs



Also, in one sense land is the ultimate arbiter since there is a finite total of land on the planet and an increasing demand for services from it. Since the total quantity of land available decreases over time through commercialization and misuse, land value should increase over time. In other words, not only will investors in a forestry carbon asset receive a return from the annuity created by their forestry carbon project, they will also receive a return from improving the quality of this land using one of the forestry carbon mechanisms, and from the fact that the quantity of land is diminishing. For these reasons, forestry carbon may become an alternative investment class.

Forestry carbon as an alternative investment class

Land-owners and communities face a strategic business choice in how they manage their forest land. To develop forestry carbon as an alternative investment class, developers need to focus on effective communication between stakeholders. They can create forestry carbon assets by engaging in three activities:

- growing trees through afforestation, reforestation and/or revegetation;
- not cutting trees or cutting fewer trees, by means of improved forest management or avoided deforestation; and
- using structural timber in long-lived wood products.

In 2008, roughly 12 million tonnes of carbon dioxide equivalent were purchased globally for roughly US$40–50 million (Hamilton et al. 2009). Forestry carbon can create a "financial asset from an environmental liability" (Thoumi 2009).[2]

The source of this financial asset is the natural capital and the activities engaging it that make up the geographic and ecological qualities of a land-owner's property. Forestry carbon projects are part of a new alternative asset class, with specific risk and return profiles that depend on the quality of the project. By focusing on improving the ecosystem services generated by a property, it is possible to develop alternative cash flows, mitigate climate disruption and generate intergenerational equity for a land-owner.

There are multiple methods by which to calculate carbon tonnes within the voluntary markets. The reason there are multiple methodologies are because each one deals with separate land-use characteristics — including urban forestry; avoided deforestation; biochar; improved forest management; afforestation, reforestation and revegetation — and each methodology has different requirements for permanence and additionality.

Forestry carbon develops from real property rights

All forestry carbon projects must have an appropriate legal approach based on rational convergence (Figure 1). Forest land is real property and cannot be moved to another location. Therefore, a forestry carbon project needs to be based on an understanding that the only rights that can be held are those related to real property ownership:

- ownership rights, including boundaries establishment;
- the right to control how the land is used;
- the right to benefits arising from the land; and
- the right to give, sell, encumber or bequeath rights or a portion of rights to others (McEvoy 1998).

A forestry carbon project must focus on developing the legal capacity to "give, sell, encumber or bequeath rights or a portion of rights to others" in a legal and commercially viable manner while protecting the public interest of the location where the rights originate. The property right that is developed into a carbon right and transferred in a voluntary market over-the-counter transaction needs to somehow be comparable to other transacted forestry carbon credits in a manner that allows for an appropriate financial accounting regime to be used. This is an area that requires further study since it is not yet clear how to proceed.

Forestry carbon, financial discounting and financial analysis

Financial institutions are a key part of sustainable economic development. If sustainability is defined as a land ethic that incorporates equitable utilization, sustainability, the no-harm principle and cooperation, then forestry carbon projects may yield results that are inherently conditioned upon developing intergenerational equity. There are three main reasons why sustainability and finance conflict: discounting, accounting and infinite growth.

- Discounting is a financial mechanism by which a debtor obtains the right to delay payments to a creditor for a defined period of time in exchange for a charge or fee (Downes and Goodman 2003). It determines the present value of cash flows by calculating the time value of money.
- Accounting for natural resources also has many discrepancies. For example, methods to account for non-sustainable extraction for coal, oil or other materials do not apply a limit to the amount that can be extracted from the deposit based on its rate of growth. This approach to extractive resources is not sustainable.
- Analyzing growth potential does not differentiate between growth and development and finite and infinite timeframes (Table 1). First, growth and development are not the same thing; there can be development without growth and growth

without development. "Development" implies overall progress for the community in sustainability. Since the planet has limited resources, economic systems should use resources more efficiently, with the perspective of creating intergenerational equity. Analysis should compare development against a baseline where resources are used sustainably at a finite natural rate of natural capital accretion (Table 1).

