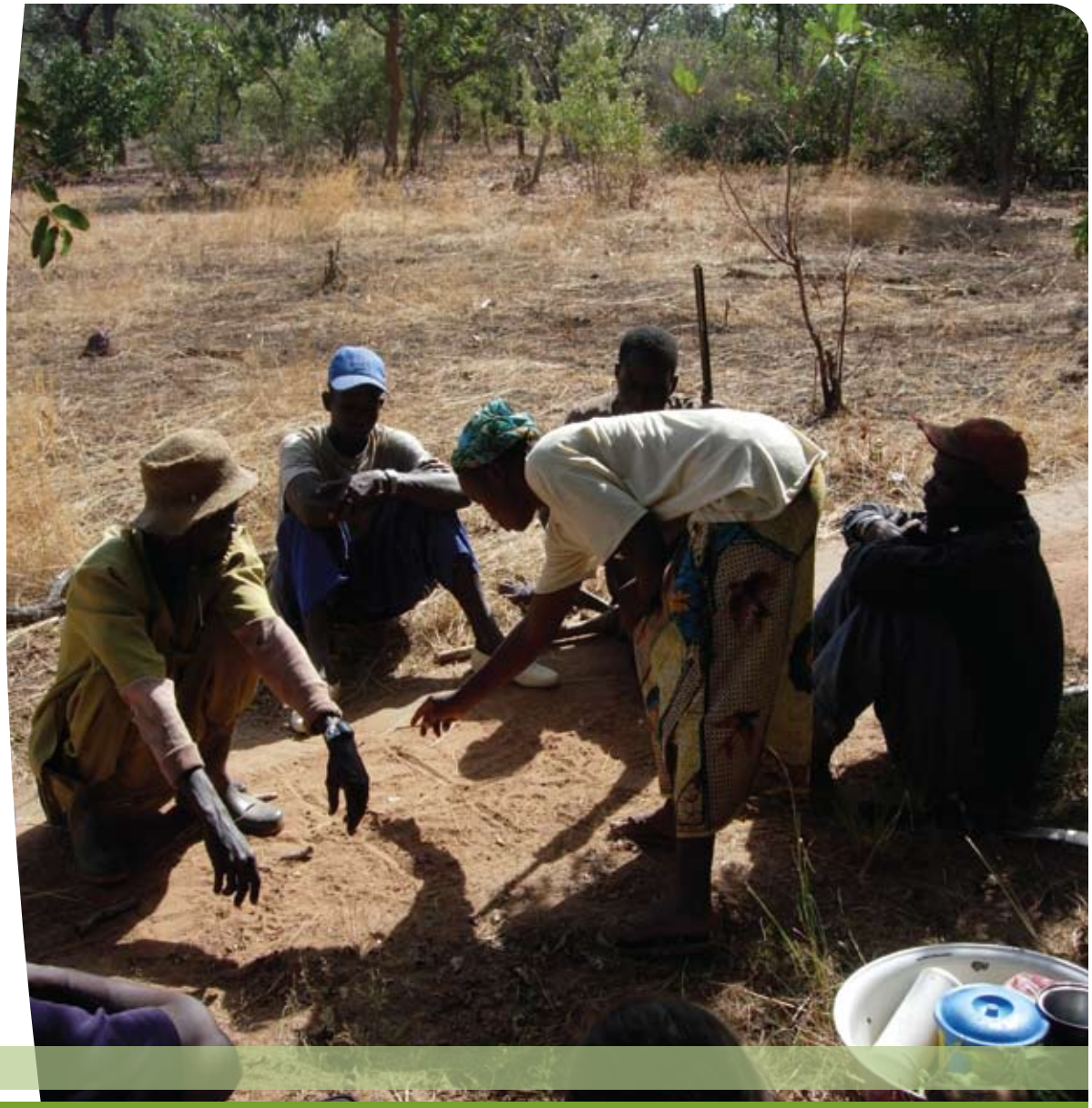
RIGHTS + RESOURCES

inter cooperation



Climate Change and Governance in the Forest Sector

An overview of the issues on forests and climate change with specific consideration of sector governance, tenure, and access for local stakeholders

THE RIGHTS AND RESOURCES INITIATIVE

The Rights and Resources Initiative is a global coalition to advance forest tenure, policy, and market reforms. It is composed of international, regional, and community organizations engaged in conservation, research, and development.

The mission of the Rights and Resources Initiative is to promote greater global action on forest policy and market reforms to increase household and community ownership, control, and benefits from forests and trees. The initiative is coordinated by the Rights and Resources Group, a nonprofit organization based in Washington, D.C. For more information, visit ***www.rightsandresources.org***.

PARTNERS

SUPPORTERS

This paper contains the authors' views and does not necessarily represent those of all partners in the Rights and Resources Initiative or of the institutions that financed it.

Cover photo: Forest users in Ifola, Sikasso Region, Mali, by Nicole Clot at Intercooperation.

Climate Change and Governance in the Forest Sector

An overview of the issues on forests and climate change with specific consideration of sector governance, tenure, and access for local stakeholders

CARMENZA ROBLEDO, JÜRGEN BLASER, SARAH BYRNE, AND KASPAR SCHMIDT

Rights and Resources Initiative
Washington DC

CONTENTS

LIST OF BOXES, FIGURES, AND TABLES

LIST OF BOXES

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

Forests play a central role in climate change.[1] Since 1850, deforestation and forest degradation, especially in the tropics, have contributed to 90 percent of the greenhouse gas (GHG) emissions from Land Use, Land Use Change, and Forestry (LULUCF). The sector now accounts for up to 20–25 percent of the current yearly GHG emissions worldwide. Climate change is having a strong effect on forests and the livelihoods of forest-dwelling communities. Forestry activities offer an important potential for reducing GHG emissions and increasing carbon sequestration. Finally, forests offer many strategies to address climate change.

Poverty-driven deforestation, especially for subsistence agriculture, accounts for approximately one-half of all deforestation and its corresponding emissions. In many cases, deforestation and inadequate forest governance systems reduce the adaptive capacity of poor, rural communities that are highly vulnerable to the negative effects of climate change. In many cases, those communities have already developed coping strategies related to the forest, but the lack of appropriate tenure and user rights reduce the possibility of promoting such strategies. Poor governance and the failure of governments to acknowledge the property rights of forest-dependent stakeholders are partially responsible for all of the circumstances.

The United Nations Framework Convention on Climate Change (UNFCCC) articulates two approaches for addressing climate change: mitigation (i.e., reducing emissions and increasing carbon sequestration) and adaptation (i.e., adjusting to the already changing climate). Forestry activities are key options for both adaptation to and mitigation of climate change.

The Kyoto Protocol is the binding agreement under the UNFCCC that regulates mitigation until 2012. The Kyoto Protocol is mandatory to only those countries that have ratified it. At present, forestry activities in developing countries under the Kyoto Protocol's Clean Development Mechanism (CDM) are highly over-regulated. This issue means that a high level of expertise is required to get projects in motion, as well as heavy investment, thus discriminating against poor forest communities. Even the simplified modalities for small-scale afforestation and reforestation (A/R) projects under the CDM, which had been developed to allow communities to participate in the CDM, have proven to be largely out of reach for poor forest communities given the high installation and transaction costs of project preparation. Those high costs, and the requirements for clear property rights for investment, have made it very difficult for the poor rural communities to initiate A/R CDM projects. Furthermore, almost all projects to date have targeted either publicly owned reforestation areas or private plantations. Initiatives with respect to the protection of existing carbon reservoirs financed through the voluntary carbon market have been mainly focused on publicly owned protected areas. The inclusion of local people in these private or public projects is a necessary element in the future A/R carbon market. But that participation alone is not sufficient to ensure that the sustainability criterion of the CDM is met. A future, more holistic approach to including forests in the carbon market must include the direct participation of local people in A/R through community-owned forestry projects. These experiences illustrate that, as currently structured, carbon markets have been inequitable, thereby posing the risk of aggravating the growing economic gap between those immediately dependent on forests for their livelihoods and the rest of society.

The inclusion of a wider range of forestry options than A/R in a post-2012 climate scenario can have considerable potential to benefit local communities. Options for local communities to participate in such a scenario must, however, be developed and promoted. Participation by all sectors of society is needed for adapting to and mitigating climate change in line with the Millennium Development Goals. Where the correct social and political conditions are in place and where the private sector and civil society can fully con-

tribute, forest projects constitute a least-cost option to reduce emissions, to sequester additional carbon, and to increase the adaptive capacity of local people.

Consequently, using forest options for addressing climate change requires a serious improvement in governance of forest resources that goes beyond traditional notions of governance and that includes issues regarding the public sector, the private sector, and civil society. Good governance of forest resources is critical for addressing climate change. Therefore, major efforts are needed for improving transparency, accountability, and equity within and among the public sector, the private sector, and civil society. For the achievement of good governance, clarification of forest tenure and use rights in favor of local forest-dependent stakeholders is a priority. Because of their nature, climate change options in forestry will always require high standards for implementation, monitoring, and evaluation. Thus, high governance standards are an ultimate requirement. Unless robust and proactive steps are taken to clarify and strengthen the property rights of rural and forest peoples, future climate change initiatives will benefit only a few, primarily wealthy elites and will reinforce existing social and economic disparities.

INTRODUCTION

Forests cover more than 30 percent of the global land area. They are essential resources for human welfare and development. In addition to providing traded goods, hydrological and atmospheric services, and soil protection, forests provide water, food, medicines, shelter, and sources of livelihood for the communities that live in and around them. Thus, forests are a valuable resource to poor and vulnerable populations in developing countries, although hard data placing an economic value on the benefits derived by poor households is not easy to find.[2] In 2000, 240 million people lived in forested areas in developing countries. Of that number, 60 million were indigenous people, 17 million worked in the formal forestry sector, and 30 million were employed in the informal forestry sector. In fact, 13–35 percent of small-scale rural enterprises are based on employment in forest-based enterprises. Without forest resources, the livelihoods of those 240 million people would be threatened—directly or indirectly.

Both timber and nontimber forest products are essential to developing countries. Timber has often been a valuable source of national income, with developing countries exporting US$15 billion in timber-based products in 2005,[3] as well as selling to large domestic markets. Poor families, however, have often not seen the benefit from the timber products, which frequently require skills, capital, and technology and entail economies of scale beyond their resources. Increasingly important are nontimber forest products, such as fruits and vegetables, biomass fuels, wild meat, medicinal plants, and many other products, which are often essential as construction materials, subsistence food supplies, agricultural inputs, and sources of financially viable small-scale enterprises. In 2000, 2.4 billion people relied on biomass fuels, and fuelwood and charcoal production provided 13 million jobs. Wild meat and fish provided 20 percent of the protein consumed in 62 countries. Worldwide, 2 billion people used medicinal plants and animals.[4]

In essence, forests play a crucial role in the livelihoods of the poor. But forests are being lost and degraded at an unprecedented rate, due in part to population growth and agriculture expanding to meet the growing global food demand and because of increasing threats from the negative effects of climate change. Effective governance of forest resources can contribute to mitigation of climate change while simultaneously enhancing the ability of local people to adapt to climate change and to develop livelihoods.

The present paper aims to analyze the role of governance in the forest sector, including forest tenure, in addressing the global challenge of adapting to and mitigating climate change. According to the terms of reference and drawing on existing knowledge, published and unpublished materials, and conversations with other expert organizations and individuals including Rights and Resources Initiative partners, we have organized this paper in the following manner and have covered the following topics:

1. The role of forests in adapting to and mitigating climate change, particularly in developing countries

2. Presentation of the major issues relevant to the particular role of tenure and governance in achieving the goals of reducing emissions from deforestation and forest degradation

3. Estimation of the scale of the issue at the global level (for example, the number of millions of people affected, tons of carbon sequestered or emissions avoided, or millions of hectares threatened or restored) and the global trends, with and without intervention, through 2030

4. Lessons learned—particularly those regarding tenure and governance—from prior projects, policies, and programs to reduce emissions from deforestation and forest degradation; the related lessons learned from efforts to secure forest tenure and governance that have been effective; and summaries of the specific lessons for designing the institutional arrangements to avoid deforestation

5. Recommendations on a set of priority actions and approaches for fostering effective tenure and institutional arrangements by national governments and international organizations, such as the World Bank, the International Tropical Timber Organization, and the Intergovernmental Panel on Climate Change, and recommendations for consideration by the Conference of Parties of the UNFCCC during the implementation of the Bali Action Plan.

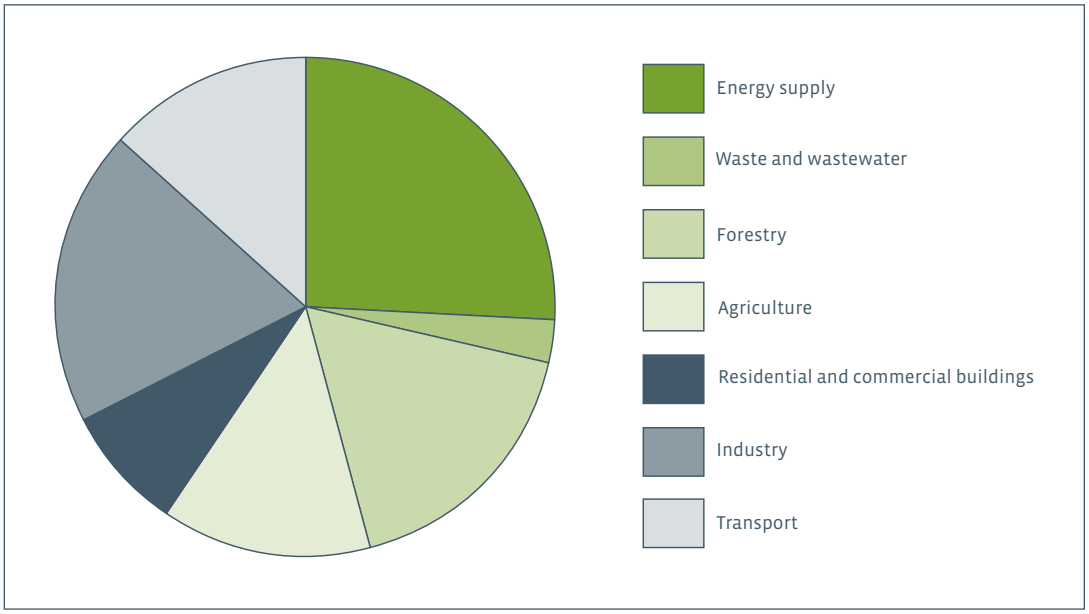
1 THE ROLE OF FOREST AND FORESTRY IN CLIMATE CHANGE

Climate change is considered to be one of the major threats to sustainable development because of its effects on health, infrastructure, settlements, agriculture and food security, and forest ecosystems.[5] Moreover, climate change may result in deterioration of living conditions in many regions of the world.

According to the Intergovernmental Panel on Climate Change (IPCC), unprecedented changes in the climate system have taken place during the 20th century. Those changes can be observed through three variables: increases in average temperatures, changes in rainfall patterns, and an increase in the intensity and frequency of extreme events. It is now widely accepted that the changes in the climate system are closely related to increased human-induced GHG emissions, especially during the past 150 years. For this reason, the terms *climate change* and *human-induced climate change* are now often used interchangeably.