Table 1. Development, growth and accretion of natural capital

	development	growth
finite	resources used sustainably at a finite natural rate of natural capital accretion	resources used unsustainably at a finite natural rate of natural capital accretion
infinite	resources used sustainably at an infinite rate of natural capital accretion	resources used unsustainably at an infinite rate of natural capital accretion

Current financial analysis has three flaws: discounting without a rational time horizon; accounting for natural resources that does not reflect ecological realities; and the separation of growth and development as applied to infinite and finite resources. This means that forestry carbon projects may need to be adjusted to focus on finite sustainable development goals. Forests are not infinite and they need to be managed sustainably.

To determine an appropriate accounting method for voluntary forestry carbon market emission reductions, it is imperative to keep in mind the character of such credits.[3] The use of credits by an entity determines their nature, which in turn dictates how they should be classified on the balance sheet, statement of cash flows and income statement of the financial statements. According to the International Accounting Standards Board's (IASB) Framework for the Preparation and Presentation of Financial Statements, an asset "is a resource controlled by the entity as a result of past events and from which future economic benefits are expected to flow to the entity" (FASB 2009). As the Financial Accounting Standards Board (FASB), in FASB Concepts Statement No. 6, defines elements of financial statements, an asset is "probable future economic benefits obtained or controlled by a particular entity as a result of past transactions or events" (FASB 2009). This means that a forestry offset is a resource that provides future economic benefits. In other words, when the offset is sold either ex-ante (pre-verification) or ex-post (after verification), money exchanges hands in return for the right to own this offset (Figure 3 and 4). The forestry offsets can be banked and later sold by the buyer or used to settle a compliance or pre-compliance emissions obligation. The author believes that forestry carbon assets can be accounted for initially at fair value based either on market value or on cost (which is nominal value).

Conclusion

Forestry carbon projects need to be structured using the models described above. They are works in progress and only through perseverance and effective communication, combined with leadership, can forestry carbon projects be developed that effectively mitigate climate change.

Forestry carbon is a developing field, and the following activities should be considered:

- It would be appropriate for forestry carbon professionals to have a journal, trade association and annual conferences. As careers develop, these professionals will increasingly be asked to demonstrate leadership within public forums;
- It would be appropriate for forestry carbon financial accounting regimes to be developed under the framework of the IASB and FASB; and
- Forestry carbon projects need to be framed as alternative investment asset classes that focus on intergenerational equity.

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6.2 Lessons from twelve years of climate forestation projects

Introduction

Up to 30 percent of global emissions of greenhouses gases (GHGs) come from agriculture, forestry and land-use, two-thirds of this from deforestation and forest degradation (WWF 2008). Furthermore, forests store more carbon dioxide (CO_2) than the entire atmosphere (Stern 2007). It is therefore clear that forests can make a critical contribution to combating climate change.

The Kyoto protocol, through its Clean Development Mechanism (CDM) supports the use of afforestation/reforestation (A/R) projects in developing countries to decrease CO_2 concentrations.[1] With that, a market for new A/R projects was born; 12 years later, 1,766 CDM projects have been registered but only six of them are A/R CDM projects. This article outlines the three major reasons why the CDM failed for A/R:

- high transaction costs to successfully implement an A/R CDM project;
- a lack of demand for the carbon credits from A/R CDM; and
- the poor reputation of tree-planting as an instrument to combat global warming.

Although the voluntary market was able to support a few dozen forest projects worldwide, it alone cannot unlock the large potential of forests in climate change mitigation, simply because it does not include the largest polluters.

These three aspects affected developments on the ground and in the market. The lessons learned from this experience should be taken into consideration when developing a global REDD mechanism.

High transaction costs

The CDM methodology to determine the net CO_2 reductions of a forest was developed by a large team of scientists who all brought in their own expertise. The result was a methodology that is so extensive and complex that it is difficult to work with in the field. As a consequence, the methodology can be implemented only by similar scientists and consultants. Because of this, the process of bringing a team together to write the project

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documents, validating the project, registering the project and later verifying the emission reductions exceeds, almost without exception, US$300,000 per project. This cost should be considered in the context of the "additionality" of a project.[2] A $300,000 investment in a project that is not business-as-usual (and hence carries additional risks) is simply too much. It would be financially acceptable only for a large-scale "normal" forest project.

The CO_2OL Tropical Mix Reforestation in Panama One project, for example, would have difficulty registering as a CDM initiative because of its size in relation to its costs. It is a relatively small-scale project developed by the company Forest Finance Service GmbH. The project is restoring 380 ha of tropical rainforest by planting a mix of more than a dozen native tree species, creating a nearly natural rainforest with very high biodiversity. The CDM did not appear to be the right mechanism to pay for these activities. The fee to register the small-scale project plus the costs of land preparation and planting a large mix of tree species are too high to be earned back in the current CDM market. A second problem is that the native rainforest species used need about 25 years to sequester their full carbon potential. The Kyoto market, however, trades only emission reductions that are already realized; without forward selling it would take 25 years to collect the potential revenues if the project were registered under the CDM. Although the climate change policy is targeting at avoiding future climate change; ironically, there is no good mechanism that rewards emission reductions that take a few decades to be fully realized.

Lack of demand

Not only are the costs high to develop an A/R CDM project, there is little demand for its credits once the project is registered. One reason is that Certified Emission Reductions (CERs) from forest projects are valid only for a certain time frame; they are therefore called temporary credits (tCERs). The concept of a temporary CER is the CDM's answer to the problem that emission reductions through A/R would not be sufficiently guaranteed to be classified as permanent (since one day the forest will disappear again). Therefore, when tCERs loose their validity (for example, after 30 years), the buyer has to replace them with CERs from other projects. From a buyer's perspective, buying forest credits means paying twice for one unit and taking the risk that the price of its CER might be much higher in the future, not a very attractive scenario.

Although it is correct that CO_2 in forests is by definition temporarily stored, the mechanism does not seem to take into account that the annual worldwide deforestation rate is 0.18 percent, meaning that the average forest lasts for 555 years (FAO 2009). This is a very rough calculation, but it shows that a tCER with a lifetime of perhaps 50 years simply undervalues the role that forests can play in climate mitigation.

The second reason for the low demand and price for A/R CDM is that the largest carbon buyer in the world, the EU Emission Trading Scheme, does not accept forest credits under its framework. This refusal is partly due to the EU's opinion that A/R credits are by definition very risky since the projects are developed in unstable countries that are subject to many uncertainties.

The Kikonda Forest Reserve in Uganda is an example of a project in a "less stable" country. The reserve is managed by the company global-woods AG. The project planted its first trees in 2002 and has a licence to plant 12,000 ha of bush and grassland. The Kikonda Forest Reserve has the "classical" dilemmas of an additional project. On the one hand it is an example of how the carbon market can trigger positive developments that would otherwise not happen. Uganda benefits from the project's activities in terms of capacity building and knowledge dissemination; in addition, important forest products will be delivered in the future. These are needed very badly; about 90 percent of Uganda's energy supply comes from charcoal or wood and the rate of deforestation of natural forests is about 2.2 percent annually. Not restoring forests right now means that in the future, the supply of energy will be seriously endangered for the people of Uganda.

On the other hand, the company also experienced how difficult it is to set up a long-term project in a country like Uganda. Stable governmental structures on which investors can rely are scarce, as is forest expertise. Keeping the project up and running requires ongoing additional work to ensure robust relationships with neighbours, forest authorities and other actors.

From the size and the type of trees (both native trees and faster-growing pines), the initiative looks like a project that could be successful under A/R CDM. However, the lack of demand for A/R credits made the company very hesitant to even apply. There is a significant risk that the project, once registered, would not earn sufficient income through the CDM to cover its costs.

Other organizations developing projects encounter other problems. As trading CO_2 rights is a relative new activity, not every country has regulations in place on the property rights of CO_2 reductions. Some organizations simply could not get sufficient guarantees that in the end they would have the right to sell the credits generated by their projects.