Burning fossil fuels is the primary source of GHG emissions. Land use change—primarily tropical deforestation—forest degradation, and forest fires are the second principal sources of GHG emissions (see figure 1). GHG emissions resulting from deforestation are mostly carbon dioxide with

FIGURE 1. GLOBAL GHG EMISSIONS



Source: IPCC. 2007. Fourth Assessment Report.

lesser amounts of methane and carbon monoxide. Besides the impacts of deforestation on the climate system, it is one of the most critical environmental problems facing developing countries today with respect to its long-term negative impact on biodiversity, loss of economic opportunities, and increased social disparity.

Four main questions must be answered to understand the role of the forest sector in climate change:

- How does climate change affect the forest sector?
- How can the forest sector contribute to reducing vulnerability to climate change?
- To what extent does the forest sector contribute to human-induced climate change?
- How can the forest sector contribute to mitigating climate change?

In this section, we present the main analytical considerations with regard to those four questions. In section 4, we provide some figures on the scale of the problem.

1.1 HOW DOES CLIMATE CHANGE AFFECT THE FOREST SECTOR?

IMPACTS ON FOREST ECOSYSTEMS

Climate change is likely to affect all forest landscapes. Indeed, predicted changes in climate variables will place severe pressure on forests' ability to maintain the current level of diversity and productivity. With rising temperatures, changes in water availability, and the expected doubling of carbon dioxide (CO_2) levels, it is anticipated that forests will change at two levels: (a) physiology and metabolism, and (b) ecosystem functioning (see Table 1). Those changes will have significant effects on the availability and quality of forest goods and services, including the capacity of forests to sequester carbon from the atmosphere.

The *Fourth Assessment Report* of the IPCC[6] indicates that, although there is still uncertainty in predictions, negative climate change impacts may be stronger than previously projected and positive impacts are being over-estimated. In addition, the projected potentially positive effect of climate change, as well as the estimated carbon sink in mature forests, may be substantially threatened by enhancing or changing the regime of disturbances in forests—fire, pests, drought, and heat waves—that affect forestry production, including timber and nontimber forest products, as well as forest ecosystem services, both environmental and social. Global climate change can also affect the mitigation potential of the forestry sector by either increasing or decreasing the potential for carbon sequestration.

IMPACTS ON FORESTRY AND FOREST-DEPENDENT PEOPLE

The socioeconomic effects of the climate-induced changes in forests have not yet been quantified.[7] However, the changes clearly affect all forestry activities, including those within the formal and informal sectors of the economy, and livelihood-related forest activities not considered part of any economy (for example, subsistence agriculture or forest products gathered for home consumption). Some of the most important foreseeable effects of climate change in forestry are the following:

- Decrease in timber production because of increased extreme events, such as forest fires, hurricanes, flooding, and droughts
- Decrease in timber production because of changes in ecosystems and increased pests
- Changes in the quality of timber

TABLE 1. SUMMARY OF CLIMATE CHANGE EFFECTS ON FOREST ECOSYSTEMS

Climate Factor	Cell level	Organism level	Species level	Ecosystem level
CO_2 increase	Photosynthetic rate increase	Growth rate increase	Decreased seed mortality	Biomass production increase
	Stomatal conductance reduction	Water-use efficiency increase	Increased recruitment	Alteration in species competitiveness
		Seed production increase	Period for individuals to reach maturity	Changes in species composition
			Changes in individual density	
Temperature increase	Photosynthesis increase or decrease	Primary production positive or negative changes	Regeneration rate changes	Alterations in species competitiveness
	Photosynthetic period can increase	Seed production changes	Possible increase in tree mortality	Species composition changes
	Transpiration increase		Negative consequences for species sensitive to temperature changes	Soil mineralization increase
Rainfall regime changes	Growth rate decrease	Seed mortality rate increase	Increase of mature individuals' mortality rate	Alterations in species competitiveness
				Species composition changes

Source: Robledo, C. and Forner, C. 2005. Adaptation of forest ecosystems and the forest sector to climate change. FAO Series Forests and Climate Change Working Paper, 2. FAO. Rome. Table based on Meer, P., Kramek, K. & Wjik, M. 2001. Climate change and forest ecosystem dynamics. Amsterday, RVIM Report, No. 410200069. 130 pp.

- Changes in the regional distribution of timber and nontimber species
- Impacts on the ability of some species designed for productive plantations to maintain growth rates and wood quality over the next 30–50 years
- Indirect effects on the timber chain attributable to changes in quantity and quality of offered timber
- Changes in the availability, in terms of quantity and quality, of all nontimber forest products, including food, medicinal plants, fiber, and others
- Changes in the production chain and markets (formal and informal) of nontimber forests products
- Changes in biodiversity
- Impacts on the availability and quality of forest ecosystem services
- Changes in land use attributable to an increasing demand for new agricultural land, although conversely, some agricultural land could be abandoned and could revert to shrub

Impacts on forest-dependent livelihoods cover a wide range of possibilities, including direct effects from extreme events, such as loss of housing; effects on health and welfare; loss or reduction of income; loss of employment or changes in working conditions; reduction in availability of food; effects on health; and loss or changes of cultural habitat.[8]

Those effects will increase the already existing vulnerability of poor communities that are directly or indirectly dependent on forest ecosystems. Currently,

many of those communities are already suffering disproportionately from the ongoing effects of climate change. Their livelihoods are extremely vulnerable to any stress. Changes in the climatic conditions very often become a burden with which such communities cannot cope. Decreases in living conditions and increases in conflicts are some of the consequences.

Despite its negative impacts, climate change can also open up opportunities for forest-dependent people. This possibility is often forgotten in the analysis of climate change impacts. Indeed, little is written on new opportunities resulting from climate change. This lack of research and analysis increases the vulnerability of the forest sector, especially of poor people.

In contrast, understanding the new opportunities attributable to climate change can bring market and nonmarket benefits to such communities. The following are some considerations of climate change–related opportunities for the forest sector:

- Recognition of local knowledge in coping with climate variability
- Promotion of native species that adapt better to climate variability
- Diversification of forest use so that the impact of each activity is reduced and, therefore, also the overall vulnerability
- Promotion of sustainable forest management as a means for reducing vulnerability
- Development of new market opportunities for traditional forest products that are highly resilient to climate change
- Sustainable forest management as a means for reducing GHG emissions and for enhancing carbon sinks

The challenge in this case is how to reduce climate change-related effects on forest dependent, impoverished communities while increasing the ability to create new opportunities that benefit the most vulnerable communities.

1.2 HOW CAN THE FOREST SECTOR CONTRIBUTE TO REDUCING VULNERABILITY TO CLIMATE CHANGE?

There are different ways in which the forest sector can reduce vulnerability to climate change. Reduction in vulnerability and improvement of the adaptation capacity in the forest sector provide benefits beyond the sector. A good example from Bolivia is how forest ecosystems can reduce the vulnerability of mountain agricultural land and settlements while ensuring water availability.[9] Research using the CRiSTAL (Community-based Risk Screening Tool—Adaptation and Livelihoods) tool was undertaken in Bangladesh, Mali, Nicaragua, Sri Lanka, and Tanzania on how local communities cope with increasing climate hazards, and it demonstrated the important role of forests in coping with climate change hazards.[10] Forests play a key role during extreme events because they provide food during droughts, they reduce the effects of cyclones in coastal areas, and they reduce the risk of landslides during storms in mountain regions. Furthermore, forests provide food and shelter when climate-related risks have reduced agricultural and livestock yields and overall production or when extreme events have destroyed houses and infrastructure.[11] Table 2 presents some examples on how forest ecosystems can contribute to reduced vulnerability at the landscape level.

The function of forests in adaptation must be highlighted because those communities responsible for managing the forest are hardly recognized for their role in reducing the vulnerability of other sectors. Lack of recognition includes lack of participation in benefits (monetary and nonmonetary) and lack of secure access and tenure rights to forestland (see section 3 of this paper). Table 3 presents different possibilities of forest management activities aimed at reducing the vulnerability

TABLE 2. EXAMPLES OF FOREST MANAGEMENT STRATEGIES AS ADAPTATION MEASURES

Management strategy	Potential impact of climate change	Adaptation measure
Conservation	Desertification increase	Watershed conservation
	Change in structure and morphology of forest ecosystems	Promotion of the most adapted and productive species in any location according to expected local climate change
	Increase of wildfire (frequency and extension)	Creation of fire barriers Collection and use of biomass
Rehabilitation	Greater exposure to torrential rains Reduced food security	Rehabilitation by development of more resilient agroforestry systems
	Change in structure and morphology of forest ecosystems	Selection of species and management practices considering future climate scenarios
Tree plantations	Increase in landslide risk	Plantations of appropriate mixes of species (deep rooting and soil coverage)
	Exacerbation of impacts on ecosystems Increased fuelwood demand	Establishment of fuelwood and other biofuel crops

Source: Adapted from: Robledo, Carmenza and Claudio Forner. 2005. Adaptation of Forest Ecosystems and the Forest Sector to Climate Change. Forest and Climate Change Working Paper 2. Rome: Food and Agriculture Organization of the United Nations. P58.

TABLE 3. ENVIRONMENTAL SERVICES AS ADAPTATION OPTIONS

Climate risk	Impacts	Environmental service	Adaptation option (examples)
Changes in rainfall regime	Droughts, floods	Regulation of the hydrological cycle	Watershed management: plantations with adapted species, agroforestry
Extreme events, such as torrential rains and hurricanes	Damage to infrastructure, floods		
Changes in rainfall regime	Droughts, floods	Microclimate regulation	Restoration and rehabilitation, enrichment planting, agroforestry
Average temperature changes	Changes in ecosystem structure, habitat loss for some species		
Changes in rainfall regime	Change in ecosystem, habitat loss for some species, loss of species (fauna and flora), loss of genetic pool, epidemics	Conservation of biological diversity (and its benefits of pollination, seed distribution, habitat, and natural pest control)	Bioprospecting studies, sustainable management of forests (conservation, restoration, and rehabilitation), sustainable plantation management
Extreme events, such as torrential rains and hurricanes			
Temperature changes			
Changes in rainfall regime	Erosion	Soil protection	Restoration and rehabilitation (forest enrichment), plantations with soil-protecting species in highly degraded areas
Extreme events, such as torrential rains and hurricanes	Landslides		

Source: Adapted from: Robledo, Carmenza and Claudio Forner. 2005. Adaptation of Forest Ecosystems and the Forest Sector to Climate Change. Forest and Climate Change Working Paper 2. Rome: Food and Agriculture Organization of the United Nations. P49.

of forest and nonforest ecosystems and of people depending on those ecosystems.

The social services of the forest ecosystems, such as conservation of cultural habitat or scenic views, also need to be considered here. Social services are closely bound to the value that certain social groups attach to the forest ecosystems. Understanding the importance of those social services is of great importance because it significantly influences the motivation of social groups to manage forest ecosystems in a sustainable way.

Although the importance of forest services—social and environmental—has gained recognition as a means for reducing vulnerability to human-induced climate change, quantifying those services and establishing their value is a major constraint to promoting corresponding management activities as instruments for adaptation to climate change.

Two challenges exist. The first challenge is how to clearly quantify the potential of forest and sustainable forest management in reducing climate change vulnerabilities. The second challenge is how to ensure that poor communities involved in such management are recognized and compensated for their efforts. Addressing those challenges makes it necessary (a) to clarify forest rights and tenure in favor of those who directly manage the forest for reducing vulnerability, (b) to design distribution mechanisms that guarantee that benefits are equally shared, and (c) to enforce participatory instruments that ensure the involvement of all stakeholders in decision making.

1.3 TO WHAT EXTENT DOES THE FOREST SECTOR CONTRIBUTE TO HUMAN-INDUCED CLIMATE CHANGE?

Forests retain carbon in five different pools: above-ground biomass, below-ground biomass, litter, dead wood, and organic soil. Fires and decomposition reduce those carbon pools, and forests emit GHG, mainly CO_2, methane, or nitrous oxide. Conversely, forests sequester carbon from the atmosphere through photosynthesis.

Forests account for almost one-half of the global terrestrial carbon pool or reservoir. If vegetation alone is considered (excluding soils), forests hold about 75 percent of the living terrestrial carbon. In 2005, the total carbon content of forest ecosystems was estimated at 1,036 gigatons of CO_2.[12] Forests play an important role in the global carbon budget because they can be either sources or sinks of atmospheric carbon.

Since 1950, the 20 percent decrease in forest area has contributed to 90 percent of the carbon emissions from land-use change.[13] Emissions depend on both the rate of deforestation and the changes in carbon stock per hectare after deforestation; changes in carbon stocks vary with land use, region, and ecosystem, as well as the use of the removed forest biomass. Forest fires also contribute to GHG emissions.[14]

Annual emissions from land-use change, mainly through deforestation and forest degradation in tropical developing countries, account for approximately 20–25 percent of the total anthropogenic emissions of GHG. However, estimates of the magnitude of the emissions are uncertain because of a shortage of appropriate data and the lack of standardized analytical methods, capacity at national levels, and resources at the international level.[15]

Estimates of the future rate of deforestation vary widely among different authors. Sathaye et al. estimate that deforestation will continue in all the regions, particularly at high rates in Africa and South America, for a total of just under 600 million hectares lost cumulatively by 2050.[16] Using a spatial-explicit model coupled with demographic and economic databases, Soares-Filo et al. predict that by 2050, under a business-as-usual scenario, projected deforestation trends will eliminate 40

percent of the current 540 million hectares of Amazon forests,[17] releasing approximately 117,000 megatons of CO_2 into the atmosphere.[18]

There are some signs that in the immediate future commercial use of biomass for bioenergy will become increasingly important and might be a new and additional threat for deforestation. Land mass used as biofuel plantations has increased dramatically around the world, particularly for soybeans and oil palm. For example, in Brazil in 1940, there were only 704 hectares of soya fields, but by 2005, there were 22 million hectares. Globally, the area used for oil palm and soybean crops increased from about 11 million hectares to 77 million hectares between 1990 and 2002. Because plantations are often established after natural forests have been logged and then burned to clear the land for planting, the increasing area of plantations of oil palm may seriously threaten the remaining tropical forests—particularly in Indonesia—outside national parks and other protected areas. Furthermore, large parts of Southeast Asia consist of peatlands, initially covered by rainforests. The peat swamp forests store significant amounts of CO_2 that have accumulated over thousands of years. Rainforest peatlands are rapidly being destroyed through deforestation and drainage for plantations, mainly for oil palm and pulp wood. A recent study by Wetlands International[19] has found that 1 metric ton of biodiesel made from oil palm grown on Southeast Asia's peatlands is linked to the emission of 10–30 metric tons of CO_2. Shockingly, this is 2–8 times as much carbon released as in the production of 1 metric ton of petro-diesel from petrol.[20]

In addition to intended deforestation, forests are severely affected globally by disturbances, such as forest fires, pests (insects and diseases), and climatic events, including drought, wind, snow, ice, and floods. All of those factors also have carbon balance implications.[21] Such disturbances affect roughly 100 million hectares of forests annually.[22]

Poor communities' contribution to increased forest-related GHG emissions is a highly relevant issue. According to a recent report presented to the Secretariat of the UNFCCC, poverty-driven activities, especially forest conversion for subsistence farming, are responsible for up to 48 percent of the deforestation and forest degradation worldwide.[23] The social, economic, and ecological effects of the emissions are not yet completely understood. Those effects are especially relevant because of the magnitude of GHG emissions attributable to poverty. Because the amount of poverty-driven GHG emissions from forests is so relevant, reducing poverty should be considered as a sensible mitigation strategy, and corresponding funds must be guaranteed for promoting poverty-alleviation programs aimed at solving the direct and underlying causes of deforestation and forest degradation. Consequently, funding pro-poor mitigation activities in forestry shall be a clear priority in any post-2012 mitigation agreement. In this context, it should be kept in mind that increased forest-tenure rights could be key, even if not sufficient, for reducing the poverty of forest dwellers.

1.4 HOW CAN THE FOREST SECTOR CONTRIBUTE TO THE MITIGATION OF CLIMATE CHANGE

According to the IPCC, a sustainable forest-management strategy aimed at maintaining or increasing forest carbon stocks in the long term, while producing an annual sustained yield of timber, fiber, or energy from the forest, will generate the largest sustained mitigation benefit.[24] In its *Fourth Assessment Report*, the IPCC considers four groups of activities as available options to reduce emissions by sources and to increase removals by sinks in the forest sector:[25]

- Maintaining or increasing the forest area through reduction of deforestation and forest degradation and through A/R[26]

TABLE 4. MITIGATION OPTIONS AND FOREST MANAGEMENT PRACTICES

Mitigation options	Forest management practices
Maintaining or increasing forest area	Afforestation and reforestation Reduction of deforestation and forest degradation
Maintaining or increasing stand-level carbon density	Reduction of forest degradation Forest restoration Improvement of management, such as reduced-impact logging
Maintaining or increasing landscape-level carbon density	Improvement of forest management, such as fire control
Increasing off-site carbon stocks in wood products and enhancing product and fuel substitution	Sustainable biofuel plantations Substitution through wood products

Source: Adapted from Metz, Bert, Ogunlade Davidson, Peter Bosch, Rutu Dave, and Leo Meyer, eds. 2007. Climate Change 2007 – Mitigation of Climate Change: Working Group III contribution to the Fourth Assessment Report of the IPCC. Cambridge: Cambridge University Press. P565.

- Maintaining or increasing the stand-level carbon density (metric tons of carbon per hectare) through the reduction of forest degradation and through planting, site preparation, tree improvement, fertilization, stand management, or other appropriate silvicultural techniques (which are mainly for plantations)
- Maintaining or increasing the landscape-level carbon density using forest conservation, extended forest rotations, fire management, and protection against insects (which are mainly for natural forest)
- Increasing off-site carbon stocks in wood products and enhancing product and fuel substitution by using forest-derived biomass to substitute products with high fossil fuel requirements, as well as increasing the use of biomass-derived energy to substitute fossil fuels

Five types of management practices are associated with those groups of mitigation activities: afforestation and reforestation, biofuel plantations and substitution through wood products, reduction of emissions from deforestation and forest degradation, improvement of forest management, and forest restoration. These practices are articulated in Table 4 and the following text.

1. Afforestation and reforestation.[27] The role of forests in carbon sequestration from photosynthesis is well known. Because trees have a much longer lifespan than agricultural crops, they act as long-term reservoirs, which lock up the carbon for decades—even centuries—in the form of cellulose and lignin. Therefore, enhancing carbon sinks and reducing GHG emissions from forests can contribute substantially to mitigating climate change and its effects on ecological and social systems. Afforestation and reforestation are the direct human-induced conversion of non-forested land to forested land through planting, seeding, human-induced promotion of seed sources, and/or natural seed sources. The two terms are distinguished by how long the non-forest condition has prevailed. Afforestation and reforestation activities lead to increases in the carbon pools. Afforestation and reforestation are currently the only forest management practices that contribute to the mitigation of climate change for which developing countries can be rewarded. That reward is possible through the CDM.

2. Biofuel plantations and substitution through wood products. Substitution of products with high upstream emissions by products with lower upstream emissions is an interesting possibility for mitigating climate change. In the forest sector, it includes mainly three options:

- Substituting wood for high energy-consuming materials in the building industry
- Using wood for heating

- Promoting forest-based biofuels (for example, through the planting of *Jatropha curcas*, *Pongamia pinnata*, *Croton megalocarpus*, and other species)

Those activities have a positive carbon balance when (a) wood is produced sustainably (that is, carbon stocks are renewed in the forest) and when (b) emissions from producing wood materials or biofuels are equal to or less than the products they substitute. Those emissions allow the annual harvest to be set equal to or below the annual forest increment, thus permitting carbons stocks to be maintained or to increase while providing an annual carbon flow to meet society's needs for fiber, timber, and energy.[28]

In addition to biofuels derived from wood, some agricultural products are used in producing biofuels (for example, maize, sugar cane, and palm oil). In terms of the potential of those products to contribute to climate change mitigation, there are two main considerations:

- In some cases, the establishment of the agricultural activities follows a deforestation event. The corresponding GHG emissions must be included in the carbon balance of the biofuel.
- Other emissions—especially upstream emissions (such as those from fertilizer production) and GHG emissions during biofuel production—must also be included in the carbon balance of the biofuel.

According to different studies, when one considers all the related emissions, many biofuels have a negative carbon balance and result in more GHG emissions.[29]

3. Reduction of emissions from deforestation and forest degradation. Deforestation and forest degradation are the main emission sources in many developing countries and are responsible for up to 20–25 percent of the total global anthropogenic emissions. In some circumstances, deforestation and forest degradation can be delayed or reduced through strict protection of forests,[30] through sustainable forest management practices, and through forest uses not involving tree removal, such as tourism and harvesting of nontimber forest products. Protecting forest from all harvests typically results in maintained or increased forest carbon stocks, but it also reduces the wood and land supply needed to meet other societal needs. Reducing deforestation and forest degradation is the forest mitigation option with the largest and most immediate carbon stock effect in the short term per hectare and per year globally (see section 4 of this paper), because large carbon stocks are not emitted when deforestation is prevented. The mitigation costs of reduced deforestation depend on (a) the causes of deforestation, including commercial agriculture, subsistence farming, and wood extraction: (b) the associated returns from the non-forest land use; (c) the returns from potential alternative forest uses; and (d) any compensation paid to the individual or institutional landowner.

4. Improvement of forest management. Forest management activities include silvicultural interventions that promote a greater proportion of the desired species, tree population, and size structure, which, in terms of timber, means promoting the maximum volume of usable growing stock and, therefore, of carbon that may not be released to the atmosphere. Such activities also include harvest systems that maintain partial forest cover, minimize losses of dead organic matter or soil carbon by reducing soil erosion, and avoid slash burning and other high-emission activities. Replanting or natural regeneration promotion after harvest or natural disturbances accelerates tree growth and reduces carbon losses. Economic considerations are typically the main constraint, because retaining additional carbon on site delays revenues from harvest.[31] Use of fertilizers or drainage of forest soil (especially in peatlands) can have a negative effect in the overall carbon balance and should, therefore, be minimized. Moderate drainage, however, can lead to an increase in peat carbon accumulation.[32] Landscape-level carbon stock changes are the sum of stand-level changes, and the effects of forest management on carbon stocks ultimately must be evaluated at the landscape level. Increasing harvest rotation lengths can increase some carbon pools (for example, tree boles) while decreasing others (for example, harvested wood products).[33]

5. Forest Restoration. What is missing in the currently discussed approaches of forests in climate mitigation is the entire field of restoration, which is probably the most promising option in forestry for restoring carbon stocks. Restoration is a combination of the planting of trees and human-induced natural regeneration within a degraded forest area[34] that has lost most of its carbon stock. Thus, forest restoration is a strategy for application in degraded forest areas. Forest restoration aims to enhance and accelerate natural processes of forest regeneration, including carbon stocks, to regain the desired species composition and growing capacity of the forest ecosystem. In terms of mitigating climate change, forest restoration becomes complementary to reducing emissions from reducing forest degradation. In those areas where a strategy of reduction of emissions from degradation is not completely successful or where degradation has already occurred, one would need to restore the forest. Under current conditions, a huge area of degraded forest could be restored while improving overall livelihood factors, including biodiversity, long-term income, and health. Forest restoration is an important issue in all developing countries.

In general, promoting sustainable forest management, including all the activities previously mentioned, will contribute to permanent reductions in emissions from the forest sector. Furthermore, sustainable forest management can be considered in many cases an appropriate and cost-effective adaptation measure, reducing not only climate-related risks but also overall ecological and human vulnerability to stress. Such activities will certainly have many collateral environmental and socioeconomic benefits. A key question is how to promote pro-poor initiatives that ensure that impoverished communities can participate in the decision making, share the benefits, and understand the responsibilities of mitigation activities in the forest sector. This would be in line not only with the goals of the UNFCCC but also with the fulfillment of the Millennium Development Goals. International decision makers must be very aware of these possibilities when defining and funding a post-2012 agreement for mitigating climate change.

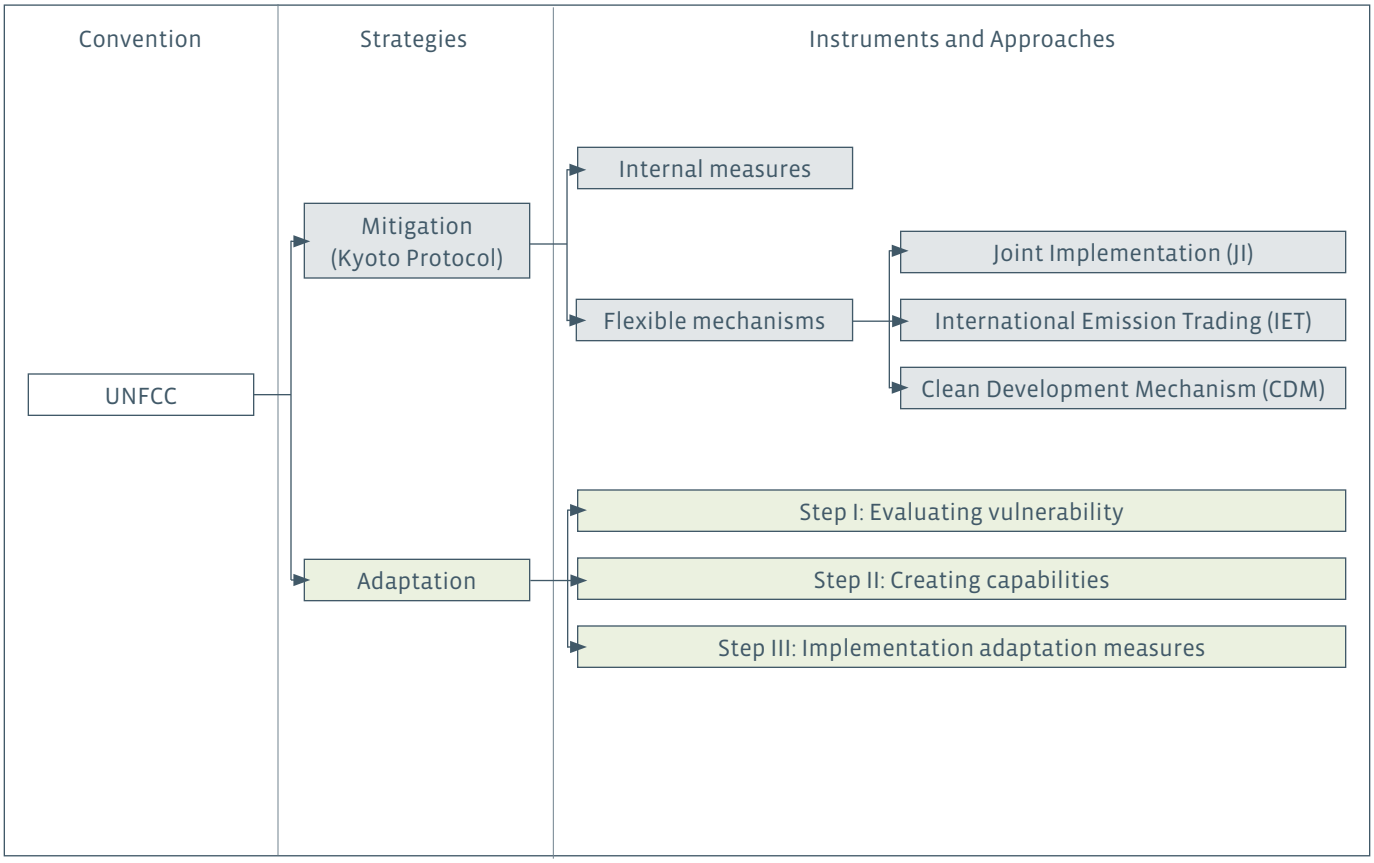
1.5 THE FOREST SECTOR IN THE INTERNATIONAL FRAMEWORK FOR ADDRESSING CLIMATE CHANGE

Evidence of human interference in the climate first emerged in 1979 at the First World Climate Conference. Increased scientific evidence, coupled with growing public concern over global environmental issues, began to push climate change onto the political agenda in the mid-1980s. Recognizing the needs of policymakers for authoritative and up-to-date scientific information, the World Meteorological Organization and the United Nations Environment Programme established the Intergovernmental Panel on Climate Change in 1988.[35]

In 1990, the IPCC issued its *First Assessment Report*, which confirmed that climate change is a threat and called for a global policy to tackle the problem. That call was echoed by the Ministerial Declaration of the Second World Climate Conference, which was held in Geneva at the end of 1990. On the basis of this declaration, the United Nations General Assembly formally launched the negotiations on a framework convention on climate change. In May 1992, after 15 months of intergovernmental negotiation, governments adopted the United Nations Framework Convention on Climate Change. The UNFCCC was opened for signature in June 1992 during the UN Conference on Environment and Development held in Rio de Janeiro, Brazil, and went into force in March 1994. Today, 191 countries have signed and ratified the Convention.[36]

The UNFCCC's goal is to stabilize atmospheric concentrations of GHG at a level that would prevent

FIGURE 2. STRATEGIES, INSTRUMENTS, AND APPROACHES TO TACKLE CLIMATE CHANGE



Source: Robledo, Carmenza and Omar Masera. 2007. Developments in UNFCCC/IPCC Discussions Regarding Reducing Emissions from Forest Degradation and Deforestation and Implications for Tropical Forests and Tropical Timber Producers. Paper presented at the XLII Session of the International Tropical Timber Council, Port Moresby, Papua New Guinea.

"dangerous anthropogenic interference" with the global climate system.[37] The UNFCCC acknowledges that countries have "common but differentiated responsibilities and respective capabilities" to address climate change.[38] Under such premises, developed countries have engaged themselves to take a leading role in achieving the UNFCCC's goal. Industrialized countries have committed themselves to provide additional funds to assist developing countries in mitigation and adaptation activities. Those activities must be consistent with and support sustainable development objectives. Scientific uncertainties that might remain cannot be used as an argument to postpone action (the "precautionary principle").