Market responses to high transaction costs and lack of demand

The first climate forest projects started in the mid-1990s. After 1997, when the Kyoto protocol was adopted, the interest in A/R projects increased. It became rapidly clear, however, that the high costs and lack of demand were serious problems; few private investors wanted to take the risk. The development of A/R CDM projects stalled.

To promote the implementation of A/R projects, the World Bank initiated the Bio-Carbon Fund. The fund would stimulate projects by buying their credits up front. This was effective, as it covered the high initial costs and eliminated the risk of the credits not being sold. All six registered A/R CDM projects had the financial support of the World Bank or a similar institution. It has to be said, however, that without the World Bank a privately funded project would not register; investors need to counterbalance a riskier project (riskier because it is not business as usual) with a guaranteed market for the credits at the very least.

Projects that were not supported by the World Bank started to look for alternatives to sell certificates where their costs would be lower and/or the demand and prices would be better. They landed in the "voluntary carbon market." The voluntary market is the sum of all CO_2-certificates that are bought for reasons other than compliance with Kyoto. An increasing number of companies and consumers are willing to pay for efforts that reduce the amount of carbon in the atmosphere. It is a rapidly increasing market, doubling almost every year since the counting started in 2004.

In principle, the voluntary market is a free market where anyone can sell whatever anyone else wants to pay for. As it matures, however, voluntary buyers are demanding that their certificates are real and independently verified.[3] And with reason. Poorly conceived and executed projects and the sale of "hot-air" meant that voluntary compensating emissions often got negative media attention. This affected the market as a whole. Although the voluntary market has until now stimulated more forest projects than the CDM, the share of forest projects in the voluntary market dropped from 36 percent in 2006 to 11 percent in 2008. The reason for the decrease is the reputation that still sticks to A/R projects.

Currently there are a couple of standards active in the voluntary carbon market that base their method on the A/R CDM, but are more practical to implement in terms of costs and methodology. Standards that include a carbon account component include the Voluntary Carbon Standard, CarbonFix Standard[4] and Plan Vivo Standard.

Reputation

Since the beginning, several interest groups were not in favour of the A/R CDM. They argued that the climate regime should focus on renewable energy, not on combating the effects from traditional energy sources. They also disagreed with the fact that the A/R CDM only looked at how many carbon reductions a project delivered. They criticized the socio-economic and ecological aspects of the projects and were concerned that traditional land tenure was not sufficiently addressed. In fact, from a climate perspective, the most valuable projects are the ones that can sequester as much carbon as possible in the least amount of time. The critics argued strongly with this, alleging that it could lead to more monocultures of fast-growing tree species. These disagreements resulted in forest carbon projects having a bad reputation. And who knows, perhaps these "feared" kind of projects would indeed be the majority of A/R initiatives if there were no critics and a non-buying EU. Over time, of course, these opinions also started to have an impact on the voluntary markets, which explains why the percentage of forest projects decreased.

The discourse on the benefits of an A/R project has shifted over time. The REDD discussions in particular, which mainly started in Bali in 2007, made more groups realize that forest projects could have benefits other than combating climate change.

The problem was — and is — that the A/R CDM does not include criteria on these other benefits. Various groups stood up and created "add on" standards that could be used by a CDM project to show its additional benefits. The most well known are the Gold Standard (backed mainly by WWF, but it cannot be used for forest projects) and the Carbon, Community and Biodiversity Standard (backed mainly by the Nature Conservancy and designed for land-use projects.) The CarbonFix Standard and the Plan Vivo Standard also include many criteria on the sustainable aspects of a project. Although some of these standards were originally meant to function in the CDM market, they are mostly applied in the voluntary market. This is understandable, as the demand for carbon credits in the voluntary market is mainly driven by branding and corporate social responsibility concerns. For such buyers it is vital that a project not only has climate benefits, but can also provide evidence of long-term socio-economic and ecological gains.