There are two main responses to climate change: adaptation and mitigation. Those strategies are complementary and nonexclusive:

- **Adaptation** to climate change refers to adjustments in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderate, harm, or exploit beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private or public adaptation, and autonomous or planned adaptation. Besides the stages of adaptation shown in Figure 2, the UNFCCC agreed in 2006 on the Nairobi work programme, which includes a wider spectrum of possibilities for promoting adaptation to climate change.
- **Mitigation** refers to interventions to reduce emissions of GHG at the source or to enhance sinks.[39] At the third Conference of the Parties, which was held in Kyoto, Japan, in 1997, the parties to the convention adopted a protocol for emissions reduc-

tion in Annex I countries until 2012.[40] This instrument is known as the Kyoto Protocol. The Kyoto Protocol is a legally binding agreement in which many industrialized countries committed to reduce a total of 5.2 percent of their emissions compared with the base year of 1990. Countries with commitments are known as Annex I countries. In addition, the reductions need to be achieved between 2008 and 2012, which is known as the *first commitment period*. Commitments beyond 2012 are currently under negotiation, and a decision is expected in 2011 during the Conference of the Parties 15.

Countries with reduction commitments have two options: reduce emissions within the country (internal measures) or use flexible mechanisms. Those mechanisms allow Annex I countries to *buy* offsets for part of their reduction commitments from other countries. There are three such mechanisms: Joint Implementation (JI), International Emission Trading, and CDM (see Figure 2).[41]

FORESTS AND ADAPTATION IN THE CONTEXT OF THE UNFCCC

Since its beginning, the UNFCCC has encouraged a large number of initiatives related to assessing the effects and costs of climate change, developing methodologies for vulnerability assessment, and building capacity. Recent experiences, such as the increase of natural climate disasters and heat waves, highlight the urgency of strengthening and energizing the political process related to adaptation. Interest has also increased because of developing countries' active participation in the negotiations and development of national communications.[42]

The international interest in adaptation issues is reflected in the UNFCCC's text. The initial paragraphs mention that changes in climate variables and their adverse effects are a common global concern. It also recognizes that countries that have low coastal areas, that suffer from droughts and floods, that are located in arid and semi-arid areas, or that have fragile ecosystems are especially vulnerable to climate change. As an objective, the UNFCCC refers to adaptation when it states, "such a level[43] should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner."

Article 4.1(b) of the UNFCCC establishes that the parties should formulate and implement measures that allow appropriate adaptation to climate change. In practical terms, every member country has committed itself (a) to assess its vulnerability, including its adaptation needs; (b) to improve capacities; and (c) to implement these measures within its territory as part of its climate change policies. The Convention does not mention specific sectors regarding adaptation to climate change.

All countries that are parties to the UNFCCC should elaborate and publish a national communication that compiles information related to activities aimed at compliance with agreed commitments, including inventories of GHGs and policies and measures for their reduction. Besides the preparation of international policies on financing, other activities related to adaptation include the process of National Adaptation Programmes of Action, which focuses on least-developed countries (LDCs).[44] Through the National Adaptation Programmes of Action, LDCs communicate their needs for capacity building, institutional development, financing, and other priority areas.[45]

The inclusion of the forest sector in the national communications and in the National Adaptation Programmes of Action is different from one country to another. According to an assessment prepared for the Swedish International Development Cooperation Agency, which covers nine developing countries in Asia, Eastern Europe, Latin America, and Africa, forestry is the second-most important sector for reducing vulnerability per information in the national communications.[46] However, participation of the sector in adaptation programs funded by international agencies is relatively small.

Another important activity related to adaptation is the compilation of methodologies and tools

to assess vulnerability and adaptation strategies. The UNFCCC Secretariat carries out this activity. Many organizations have sent their methodologies and tools in the hope of participating in this process. The database includes different methodologies and analyses for various sectors. No specific tool is currently available for forest ecosystems and the forest sector. However, it is expected that the information will be integrated into the Nairobi work programme on effects, vulnerability, and adaptation to climate change.[47]

The objective of the Nairobi work programme is twofold:

- To assist all Parties, in particular developing countries, including the least developed countries and small island developing States, to improve their understanding and assessment of impacts, vulnerability and adaptation; and
- To assist all Parties to make informed decisions on practical adaptation actions and measures to respond to climate change on a sound scientific, technical and socio-economic basis, taking into account current and future climate change and variability.[48]

In the Nairobi work programme, there is no specific mention of either forests or other sectors. The program remains, however, a good opportunity to highlight the cross-cutting character of the forest sector in relation to its role in adapting to climate change.

FORESTRY ACTIVITIES IN THE KYOTO PROTOCOL UNTIL 2012

In the Kyoto Protocol, forestry activities fall under Land Use, Land Use Change and Forestry (LULUCF). The use of LULUCF activities under the Kyoto Protocol is ruled by articles 3.3 and 3.4 of the protocol.[49] In addition, eligibility of LULUCF activities for internal measures and in the flexible mechanisms are ruled by decisions of the Conference of the Parties, including specific modalities and procedures for the CDM. LULUCF includes the definition of forest and seven activities for the Kyoto Protocol activities.[50] There are important differences in the treatment of those seven forestry activities that are to be considered for the internal measures, for the JI, or for the CDM.

The main difference between internal measures and flexible mechanisms in the treatment of forest is that for the internal measures, emission reductions are accounted for on the basis of net changes in carbon stocks at the national level. Those changes are recorded in the GHG national inventories submitted to the UNFCCC Secretariat. In the case of the flexible mechanisms, especially the JI and the CDM, emission reduction or carbon sequestration is based on project activities. There are also important differences in the treatment of LULUCF in the JI and the CDM, especially with regard to host countries, eligible activities, permanence, and leakages (see table 5).

As of May 2007, 44 projects have been presented for the JI, none of them on forestry activities. With regard to the CDM, there are seven approved methodologies for forestry projects, including a simplified methodology for small-scale projects. As of October 2007, only one project has been validated.

It is too early to make an accurate evaluation of the effects of the A/R CDM on poverty alleviation or in terms of real participation of forest activities within the global mitigation portfolio. One reason is that even if the carbon market is active, its real development will not begin until 2008 with the beginning of the first commitment period. Another reason for the difficulty in evaluating the A/R CDM is that the regulation and methodologies in A/R CDM are strongly delayed in comparison with the CDM in other sectors (for example, energy). However, some observations are worth mentioning:

- The CDM is a heavily regulated system, and the main investments are to be made up front. These facts increase the overall costs of the projects. Consequently, poor communities must either establish partnerships with investors or obtain some kind of subsidy to participate.
- A/R CDM projects require, at least at the beginning, a high level of knowledge of the internationally agreed modalities, procedures, and methodolo-

TABLE 5. COMPARISON OF THE TREATMENT OF LULUCF ACTIVITIES IN JI AND CDM

Treatment of LULUCF by host countries	JI by Annex I countries	CDM by non-Annex I countries
Eligible activities for the first commitment period	Afforestation and reforestation Revegetation Forest management Cropland management Grazing-land management	Afforestation and reforestation are used.
Additionality	Not considered	Project activities must sequester additional carbon against the baseline.
Treatment of leakage	Not considered	Leakage must be considered and, if existent, must be reduced from the carbon potential and monitored during the lifespan of the CDM project activity.
Treatment of permanence	Not considered	Carbon offset for afforestation and reforestation project activities in the CDM is considered as nonpermanent. As a consequence, credits from the projects have a temporary character and are, therefore, cheaper than credits from other sectors.
Socioeconomic and environmental effects	Only environmental issues considered	Socioeconomic and environmental effects must be considered. If any potential effect is considered significant by the host countries or project participants, an impact assessment must be conducted. Measures aimed at reducing the potential negative effects are the subject of periodic monitoring.
Responsible body	Joint Implementation Supervisory Committee	The Executive Board of the CDM is responsible.
Key decisions	—	Marrakech Accords, COP-7, 2001 (FCCC/CP/2001/13) includes Dec. 11/CP7: Land Use, Land-Use Change and Forestry; and Dec. 17/CP7: Modalities and procedures for a clean development mechanism as defined in Art. 12 of the Kyoto Protocol. COP-9, 2003 (FCCC/CP/2003/6) includes Dec. 19/CP9: Modalities and procedures for afforestation and reforestation project activities under the clean development mechanism in the first commitment period of the Kyoto Protocol. COP-10, 2004 (FCCC/CP/2004/10) includes 13/CP.10: Incorporation of the modalities and procedures for afforestation and reforestation project activities under the clean development mechanism into the guidelines under Articles 7 and 8 of the Kyoto Protocol; 14/CP.10: Simplified modalities and procedures for small-scale afforestation and reforestation project activities under the clean development mechanism in the first commitment period of the Kyoto Protocol and measures to facilitate their implementation; and 15/CP.10: Good practice guidance for land use, land-use change and forestry activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol. COP-11, 2005 (FCCC/CP/2005/10) includes Dec.-/CMP.1: Simplified modalities and procedures for small-scale afforestation and reforestation project activities under the clean development mechanism in the first commitment period of the Kyoto Protocol and measures to facilitate their implementation.
Number of methodologies and projects approved as of October 2007	None	10 methodologies for full-scale projects and 2 methodologies for small-scale projects, as well as different tools and clarifications.

Source: Updated from Robledo, Carmenza and Omar Masera. 2007. Developments in UNFCCC/IPCC Discussions Regarding Reducing Emissions from Forest Degradation and Deforestation and Implications for Tropical Forests and Tropical Timber Producers. Paper presented at the XLII Session of the International Tropical Timber Council, Port Moresby, Papua New Guinea.

gies. Because many countries lack this knowledge, they must engage international expertise, which further increases the project costs. Some development agencies have reacted to this fact and are currently funding capacity building and know-how transfer activities that facilitate participation in the A/R CDM.[51]

- The A/R CDM has stimulated new interest in planting trees, especially in heavily degraded areas. This opportunity is indeed a new one for the forest sector. It opens the possibility to promote restoration of forestland and sustainable plantations. Unfortunately, the sector is reacting very slowly to the opportunities provided by the CDM. Because people are interested in the A/R CDM but the forestry sector itself is not reacting fast enough, many A/R CDM activities are proposed without consideration of the forest strategy. Even worse, national strategies for promoting forestry are frequently lacking any consideration of the A/R CDM as a new mechanism for forestry promotion.
- The A/R CDM, especially through small-scale projects, offers a possibility for poor people to get involved, particularly through the promotion of community forestry. Some very interesting projects are being developed (for example, in Colombia, Madagascar, and Uganda) that promote participation and empowerment of local communities and indigenous peoples and that are aimed at improving not only the carbon balance, but also the communities' overall livelihoods. However, the so-called simplified modalities for small-scale A/R CDM projects that have been developed to allow communities to participate in the CDM instead have proven largely out of reach given the high installation and transaction costs of project preparation. The high costs, and the requirements for clear property rights for investment, have resulted in the current situation where almost all projects to date have targeted either publicly owned reforestation areas or private plantations. Initiatives with respect to the protection of existing carbon reservoirs financed through the voluntary carbon market have been mainly focused on publicly owned protected areas, and their experience in including local people can only partly be applied for a future, more holistic approach to include forests in the carbon market.

Those experiences illustrate that, as currently structured, carbon markets have been inequitable, thereby posing the risk of aggravating the growing economic gap between the forest dwellers and the rest of society. A lot needs to be done to make a post-2012 carbon sequestration approach obtainable for poor communities in the tropics.

2 CHARACTERIZATION OF THE MAIN ISSUES ON GOVERNANCE AND CLIMATE CHANGE IN THE FOREST SECTOR

Governance as a concept lends itself to a certain ambiguity, and most authors feel obliged to provide a definition when they use it. The concept itself has been around in political and academic discourse for a long time, referring in a generic sense to the task of running a government or any other appropriate entity, such as a corporation. In that sense, governance is often used as a synonym for government. However, in the past few decades, the concept of governance has taken on a specific meaning clearly distinguishable from government. Today, governance as a concept is much broader than simply "government," although government institutions often play a central role in governance. Rather, the concept of governance, as we now understand it, refers more broadly to policy processes and institutions. Within this broadly defined concept, a number of different approaches are taken, the choice of which is largely dependent on the authors' disciplinary background or ideological leaning. For example, some authors concentrate on the institutional, or regulatory, sphere of governance, while others prefer to consider a wider scope. A wider view would mean, for example, looking at governance as "a complex tapestry of competing authority claims."[52] Thus, an analysis of the governance of a particular resource, in keeping with the tapestry metaphor, implies unraveling the threads that are knotted together to make the tapestry. This process is what we will undertake in the rest of this section. We will clarify a number of key issues in forest governance in the context of climate change.

In Box 1, we present our working definitions for three key concepts: governance, good governance, and forest tenure and rights. The working definitions are the basis for this section. To provide a more comprehensive framework for the arguments that will follow, we will first elaborate further on our concept of governance, looking at where governance takes place and who are the relevant actors.

Governance is a situated practice, and, as such, it takes place in particular spaces. The notion of *space* is widely used across the literature on power, policy, democracy, and citizen action. In our understanding, spaces essentially are the *where* of governance. In this sense, spaces are the arenas in which decision making takes place and in which power operates. Power, in fact, is central to understanding spaces: all governance spaces are political in nature and are open to contestation and conflict of different kinds. Furthermore, spaces do not exist in a vacuum but rather are constantly reacting to other spaces and the sociopolitical context in which they are embedded. Spaces cannot be viewed in isolation but rather must be considered in relation to other simultaneously existing and possibly overlapping spaces and in relation to the context. Spaces are very diverse because they are created whenever policymakers and citizens come together, whether formalized in an institution or as an ad-hoc meeting. Furthermore, as Gaventa points out, "inherent also in the idea of spaces and places is also the imagery of 'boundary.' Power relations help to shape the boundaries of participatory spaces, what is possible within them, and who may enter, with which identities, discourses and interests."[53] Here are three key questions to ask about governance spaces: How

BOX 1. KEY WORKING DEFINITIONS

Governance is understood here broadly as political institutions and processes, or more specifically, as "a neutral concept comprising the complex mechanisms, processes, relationships and institutions through which citizens and groups articulate their interests, exercise their rights and obligations and mediate their differences."[54] The political institutions and processes determine how power and responsibilities are exercised, how decisions are taken, and how the various stakeholders have a say. Although in reality, governance is better characterized as "institutional bricolage,"[55] for the sake of the present analysis, it can be simplified somewhat by identifying three overlapping spheres: (a) the state sector, as represented through public institutions at local, regional, national, and international levels; (b) the private sector; and (c) civil society, including, but not limited to, such organized citizens' groups as nongovernmental organizations, community-based organizations, and traditional authorities. In theory, the roles of each sphere are that "the state creates a political and legal environment. The private sector generates jobs and income. And civil society facilitates political and social interaction—mobilising groups to participate in economic, social and political activities."[56]

Good governance refers to the quality of the governance process. It is a normative concept used to emphasize that improvements to governance *as usual* are sought and to highlight that the ultimate goal of governance is to benefit society. According to the United Nations Development Programme, good governance "ensures that political, social and economic priorities are based on broad consensus in society and the voices of the poorest and the most vulnerable are heard in decision making over the allocation of development resources. It includes essential elements such as political accountability, reliable and equitable legal frameworks, bureaucratic transparency, effective and efficient public sector management, participatory development and the promotion and protection of human rights."[57]

Forest tenure and rights is understood to describe the bundle of legally or customarily defined rights and responsibilities of forest ownership and for forest use and management that adhere to a given area of forests.[58] In other words, forest tenure arrangements determine, among other issues, who owns and who can use and manage what forest resource, for how long, and under what conditions.[59]

Source: Authors' compilation.

were they created? Whose interests are in mind? What rules of engagement are being followed?

In addition to analyzing the *where* of governance, it is important to look at who the relevant actors are and how they are related. Governance involves multiple actors, often in complex relationships. Although, for the sake of simplicity, we group actors according to the three spheres of state, private sector, and civil society, in reality the spheres clearly do not constitute bounded entities. Rather, interactions within and across them are key, creating networks and blurred boundaries. In fact, this behavior has lead to a new concept of governance that seeks to capture the complexity of these relationships: policy networks. These networks can be defined as "loosely coupled groups of private and public actors, characterised by the recognition of mutual dependence in achieving their goals."[60] In this concept, governance is less steered by the government and more coordinated among a wide variety of actors with different purposes and objectives. Thus, negotiation, and the relative power of the different actors to negotiate, is an important concern.

In the following analysis, we have grouped issues loosely by spheres that are active in governance: the public sector, the private sector, and civil society. As mentioned earlier, these three spheres overlap and are interlinked to such an extent that it is not possible to fully separate them. However, a number of issues are distinctly relevant for particular spheres. For example, the public sector is responsible for setting the legal framework and implementing laws. Although the state may consult with the private sector and civil society in drafting laws, the state itself is accountable to citizens for providing a legal framework conducive to realizing citizens' human rights. Questions that are relevant for all three spheres, such as capacity building, are dealt with in this section under "Cross-cutting Issues."

Why is it important to consider all three spheres when discussing the governance of forest resources in the context of climate change? The following are the most important arguments that explain this position:

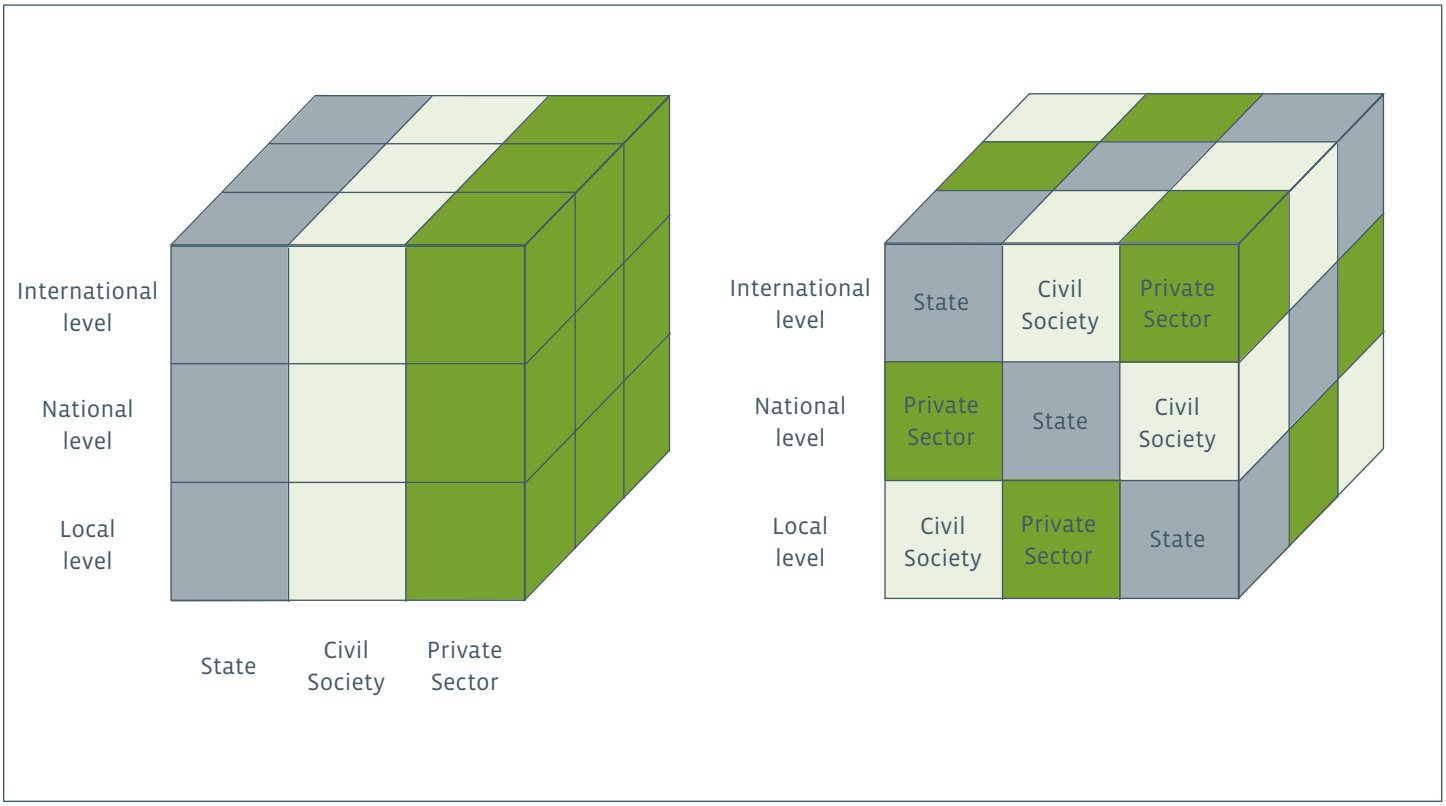
- Climate change is a global concern that needs to be addressed by society as a whole. If only one or two spheres set and implement the agreements for governing forest resources in a manner that contributes to addressing climate change, then many stresses, needs, challenges, and opportunities will be not properly considered. As a consequence, such agreements could increase vulnerabilities of forest livelihoods and enhance GHG emissions from the forest sector. This scenario must be avoided.
- Climate change affects forest resources without differentiating between public or private ownership or regarding ownership under another tenure form. Moreover, climate change can increase existing or potential conflicts with regard to land tenure and rights. A legal framework on forest tenure and rights that recognizes customary rights and also corresponds to the legitimate interests of all stakeholders is required for addressing climate change in the forest sector.
- Addressing climate change requires huge investments, which are beyond the public budgets. However, it also brings new business opportunities. In each case, the appropriate participation of both private sector and civil society is required. Such participation can be promoted only if governance agreements are in place that reflect the priorities of all sectors.
- The UNFCCC has created market mechanisms, such as the CDM. To ensure equal participation of all stakeholders, the three spheres of governance must be considered.
- The failure to consider any sector can increase existing social conflicts or create new ones.

Consequently, we include in this analysis the issues in each sphere that are key for governing forest resources in the context of climate change (see Figure 3). Forest tenure and rights is a primordial issue in governing forest sectors. As such, this issue as well as the rights regarding environmental services of forest ecosystems are considered in this section (see Section 3 for more discussion). However, improving forest tenure and rights is not enough when using the opportunities and reducing the risks while addressing climate change. For this reason, a more integrative framework is presented here.

In addition to viewing the issues by sphere, we consider existing or required agreements in the three spheres of governance (public sector, private sector, and civil society) that are necessary to ensure the successful planning and implementation of any initiative in the forest sector that considers adaptation to and mitigation of climate change. The list of issues is not closed, and we are aware that the more analysis and experience that occur in the area of climate change and governance in the forest sector, the more other issues will need to be considered.

For each of the three spheres, we analyze the most important issues that are needed to promote good governance of the forest resources and an active participation by forest-dependent poor communities in adapting to and mitigating climate change.

FIGURE 3. SPHERES OF GOVERNANCE



Source: Author's compilation

Note: The figure shows two different representations of the spheres of governance. Although the models are simplified, they provide some useful insights into the structure of governance. The model on the left groups actors, represented by the individual cubes, by governance sphere—state, civil society, and private sector—and by level of governance—local, national, and international. This approach is useful because, while acknowledging the multiplicity of actors, it facilitates analysis by grouping the actors according to common elements. Thus, we can analyze certain characteristics of governance at the local level, for example, or look at the role of civil society actors in a governance process. The model can also be expanded to include more actors (depth) or more levels of governance, for example, at the regional level (height). The model on the right is perhaps a more realistic representation of governance. It recognizes that governance spheres are not bounded and that cooperation and conflict occur across and within spheres. The model on the right is in constant motion, meaning that the levels of governance are also not bounded and that a local actor can be active, for example, in international fora.

2.1 ISSUES RELATED TO THE PUBLIC SECTOR

Here, we analyze the relevance, existence, and degree and extent of enforcement or lack of institutional agreements with respect to the following:

- International agreements regarding climate change, especially decisions taken in the UNFCCC context
- National frameworks on climate change and their relation to the forest sector and other natural resources
- Land tenure and land use rights
- Rights regarding services from forest ecosystems

Good governance of forest resources and the participation and empowerment of forest-dependent poor people will substantially rely on the consideration of their priorities when institutional frameworks are defined.

INTERNATIONAL AGREEMENTS REGARDING CLIMATE CHANGE, ESPECIALLY DECISIONS TAKEN IN THE UNFCCC CONTEXT

The 191 parties to the UNFCCC design the international institutional framework for adapting to and mitigating climate change. They define rules and pledge budgets for scientific, technological, and implementation matters. By doing so, the parties to the convention clarify the global priorities for adapting to and mitigating climate change. In this sense, decisions in the UNFCCC take place in a closed space where only parties (member countries) have a vote. Other actors, such as nongovernmental organizations or representatives of the private sector, are outside the decision-making process when they are not included in party delegations. However, in the open meetings of the UNFCCC, accredited institutions can express and share their experiences and priorities. Ideally, the discussions should be integrated into the decision-making process by the parties.

Since the agreement on the Millennium Development Goals in 2000, poverty alleviation, environmental sustainability, and good governance have been of high importance on the international agenda and, hence, in the negotiations within the UNFCCC. However, there remains much to do to ensure that the institutional framework for addressing climate change is designed in a way that facilitates pro-poor initiatives and good governance in the forest sector.

With regard to **adaptation** to climate change, there are at least three initiatives with a clear pro-poor character:

- *The support to the National Adaptation Programmes of Action*. These programs provide an opportunity for LDCs[61] to identify priority activities that respond to their urgent and immediate needs with regard to adaptation to climate change. The rationale for these programs rests on the limited ability of LDCs to adapt to the adverse effects of climate change.[62]
- *The Nairobi work programme* (see "Forests and Adaptation in the Context of the UNFCCC", above)
- *The ongoing process in the Organisation for Economic Co-operation and Development (OECD) for mainstreaming adaptation to climate change into development cooperation*. In April 2006, Development and Environment Ministers of the OECD member countries adopted an OECD Declaration on Integrating Climate Change Adaptation into Development Co-operation.[63] As a follow-up to the declaration, in 2007 the Secretariat of the OECD published *Stocktaking of Progress on Integrating Adaptation to Climate Change into Development Co-operation Activities*.[64] The report provides information on the progress achieved to date in integrating climate change adaptation into development activities of bilateral and multilateral development cooperation agencies and international financial institutions.

The stocktaking report of the OECD Secretariat summarizes the findings of the various portfolio assessments made by different agencies; presents the first operational measures initiated by some agencies to date, including programs such as Climate Protection Programme for Developing Countries by Deutsche Gesellschaft für Technische Zusammenarbeit, as well as tools and methods designed for integrating adaptation into development cooperation activities such as Assessment and Design for Adaptation to Climate Change – A Prototype Tool (ADAPT) and CRiSTAL; and highlights the need for cross-cutting fertilization. The outlook section highlights that although a great deal of constructive work has been done by OECD members to develop climate change policies, as well as internal and external awareness and knowledge of climate change adaptation and tools, there has been less progress at implementing concrete adaptation at the field level. The report concludes that there is an urgent need for donors and external partners to collaborate so that donor policies, tools, and

knowledge are translated into practical projects on the ground.

The stocktaking report should be commended for its specific considerations of the role of forests and the forest sector in climate change, drawing on the experience of many institutions with a tradition of cooperation activities in forestry. In other studies and initiatives, the role of the forest sector is not spelled out specifically. This fact can be seen as a positive challenge for developing a pro-poor framework for adapting to climate change that considers the vulnerabilities and adaptation capacities in the forest sector.

With regard to mitigation the picture is a bit different. Under the current agreements in the Kyoto Protocol, forestry activities in developing countries are restricted to A/R (and bioenergy) under the CDM (see the first part of this paper). For small-scale A/R CDM projects, the participation of "low-income communities or individuals" is required under UNFCCC Decision 19/CP.9 and Decision 14/CP.10. The definition of "low-income communities or individuals" and the degree of participation (planning, implementing, and owning) is to be established by each developing country. Small-scale A/R CDM projects have simplified modalities and procedures and a simplified methodology for carbon accounting. Such simplifications are aimed at reducing the transaction costs of the projects while maintaining the accuracy in the carbon accounting. The current agreements, decisions, and modalities are for the first commitment period of the Kyoto Protocol, which spans 2008 through 2012.

Negotiations on the post-2012 regime on mitigation are now beginning. In accordance with Article 3.9 of the Kyoto Protocol, Annex I countries have begun to consider potential future commitments. These considerations take place in the Ad Hoc Working Group. As part of its work, the group prepared a dialogue working paper *Investment and Financial Flows to Address Climate Change*. This report clarifies the mitigation potential of the forest sector worldwide and differentiates the potential of the so-called non-Annex I countries (mainly developing countries).[65] The background paper also summarizes the data on the size of the potential for mitigation in the forest sector.

Discussion of the post-2012 regime on mitigation must address three major issues that will affect the forest sector in developing countries:

- *The role of reducing emissions from deforestation and forest degradation (REDD)*.[66] In this regard, the following major tasks need to be clarified:
  - Which policy instrument will be used? The possibilities are REDD as an eligible activity in the CDM, as a new mechanism in the Kyoto Protocol, or as part of a new protocol.
  - Which level of action will be agreed on? The options in this case are activities at the national level or at the subnational (project) level.
  - How will these mitigation measures be funded? That question is whether the measures should be financed using market mechanisms or using international funds such as those established by the UNFCCC. Here again, some parties are advocating the need to combine funding mechanisms to ensure a wide participation of countries and forest actors in REDD.
- *The role of biofuels*. This alternative is very controversial. On the one hand, it seems that under specific technological conditions, the use of biofuels could be a promising alternative to reduce emissions from GHG. On the other hand, there are many concerns and open questions regarding the net full life-cycle and GHG balance of biofuel projects and the negative implications that promoting biofuels will have or are having on food security, land tenure, distribution of benefits, and environmental issues. A clear institutional framework aimed at ensuring sustainable production of biofuels must be set. It must cover not only the carbon balance of biofuels from the plantations to the final use, but also the social and environmental implications of using more land for bioplantations and the effects on food security.
- *The forestry activities to be included in the CDM in the second commitment period*. Which activities will be eligible, and what modalities and procedures will be used, must be determined.

The Bali Action Plan, agreed to in December 2007, is a comprehensive two-year process aimed at enabling "the full, effective and sustained implementation . . . through long-term cooperative action, now, up to and beyond 2012."[67] It will have a major effect on how and by whom the forest will be used in the future. Therefore, it is of prime importance to ensure that pro-poor considerations are taken into account when defining a post-2012 regime on mitigation.