Lessons learned

High transaction costs, lack of demand and criticism of A/R CDM meant that the CDM could not be the incentive for a significant number of new A/R projects as was initially expected. This is unfortunate from a climate perspective, as A/R projects alone could mitigate about ten percent of potential global warming. It is also unfortunate because projects that go beyond business as usual and bring lots of co-benefits are not implemented. Initiatives that are unlikely to be executed with private money, such as the restoration of lost rainforests with slow-growing species or the implementation of projects in underdeveloped countries, could have been the result of a working A/R mechanism. That is not the case, however.

The lessons that REDD can learn from A/R originate from projects that are sold in the voluntary market. The voluntary market enables projects to actually operate because it alleviates the three conceptual problems described above:

- Transaction costs are lower. Although all standards in the voluntary market are based on or use the A/R CDM methodologies, the time span and costs to get a project registered are much lower. This is particularly important for projects that are small-scale, since for them the costs to become registered as an A/R CDM project could simply never be earned back.
- There is demand. When implementing a climate project the project developer has to be sure that there will be a market for the credits. The Kyoto market appears not to be such a place; the voluntary market is. There, forest credits are popular and even those projects that need several decades to sequester significant amounts of CO_2 can sell their future reductions. The six projects now registered as official A/R CDM initiatives were able to do so because they were supported by the World Bank or a similar institute that bought up in advance all the credits the project would deliver. Demand is decisive in encouraging participants to start a project.

- The poor reputation of forest projects began to be reconsidered when they started to apply standards that include criteria on social and ecological factors.

Although the voluntary market was able to support a few dozen forest projects worldwide, it alone cannot unlock the large potential of forests in climate change mitigation, simply because the largest polluters are not included in the market. Only an effective CDM can make the most out of forest projects.

Final reflections on a REDD mechanism

From a methodological point of view, REDD is even more complicated than A/R. For REDD to become a success, however, the methodology with which it is implemented must be workable. Key elements for the success of REDD will be whether projects can work with the REDD methodology and whether it pays off. Paying off means that project costs — including getting the right people together, designing and implementing the project, and having the credits independently verified — can be earned back because there is a market for the credits.

The first rule for any type of climate projects is that they have to be additional, meaning that without the project, the carbon would not be saved. The Kikonda Forest Reserve in Uganda and the Forest Finance project in Panama have shown what additionality can truly mean: projects that restore slow-growing trees or are implemented in countries that are normally ignored by investors.

The additionality principle also counts for REDD: the higher the threat to the existence of the forest, the more potential credits. This understandable (but somewhat ironic) rule means that REDD makes the most sense exactly where the risk of the forest disappearing is highest. For example, saving a forest in a conflict area of the Congo or conserving a part of the Brazilian rainforests that was planned to be cut for a new road truly means avoided emissions. But these two examples also clearly show that REDD can only be a success when the institutional structures, means of governance and security are improved at the same time.

Adequate knowledge, capacities and communication are very important for making any type of forest project a success. Particularly in the developing countries where REDD will typically take place, success in this area is determined by the level at which REDD is implemented. To make REDD implementation effective and scalable, therefore, relations with existing forest institutes and other sources of knowledge require major improvements. This is a big challenge, as in many cases there still seems to be two different groups working on a “climate forest project” or a “normal forest project.”

The World Bank has already started to support the first of the REDD pilot projects. This is a good thing, as experience is needed. The REDD mechanism should be set up in such

a way that private investors will want to invest in a project, as until now has not been the case for A/R CDM (the World Bank alone cannot finance REDD worldwide). It has to be certain that there will be a market for the credits. If the largest buyers (the EU and perhaps in future the U.S.) do not guarantee that they buy REDD credits, it is not worth negotiating a mechanism.

Finally, no forest mechanism should focus only on carbon. Forest projects have a life span of several decades and should operate sustainably. They need an appropriate structure that includes secure land tenure and social and ecological aspects, taking the multi-functional nature of forest as the point of departure. Experience has shown that project developers are happy to set up such initiatives. It is up to the negotiators in Copenhagen to show that they understand that although carbon might mobilize the currency, forest are more than just carbon. They have to design a mechanism that supports sustainable forest management as a condition of achieving climate goals.

Endnotes

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