NATIONAL FRAMEWORK ON CLIMATE CHANGE AND ITS RELATION TO THE FOREST SECTOR AND OTHER NATURAL RESOURCES

Each country that participates in the UNFCCC defines its own institutional framework for addressing climate change. This national framework constitutes the articulation between international decisions and the implementation of climate change programs and projects at the national and local levels. This governance space should be very flexible, where a multitude of actors can participate. Because of its cross-cutting character, climate change must be addressed at the national level with a high degree of coordination between the different governance spaces that are to participate in adapting to or mitigating climate change.

The institutional framework for **adaptation** in the forest sector should be formulated by considering cross sectoral linkages at least the following sectors:

- Energy—Special concern should be given to the effects on forest ecosystems of generating, transmitting, and distributing different types of energy, as well as the need to conserve ecosystems, thereby guaranteeing the existence of natural resources.
- Tourism—Forest ecosystems that are important for reducing resilience can be conserved as natural and recreational parks. The tourism sector can so contribute to finance adaptation measures.
- Industry— Beyond timber production the forest sector is important to different sectors in the national economies (e.g. providing raw material for packaging, medicines, shelter, food or other non-timber forest products). Vulnerability of forest ecosystems imply a relative vulnerability of these sectors.
- Agriculture—Adaptation measures can consider the development of specific territorial development policies and plans, as well as land-use changes.

In addition, it should be mentioned that all sectors depending on, using, or managing water resources must be especially aware of the links between forests and water regulation.

Conserving and sustainably managing forests can also reduce vulnerability in those sectors. A national framework on adaptation to climate change should facilitate the creation of adaptation programs that promote the sustainable management of forest ecosystems and recognize the benefits that people responsible for the management of those ecosystems or actively involved in their management bring to the society as a whole. This is particularly important for forest-dependent communities, including indigenous peoples, looking for alternatives for conserving their cultural habitat.

The integration of the forest sector in **mitigating** climate change during the first commitment period (2008–2012) must include the following elements:

- Non-Annex I countries (developing countries) must fulfill some requirements to participate in the CDM during the first commitment period. These requirements are as follows:
  - Creating a designated national authority at the level of public services
  - Defining the forest criteria thresholds within the range provided in the forest definition[68] for the country during the first commitment period (high, area, and minimum cover)
  - Defining the meaning of "low-income communities and individuals" that will participate in the planning or implementation of small-scale A/R CDM projects
- All projects in the A/R CDM will take place in areas that have been nonforested since at least 1990. In the majority of the cases, those areas are under

a different land use than forest, and the A/R CDM projects take place on land outside of the influence of the forest authority. In such cases, coordination between the forest and other sectors is necessary.

- If A/R CDM projects are expected to have significantly negative environmental or socioeconomic effects, a corresponding impact assessment must be done on the basis of national legislation. Recommendations for mitigating those negative effects are to be included in the monitoring plan of the A/R CDM projects and are subject to verification every five years.
- Bioenergy projects are considered to be part of the energy projects of the CDM. According to the decisions within the UNFCCC socioeconomic effects are not to be assessed in those projects. This can jeopardize sustainability of the projects as impacts on food security, on land tenure and access to the forest, on labor force and displacement of people can occur as a consequence of bioenergy projects. Therefore, a wider understanding of the effects of bioenergy projects must be carefully considered.

The clarification of these elements at the national level will largely determine which social groups can participate in the A/R CDM and under what conditions. Non-Annex I countries should consider pro-poor agreements that ensure that poor people can participate in the A/R CDM during the first commitment period. Participation of the private sector and civil society is key in designing such agreements.

For the commitment periods after 2012, new agreements will be needed. Especially important will be the definition of national frameworks for participating in REDD activities. Committing forests as carbon reservoirs will require clarity on which forest areas are to be used for development purposes (forest that might be converted through a planned process into other land uses in a foreseeable future) and also which areas are to be considered as a permanent forest estate.[69] A national framework on REDD will need to consider all social groups that claim forest tenure and use rights. Besides the state and private owners, those groups also include indigenous peoples, settlers, concessionaires, and many other groups dedicated to forestry activities, both legal and illegal. Activities in REDD, which will be related to one or another form of payment, need a clear institutional framework that promotes an equal participation of these social groups, with special consideration for poor people.

One of the most important activities that each country needs to undertake is preparing the national communications and the inventory on GHG emissions. LDCs also have the possibility of preparing their National Adaptation Programmes of Action. It is unfortunate that the role of the forest sector is clarified in very few of these documents. In this respect, more clarification and analytical work is urgently needed in the non-Annex I countries.

A great challenge is to ensure a *decentralization* of climate change plans and programs in developing countries that is consistent with ongoing decentralization processes. Experience with this regard is very limited. In general terms, subnational entities are not well informed nor are they aware of existing mechanisms aimed at addressing climate change. Relations are established between project participants at the local level and at the regulatory climate focal points at the national level. This situation represents a clear gap in governance that must be addressed.

LAND TENURE AND USE RIGHTS

There is plenty of literature on forest land tenure and use rights.[70] A major issue is the many implications to forest management because forest owners and users are, in many cases, not the same. More strongly stated, hundreds of millions of people live in or near forests and use forest lands and resources but have few or no secure rights and tenure over the lands and resources. In many cases, the lack of rights and tenure is directly related to their poverty and to the destruction and degradation of those resources. This issue considerably affects the possibility of promoting activities in the forest sector that are aimed at adapting to or mitigating climate change.

With respect to **adaptation** to climate change, some concerns must be carefully analyzed:

- Forests provide food and shelter in times of extreme climatic events, thereby reducing the vulnerability of communities (see results of the testing cases with the CRiSTAL tool and from Robledo and Deckens).[71] Many of the communities are normally agriculturalists or pastoralists. Thus, the coping strategies used during extreme events increase the pressure on the forest. Lack of clarity on land tenure and use rights intensifies the potential for conflicts under such stressful situations because forest-dependent people can be excluded when they most need the forest. However, land tenure and use systems that clearly exclude some social groups, such as settlers, can also increase the potential for social conflicts because of an increased demand for forests goods.
- In addition, the situation of rural people who rely on forest products for their survival, and the degree of this dependency, is determined not just by extreme climatic events, but also by annual or seasonal variations of productivity on nonforest land (such as agricultural crops and fodder), making them highly vulnerable. Such variables need to be considered when defining and improving forest tenure and use rights schemes.
- Who to compensate must be considered. One of the alternatives in improving adaptation capacity is to compensate for the damage. Negative effects of climate change on forest ecosystems will significantly affect forest-dependent livelihoods. However, when owners and users (in terms of dependent people) are not the same, compensation schemes could create further inequalities because people receiving the compensation are not those suffering the negative effects.

FOREST MANAGEMENT PRACTICES AFFECT ADAPTATION AND MITIGATION MEASURES

According to many authors, forest management practices tend to be more sustainable when local communities are landowners or at least have clear user rights.[72] In addition, forests that are managed in a more sustainable manner are likely to be less vulnerable to climate change.[73] When considering those findings, one can easily conclude that when land and forest tenure and use rights favor local communities, the vulnerability to climate change could be reduced. A further conclusion is that clear ownership and access rights to forests will be a prerequisite to formalizing agreements on compensation for resilience of forest ecosystems and for carbon sinks.

With respect to **mitigation**, the main question is who owns the credits, certificates, and other benefits when GHG emissions are reduced or carbon sequestration is enhanced through forestry activities. To understand the question, we need again to differentiate between the agreements valid for the first commitment period and the possibilities in a post-2012 regime, currently under negotiation:

- For the first commitment period, the regulations on A/R CDM require that "changes in circumstances within the project boundary that affect legal title to the land or rights of access to the carbon pools" are to be clarified and are subject to monitoring and verification.[74] In cases where the ownership of the pools is not clear or when different carbon pools have different owners, it is extremely difficult to determine who owns the carbon credits, in the form of Certified Emission Reductions.[75] If there is no clarity on the ownership of the Certified Emission Reductions, then any market transaction can be questioned, bringing many difficulties for both credit sellers and buyers. This difficulty can be solved at the level of national legislation or by the use of specific and clear agreements and contracts between the owners of carbon pools in a given project.[76] Solving ownership of carbon credits can become the major burden for any mitigation scheme in the forest sector that is based on a market mechanism.
- For a post-2012 regime, the concerns of the CDM will remain, and new concerns related to REDD and ownership of forest land will gain importance. The key questions remain: Who owns the emission reductions, and, therefore, who should be compensated for emission reductions?

Those questions open the door to many other considerations:

- If there is a payment scheme (market or nonmarket mechanism) then how are these payments to be distributed between owners and users?
- When forest conversion and degradation are because of illegal practices, who will own the reduction of the emissions? Does a forest owner, such as a community, need to negotiate the stopping of degradation with the illegal users? What would be an appropriate mechanism for sharing compensation among stakeholders conducting illegal or nonregulated practices that produce GHG emissions? If sharing benefits is not an alternative, then which mechanisms will be needed to reduce GHG emissions resulting from forest conversion and degradation attributable to illegal or nonregulated practices? Are these mechanisms going to boost social conflicts? This circumstance is equally difficult if the forest is public, private, or community-owned.
- Which social groups will become empowered under a given international REDD scheme?

As we have noted, about 50 percent of the deforestation and forest degradation worldwide is a consequence of poverty. Thus, what is necessary to reduce the emissions and, when possible, to increase sequestration capacity in already degraded areas while promoting an improvement in the living conditions of forest-dependent communities and the forest-dependent impoverished people? The negotiators for REDD need a clear answer to promote an international scheme that does not advance further inequalities in the forest sector.

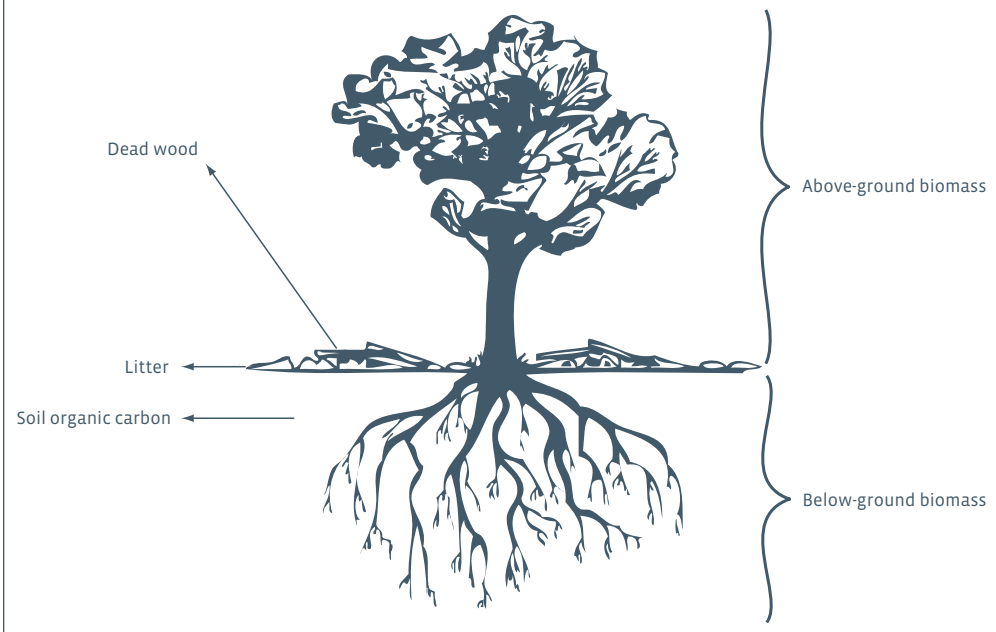
RIGHTS REGARDING SERVICES FROM FOREST ECOSYSTEMS

There are only a few countries where the ownership of services from forest ecosystems is included in the corresponding legislation (for example, forest legislation and territorial legislation). With increasing interest in various payments for environmental services schemes, the question of ownership of the services is coming to the fore.

Services of forest ecosystems can play a key role in **adapting** to climate change (see table 3).[77] Under proper management practices, such services can help to reduce the climate vulnerability not only of forest but also of forest-dependent people and people living in downstream areas. The role of forest in reducing landslide risks in mountain areas or in regulating the hydrological cycle and reducing the vulnerability of livelihoods when hydrometeorological hazards increase has been repeatedly reported.[78] In addition, even if this link has been clarified, there is still a key open question that makes it difficult to promote forest ecosystem services as a means for adapting to climate change: Who should get the benefits of a scheme that recognizes the role of forest ecosystem services in reducing vulnerability—the owners, the users, or those who manage the forest? This question remains challenging as long as forest owners and local stakeholders are not the same.

With regard to **mitigation**, the problem is similar. The A/R CDM scheme pays for the service of sequestering carbon from the atmosphere and retaining it in the biosphere. In the case of REDD, the idea is to promote emissions reductions, supporting the capacity of the forest to sink and maintain carbon in the five carbon pools. In addition, maintaining forests through REDD has a direct effect on the forest's capacity to provide ecosystem services, such as water flow regulation and the conservation of biological diversity and cultural habitat. If the direct beneficiaries of these services own or have secure access rights to the forest and the ecosystem services, then they will become the best allies in conserving the forest and in reducing emissions from deforestation and forest degradation. Potential conflicts between different stakeholders because of their various interests in using the forests will need to be carefully considered when discussing any governance mechanism of the forest resources that should contribute to addressing climate change (see figure 4)

FIGURE 4. CARBON POOLS IN THE FOREST



The different carbon pools must be closely considered from the rights perspective.

Who owns which type of carbon pool and, hence, the expected payments to maintain carbon pools? For example, the tree owner, or the person who plants the tree, is not necessarily the owner of the below-ground biomass, the litter, and the soil organic carbon.

In all forest activities aimed to mitigate climate change, the question of what pool is considered is very important and should be resolved beforehand.

Source: Author's compilation

2.2 ISSUES RELATED TO THE PRIVATE SECTOR

In this portion of the paper, we discuss some key elements needed to promote the active and constructive participation of the private sector in governing forest-related issues for adapting to and mitigating climate change. As we understand *private sector*, the term includes the actors of civil society who are directly involved in the business environment and financial sector.[79] Thus, the private sector includes all sectors of the economy, including formal and informal segments.[80]

Forestry activities required for promoting adaptation to and mitigation of climate change are often linked to the informal segment of the economy. An authoritarian treatment of the informal segment of the economy will cause an increment of social conflicts, will reduce the *permanence* of carbon in the forest, and will increase the vulnerability to climate change of many forest-dependent people.[81] Therefore, we argue that any strategy for climate change adaptation and mitigation must be based on dialogue with all forest users and must create business schemes available for all forest-dependent people that promote an equal distribution of benefits. For the purposes of this paper, this type of business is a *participatory business*.

Until now, the role of the private sector in the context of forests and climate change has not always been positive. More than 40 percent

of the emissions from deforestation and forest degradation are completely or partially related to extractive activities funded by private companies. Moreover, conflicts of interests between large companies and local communities regarding forest-use rights have been repeatedly reported. In many cases, these conflicts have reduced the adaptive capacity of forest ecosystems as well as that of forest-dependent people. A private sector oriented only by short-term profit must be re-oriented toward a more participatory business practice if forest resources are going to be used in addressing climate change.

In designing participatory business schemes, the following issues should be considered:

- Sharing benefits
- Sharing responsibilities
- Providing access to new business opportunities

SHARING BENEFITS

Adapting to and mitigating climate change[82] brings opportunities for new business. In the case of **adaptation**, these new businesses are mainly related to the following:

- The possibility of receiving payments for ecosystem services because these contribute to reducing vulnerability
- The possibility of access to new open markets for traditional forest products

In the case of **mitigation**, countries with reduction commitments are already paying for carbon sequestration through the CDM. In addition, market mechanisms are under discussion for REDD.

In both cases, forest activities can bring many collateral benefits, including income improvement. However, questions arise: Who will receive this income? What is necessary to ensure that forest-dependent people participate as beneficiaries in the payment mechanisms resulting from the UNFCCC? We foresee at least five requirements:

- Recognition of the forestry activities for adaptation to and mitigation of climate change
- Recognition of the key role of forest-dependent people in undertaking these activities
- Understanding of new business opportunities and the role of forest-dependent people in making these opportunities possible
- Creation of a legal framework that reflects the three previous requirements
- Creation and application of business mechanisms that facilitate the participation of all forest users in business aimed at adapting to or mitigating climate change

SHARING RESPONSIBILITIES

One characteristic of adaptation to and mitigation of climate change is the long-term quality of the activities. Forestry aimed at addressing climate change must ensure the permanence of forest for a determined period of time.[83] If a forest is lost, for example, because of a forest fire, who is liable for the GHG emissions or for the reduction in forest goods and services? Clarification concerning liabilities is, therefore, extremely important when considering any business in adaptation and mitigation. Not only must benefits be shared among different forest users, but responsibilities must also be shared if users want to participate in the mechanisms defined within the UNFCCC. This approach is fundamental for promoting good governance in forest sector activities that are aimed at addressing climate change. In the promotion of good governance, the following issues need to be considered:

- Clarification and, whenever possible, quantification of existing and future risk of forest loss and reduction of ecosystem services
- Participation by forest users and their role in increasing or reducing these risks
- Definition of legal instruments for an equal sharing of responsibilities, with such instruments linked to the business mechanisms for sharing benefits

PROVIDING ACCESS TO NEW BUSINESS OPPORTUNITIES

As explained earlier, adapting to and mitigating climate change opens many opportunities

for new business. Even if the best-known current opportunity is the trade of carbon credits through CDM, there are other new opportunities. Forest-dependent people should have fair access to this business to assure sustainable management of forests. However, because of many constraints, many direct forest users are partially or completely excluded. The reasons for this exclusion become major barriers to adapting to and mitigating climate change and, therefore, must be removed. Some of the most important constraints for forest users in accessing new business opportunities are the following:

- Lack of access to credits and repayment capacity
- Lack of access to information
- Lack of access to markets, especially international markets, partially because of insufficient or complete lack of knowledge of the opportunities, rules, modalities, and requirements
- Lack of legal frameworks that recognize the participation and the role of all forest users in forestry activities aimed at adapting to and mitigating climate change
- Lack of forest tenure and use rights that facilitate participation of local stakeholders in sustainable forest management

The issues clarify how, by addressing climate change, the participation of new actors in the private sector is essential. Because much of the business related to climate change – that is, carbon trading – happens in international markets, there are other, more simple constraints that make it impossible for many forest users to participate in this new business. Mechanisms for addressing those constraints are regularly forgotten in international negotiations. However, for people in the field, those constraints remain a major barrier to access to international markets and therefore have an effect in governing the sector.

2.3 ISSUES RELATED TO CIVIL SOCIETY

The participation of civil society[84] is the third sphere that we consider in the analysis. One must understand that there are different levels in civil society. At the basic level are individuals. According to their characteristics, individuals can be classified in social groups (for example, farmers and settlers). At the next level the term local community includes all social groups acting in a given landscape. Participation implies that all social groups that depend on forests should be involved in planning and implementing measures for adapting to and mitigating climate change.

Participation in this context goes far beyond simply being informed. It requires that social groups make their priorities and expectations clear, are included in decision making, obtain benefits, assume responsibilities, and are fully recognized for their involvement. The participation of civil society members will likely be strong if their forest rights and tenure are strong, and conversely, their participation will be undermined if there are weak or no rights and tenure.

In addressing climate change, participation becomes a key issue because social groups that have been involved in using the forest will need to either (a) change their behavior if their management practices are increasing vulnerability or (b) to keep traditional practices that increase resilience and to convince other social groups to imitate these practices forests standing convince. In both cases, a other b, there is a relevant potential for social conflicts that can be addressed to an adequate participation of all social groups affected.

Addressing climate change requires, on the one hand, innovation in terms of legislation, sci-

ence, and technology and, on the other hand, a better understanding of and respect for traditional knowledge and civic mechanisms. These two elements—the need for change in behavior and the capacity to absorb innovation and to combine it with traditional knowledge—bring many challenges and opportunities for civil society and state institutions. The following are the issues that we consider essential for tackling these challenges and opportunities:

- Empowerment
- Knowledge Sharing
  - Valuing local and traditional knowledge
  - Disseminating scientific knowledge
- The effect of associations

EMPOWERMENT

Empowerment[85] is a complex process that begins with the awareness of lack of power (particularly decision-making power) and lack of the right to access this power. Through empowerment, social groups can actively participate in a decision-making process. If empowerment is not based on dialogue and mutual respect, then social conflicts can arise and chances to increase equity can be jeopardized.

Empowering social groups so that they can participate in activities to address climate change includes clarification of land tenure and land use rights, access to capacity building, valuing of local knowledge and access to other knowledge, and access to business opportunities and markets.

KNOWLEDGE SHARING

Ideally, knowledge sharing should ensure at least two processes: valuing local and traditional knowledge and disseminating scientific knowledge.

Valuing local and traditional knowledge. In terms of addressing climate change, it is important to value local knowledge. As noted earlier, traditional and sometimes ancestral uses of the forest can become extremely important in coping with climate hazards. Rural people cope with drought by using forest products that are not normally part of their own or their animals' food basket, by gathering and trading forest products when climate hazards have reduced the productivity of pastoral or agricultural land, and by using medicinal products from the forest when climate-induced illnesses are more frequent. In principle, all these practices help to reduce the vulnerability of forest-dependent people to climate change. However, coping strategies might also have their limitations. Thus, a number of questions must be answered: (a) Do forests have the carrying capacity needed to support these practices, especially under extended and more frequent extreme climatic events? (b) Are these practices sustainable, especially in a changing climate? (c) Will these practices create or increase social conflicts, and if so, under what circumstances?

Similarly, the role of local knowledge in mitigating climate change, is highly relevant. However, because climate change is affecting forest ecosystems, the extent to which this knowledge can be helpful for mitigating climate change will depend on specific circumstances.

Valuing local knowledge should therefore, first, involve its recognition and, second, require analysis of how useful it is likely to be under changing climatic conditions. Local and scientific knowledge should be seen as complementary in adapting to and mitigating climate change.

Disseminating scientific knowledge. Much has been said on the importance of research in understanding the role of the forest sector in addressing climate change. Both the IPCC and the UNFCCC have highlighted many times the need for promoting scientific research on climate change and have asked their member parties to ensure more funds for research. However, if results of scientific research are not available to forest-dependent people, then it will not be possible for them to understand the innovations that addressing climate change will require. Thus, knowledge transfer must occur from the science world to communities and vice-versa.

THE EFFECT OF ASSOCIATIONS

Many measures for adapting to and mitigating climate change are to be taken on a large geographical scale. Social groups interested in participating in planning and implementing these measures will benefit from creating associations that help them to bring their priorities onto the agenda. Interest groups can be focused on similarities, such as belonging to a cultural group or to a type of user, or on complementarities, such as private investors and small farmers. Ongoing experience, both on adaptation and mitigation and on improved governance in the management of forests, has demonstrated the advantages of promoting associations based on complementarities, such as public–private–civil society partnerships, company–community partnerships, and civil society–private sector partnerships (see section 4 of this paper).

2.4 CROSS-CUTTING ISSUES

The following are some issues that are important in all spheres.

CAPACITY BUILDING

Improving capacities is a key issue in making progress in governance and should be considered for the public sector, private sector, and civil society. Capacity building should increase the skills of different actors to participate in different governance spaces, using or modifying existing mechanisms or proposing new ones when required.

In the context of this paper, it is important to note that only through an improvement of their own capacities can impoverished forest-dependent people use new opportunities, understand the risks involved, and assume responsibilities for adapting to and mitigating climate change. New knowledge on climate change adaptation and mitigation should be an integral part of capacity building in sustainable forest management. In this field, support organizations, such as nongovernmental organizations, would have an important role to play.

MECHANISMS FOR DECISION MAKING

International mechanisms for decision making have been established for addressing climate change. These mechanisms are the set of rules used in a specific governance space as a means to agree, disagree, and voice disputes. However, activities in the forest sector aimed at adapting to and mitigating climate change are implemented at the local level, where other decision-making mechanisms are in place. The first challenge is, therefore, to ensure that mechanisms for decision making on forest resource and climate change either (a) integrate local, national, and international levels or (b) make it possible for actors from a given governance space to have access to decision mechanisms from other governance spaces.

In the context of this paper, it is essential to highlight **the importance of using participatory mechanisms for decision making and for promoting the understanding of the priorities and decisions at all levels when addressing climate change in the forest sector**.

3 SCALE OF THE PROBLEM

Addressing climate change through the adaptation and mitigation created under the UNFCCC is one of the biggest institutional challenges ever faced by the forest sector. As we noted earlier, many governance issues must be addressed and properly handled to make the forest sector able to cope with future climate change scenarios.

Here, we present an overview of the potential scale of contribution of the forest sector to the adaptation to and mitigation of climate change. This overview should help to complete the overall picture of governance and climate change in the forest sector.

Quantifying the effects of climate change on the forest sector and the potential that the sector has for mitigating that change presents many difficulties, such as the following:

- There is some quantitative information regarding the potential effects of climate change on boreal and temperate forest, but far less is known about the vulnerability of tropical ecosystems to climate change and the implications for the whole sector.
- The likely indirect or incremental effects of climate change on the forest sector (for example, effects on the production chain or on employment) have not yet been evaluated.
- Because many forest-dependent communities operate outside the formal economy, real loss in terms of economic indicators, such as gross domestic product, does not provide a complete picture.
- The mitigation potential of the forest sector is highly dependent on many different variables. Relatively simple measures, such as technology transfer, are not the only limitation for fully using the forest sector's mitigation potential; the greater constraints by far are the complex set of socioeconomic and institutional issues.

3.1 EFFECTS OF CLIMATE CHANGE ON THE FOREST SECTOR

The resilience[86] of many forest ecosystems will be exceeded because of the effects of climate change and other global drivers (for example, pressure for changing land use). Increments in GHGs in the atmosphere will also have an additional effect on forests. If global mean temperature exceeds a warming of 2°C to 3°C, a high number of plant and animal species are likely to be at greater risk of extinction risk and changes in the structure and functioning of terrestrial ecosystems are very likely to occur.[87] Changes in temperature, exposure to sunlight, and availability of water will have different effects on forest ecosystems, depending on the specific region.[88]

Biosvenue and Running (2006) elaborated a global analysis of the effects of climate change on natural primary production[89] based on the review of scientific literature. With regard to tropical forests, their results can be summarized as follows:

- Tropical forest regions show temperature increases averaging between 0.26°C and 0.5°C since the mid-1970s and a strong variation in long-term rain trends. Overall precipitation appears to have declined in tropical rainforest regions at a rate of 0.8–1.0 percent per decade since 1960.
- Until recently, the prevailing view has been that mature tropical forests are likely to have acted as substantial carbon sinks over the recent decades, increasing their net primary production. Currently, there is much debate about the productivity of tropical forests, and existing data are insufficient to support any firm conclusion. Data from a few eddy covariance (tower-based) studies of whole-forest CO_2 exchange have been interpreted as evidence that mature tropical rainforests are currently acting as moderate to very strong net carbon sinks.[90]
- Changes in tree growth in Central America have been related to annual changes in temperatures and the El Niño Southern Oscillation (ENSO).[91]
- Changes in net biomass increase were found in the Amazon region, where an analysis of 50 long-term monitoring plots spanning 1971 to 2002 showed increases in tree and stand biomass.[92] Though carbon flowed in and out of these pools, gains consistently exceeded mortality losses. We conclude that this implies a continent-wide increase in resource availability, which is increasing natural primary production and altering forest dynamics.[93]
- Field observations of mortality rates during 1982–85 and 1985–90 in Barro Colorado Island in Panama showed that canopy trees had the highest mortality of three group types studied during a dry period from 1982 to 1985, whereas small trees and shrubs showed no difference between the two periods studied.[94] During drought years, forestwide mortality rates were 2 percent higher in the larger-size class. Tropical forest plot data from both the neotropics and the palaeotropics show large increases in forestwide tree mortality associated with the very strong ENSO events of 1982/1983 and 1997/1998[95] and localized species-specific effects.[96] Higher mortality rates, which increased with tree size, were also seen in trees of unburned rainforests in East Kalimantan during the 1982/1983 ENSO, with 37 percent of trees 460 centimeters (181 inches) in diameter found dead on ridge tops and 71 percent on slope plots.[97] Clark states that tropical forests have already experienced notable shifts in floristic composition and in tree-size structure owing to these selective mortality patterns of a single strong ENSO. Clark interpreted the general finding of a sharp increase in tree mortality in the strong ENSO events of recent decades to mean that, generally in the tropics, these old-growth primary forests are already being strongly negatively affected by current levels of temperature and drought stress.[98]

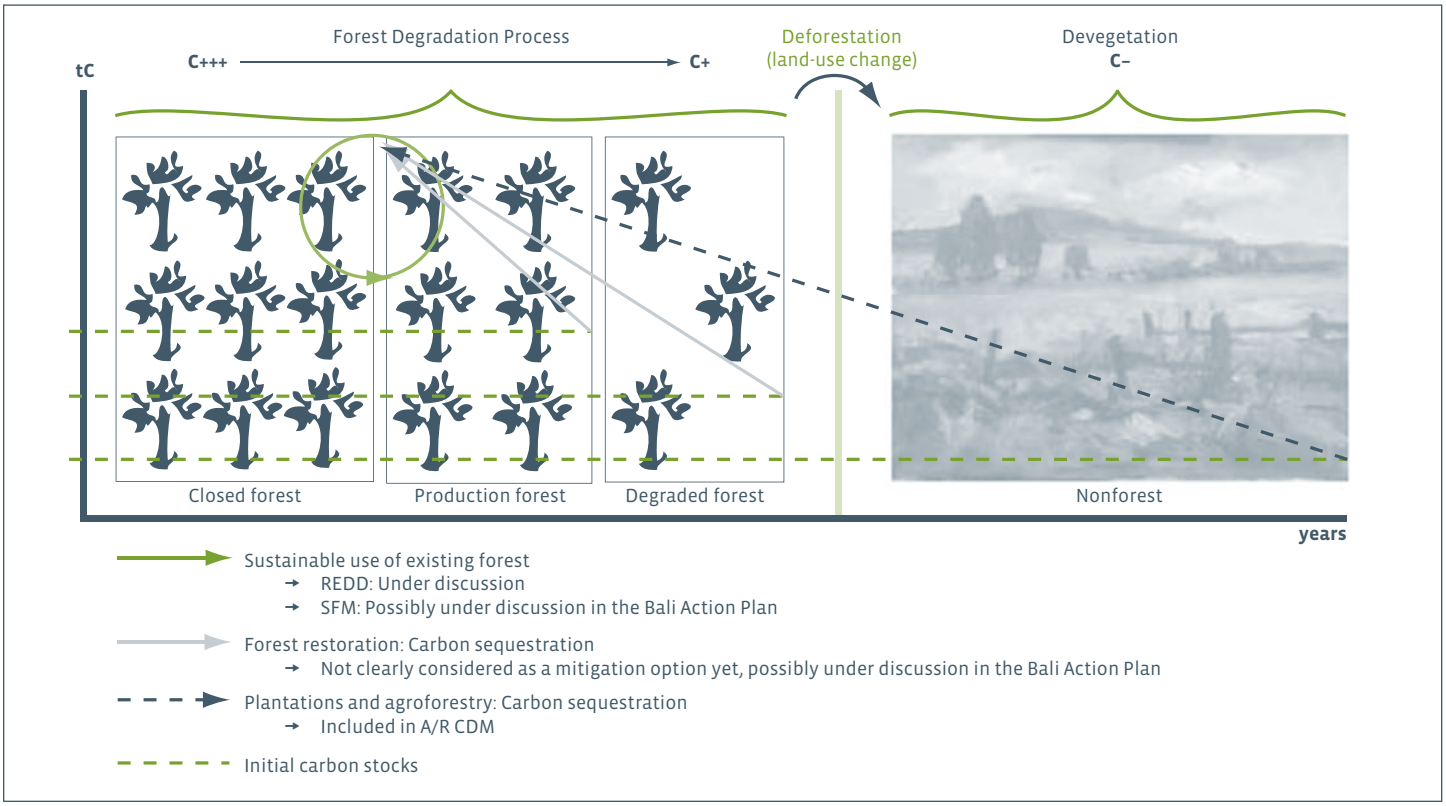
According to the IPCC, in global terms, commercial forestry productivity rises modestly with climate change in the short and medium term, with large regional variability in trends at the global level.

3.2 MITIGATION POTENTIAL IN THE FOREST SECTOR

We have estimated the mitigation potential for the following four existing options in the forest sector:[99]

- Reduction of emissions from deforestation and forest degradation
- Forest management—the sustainable use of existing forests
- Forest restoration—the restoration of degraded forest areas to a sustainable use forest

FIGURE 4. MITIGATION OPTIONS



Source: Author's compilation

■ A/R[100]—full restoration of lost carbon stocks to a sustainable use forest

Figure 5 illustrates the link between the different options. The forest degradation process is considered here as the loss of existing carbon stocks through unsustainable use of forest resources.

According to the Food and Agricultural Organization of the United Nations, the rate of deforestation during the 1990s was 12.9 million hectares per year (31.9 million acres per year), corresponding to an emission of 5.8 gigatons of CO_2 per year.[101] This figure has been taken as the basis for defining the mitigation potential of REDD until 2030.[102]

The regions with the highest emissions from deforestation and forest degradation are Latin America, Africa, and Asia (see table 6).

Drivers for deforestation and forest degradation vary from region to region. A recent report prepared for the UNFCCC Secretariat quantified the mitigation potential of REDD considering the following direct drivers of deforestation and forest degradation (see table 7):[103]

■ Commercial agriculture for national and international markets
  - Commercial crops
  - Cattle ranching (large scale)
■ Subsistence farming
  - Small-scale agriculture, shifting cultivation, and slash-and-burn agriculture
  - Gathering of fuelwood and nontimber forest products for local use, mostly family-based
■ Wood extraction
  - Commercial timber, legal and illegal, for national and international markets
  - Traded fuelwood (commercial trading at subnational and national levels)

TABLE 6. ESTIMATES OF CARBON LOSS FROM TROPICAL FORESTS AND CARBON LOSS ATTRIBUTED TO DEFORESTATION (from different authors) (carbon loss to the atmosphere in GtC/yr ($GtCO_2$/yr)

Region	Fearnside (2000) 1981–1990	Malhi and Grace (2000) 1980–1995	Houghton (2003) 1990s	DeFries et al. (2002) 1990s	Achard et al. (2004) 1990s
America	0.94 (3.45)	0.94 (3.45)	0.75 (2.75)	0.43 (1.58)	0.44 (1.61)
Africa	0.42 (1.54)	0.36 (1.32)	0.35 (1.28)	0.12 (0.44)	0.16 (0.59)
Asia	0.66 (2.42)	1.08 (3.96)	1.09 (4.00)	0.35 (1.28)	0.39 (1.43)
Total	2 (7.33)	2.4 (8.8)	2.2 (8.06)	0.91 (3.33)	0.99 (3.63)

Source: Adapted from UNFCCC, 2007b

Achard, F., Belward, A.S., Eva, H.D., Federici, S. Mollicone, D. and Raes, F. 2005. Accounting for avoided conversion of intact and non-intact forest; technical options and a proposal for a policy tool. *EU Joint Research Council, presented at COP11, Montreal, Dec 1.*

Fearnside, Ph. 2000. Global warming and tropical land-use change: Greenhouse gas emissions from biomass burning, decomposition and soils in forest conversion, shifting cultivation and secondary vegetation. Climatc Change, 46: 115-158.

Defries, R.S Houghton, R.A., Hansen, M.C., Field, C.B., Skole, D., Townshend, J., 2002. Carbon Emissions from tropical deforestation and regrowth based on satellite observations for the 1980s and 1990s. *Proceedings of the National Academy of Sciences 99, 14256-114261.*

Mahli, Y. & Grace, j. 2000. Tropical forests and atmospheric carbon dioxide. *Trends in Ecology and Evolution, 15, 332-337.*

TABLE 7. DEFORESTATION AND FOREST DEGRADATION ACCORDING TO DIRECT DRIVERS, 1990–2000

Main direct drivers	DD (percentage of total)	Area of DD (million hectare $^{-1}$
Commercial agriculture		
Commercial crops	20	2.60
Cattle ranching (large scale)	12	1.60
Subsistence farming		
Small-scale agriculture and shifting cultivation	42	5.50
Gathering of fuelwood and nontimber forest products	6	0.75
Wood extraction		
Commercial timber (legal and illegal)	14	1.80
Fuelwood and charcoal (traded)	5	0.70
Total	99	12.95

Source: Blaser J. and C. Robledo, 2007. Initial Analysis on the Mitigation Potential in the Forestry Sector. *Report prepared for the Secretariat of the UN-FCCC. August 2007. http://unfccc.int/files/cooperation_and_support/financial_mechanism/application/pdf/blaser.pdf.*
DD = deforestation and forest degradation.

Calculating the cost of REDD is extremely difficult. This difficulty explains the wide variations in estimates. When using the opportunity cost of direct drivers as a basis for the calculation, and deciding whether emissions from deforestation and forest degradation are to be reduced to zero by 2030, a **minimum investment of US$12.2 billion[104] per year** would be necessary to compensate the opportunity costs of deforestation and forest degradation.[105] According to this calculation, an average price of US$2.80 per ton of CO_2 will cover the opportunity cost of deforestation and forest degradation of 8.5 million hectares per year (20.9 million acres per year). This would represent an emission reduction of ~GtC 3.76 tCO2/year, or 65 percent of the emissions. For this scenario, the price of US$2.80 per ton of CO_2 will also improve livelihood conditions in many regions, because this price is higher that the opportunity cost of the poverty-driven deforestation and forest degradation. Such an improvement would depend on various factors, especially on the administration and transaction costs of REDD activities and the specific conditions of each region, such as socioeconomic and institutional aspects and access to infrastructure.[106]

When the highest marginal cost to completely stop deforestation—the choke price—is applied to the projected deforestation to estimate the cost of reduced deforestation, prices vary between US$11 and US$77 per ton of CO_2, excluding transaction costs.[107] Application of those prices to the projected emissions because of the loss of primary forest in each region yields a cost between US$25 billion and US$185 billion per year to stop deforestation.[108]

MITIGATION FOREST MANAGEMENT[109]

The basic assumption is that the production forest area in 2030 will be the same as the current area. The cost estimates of achieving this assumption are based on the International Tropical Timber Organization (ITTO) Expert Panel report on estimating the costs to achieve the ITTO Objective on Sustainable Forest Management.[110] This report was produced in 1995 on the basis of an analysis using criteria and indicators for sustainable forest management. The ITTO report estimated the costs of sustainable forest management for all tropical production forests in ITTO member countries—about 350.0 million hectares (864.5 million acres)—to be US$6.25 billion. If one considers values as of 2007 and applies a 5 percent devaluation factor, this estimate would correspond to about US$12 per hectare (US$4.86 per acre) by 2030.

For non-Annex I tropical and subtropical countries, the cost estimate for achieving sustainable forest management would, therefore, be about US$7.3 billion. An additional US$1 billion can be estimated as the cost of forest management for these countries.

FOREST RESTORATION

Restoration is understood here as a combination of planting of trees and human-induced natural regeneration within a degraded forest area[111] that has lost most of its carbon stock. Hence, forest restoration is a strategy applied in forest areas. Forest restoration aims to enhance and accelerate natural processes of forest regeneration (including carbon stocks) to regain the capacity of the forest ecosystem to provide goods and services.

Forest restoration is an issue in *all* non-Annex I countries where REDD is also considered.

Forest restoration potential is about 850 million hectares (2.1 billion acres) (see table 8):

- If one considers an average carbon stock of 30 tons of carbon per hectare in living carbon pools (above- and below-ground biomass) in degraded forests, the stock would total 25 gigatons of carbon for the pantropical area.
- Fully stocked, these 850 million hectares (2.1 billion acres) would amount to 57 gigatons of carbon.
- Hence, the maximum carbon stock restoration potential through restoration of degraded forest would amount to 32 gigatons of carbon.
- If a price of US$12 per ton of carbon were used, as currently paid by A/R CDM, there would be an additional potential cost of about US$38 billion,

TABLE 8. ESTIMATED EXTENT OF DEGRADED FOREST LANDSCAPES BY CATEGORY IN TROPICAL ASIA, TROPICAL AMERICA, AND TROPICAL AFRICA, 2000* (million hectares)

Landscape	Tropical Asia (17 countries)	Tropical America (23 Countries)	Tropical Africa (37 countries)	Total
Degraded primary and secondary forest	145	180	175	500
Degraded forest land	125	155	70	350
Total	270	335	245	850

Source: J. Blaser and C. Robledo. 2007. "Initial Analysis on the Mitigation Potential in the Forestry Sector," report prepared for the Secretariat of the United Nations Framework Convention on Climate Change, Bern, Switzerland, http://unfccc.int/files/cooperation_and_support/financial_mechanism/application/pdf/blaser.pdf.

Note: In tropical America, about 38 million hectares (93.9 million acres) are classified as secondary forests. For the other regions, it is not possible to distinguish between degraded primary and secondary forests.

which has not been included in the A/R CDM for the first commitment period. Nevertheless, this activity should be considered for a post-2012 forest mitigation regime.

AFFORESTATION AND REFORESTATION[112]

A/R initiatives have been driven mainly by the private sector, particularly for undertakings such as commercial plantation forestry, or by governments, particularly for soil and watershed protection. The drivers that influence A/R vary according to region and often even within a country.

Sathaye and others projected the potential land area planted and the benefits of carbon sequestration across a number of scenarios relative to 2100 and compared to a reference scenario.[113] For 2050, the range of land area planted is estimated to be between 52 million and 192 million hectares (128.4 million and 474.2 million acres), whereas the carbon benefits range from 18 to 94 megatons of CO_2.

The estimate of the *Fourth Assessment Report* of the IPCC Working Group III of the mitigation potential of afforestation by 2030 (that is, 1,618–4,045 megatons of CO_2 per year) is substantially lower than the estimate of Sathaye and others.[114] Using a similar ratio between carbon sequestered and hectares planted, the *Fourth Assessment Report* estimates would require between 4.6 million and 8.2 million hectares (2.2 million to 20.3 million acres) of land. At an establishment cost of between US$654 and US$1,580 per hectare (US$265 to US$640 per acre), establishment costs would be between US$3 billion and US$12.9 billion, or US$0.1 billion to US$0.5 billion per year over 25 years. Conservative estimates from IPCC have been used for this analysis.

4 OPERATIONAL LESSONS TO DATE

Even though the UNFCCC was ratified in 1994, there is little operational experience in adaptation and mitigation in the forest sector. With regard to adaptation, progress has been made in research to understand both the potential negative effects of climate change on forest ecosystems and the coping strategies in which forest resources are used. Besides the experiences through the national communications and the national adaptation programmes of action, two particular projects must be highlighted: Tropical Forests and Climate Change Adaptation (TroFCCA), a European Union–funded project; and Programming Climate Change Adaptation, a United Nations Development Programme (UNDP)–Global Environment Facility (GEF) project.

The TroFCCA project aims to address mainstreaming adaptation into development policy by undertaking relevant research on how the effects of climate change on forests are likely to undermine specific development policies. TroFCCA is an effort to contribute to the limited understanding of climate change effects on forests, as well as to the scarcity of robust methodologies to assess vulnerability and to plan for adaptation for these systems in particular. TroFCCA works in Central America, Indonesia, the Philippines, and West Africa. First experiences on the role of resource governance for adaptation in West Africa are summarized in box 2.

Programming Climate Change Adaptation has been developed to provide guidance in preparing proposals on adaptation-related projects for submission to UNDP–GEF. It includes a fund dedicated to ecosystem resilience that finances projects on biodiversity, land degradation, and international waters. The goal is to ensure that climate change concerns are incorporated in the management of ecosystems through GEF focal area projects. It will pilot demonstration projects concerned with the management of ecosystems to show how climate change–adaptation planning and assessment can be practically integrated into national policy and sustainable development planning.

With regard to mitigation, there is little operational experience in the forest sector to date. For a full understanding of this issue, some clarifications are needed:

- Modalities and procedures for the A/R CDM were agreed on in 2003.
- The first methodology was approved in 2005. In October 2007, there were 10 approved methodologies at one's disposal—8 for full projects and 2 for simplified methodologies.
- There is a general lack of knowledge of the modalities, procedures, and methodologies of the A/R CDM within the forest sector in developing countries. For this reason, existing opportunities and challenges remain unrecognized.
- A/R CDM requires high upfront investments. Because there is not yet full certainty of the market for Certified Emission Reductions, project proponents have had difficulties in designing projects in the past.

BOX 2. EXPERIENCES FROM TROFCCA: THE ROLE OF RESOURCE GOVERNANCE IN ADAPTATION—OPPORTUNITIES AND CONSTRAINTS IN WEST AFRICA

Livelihoods in West Africa largely depend on forest ecosystem goods and services, which often interplay with agriculture and livestock production systems for food security. To reduce the increasing vulnerability to climate change risks, adaptation is highly indispensable. Incidentally, weak policies and institutions coupled with poor governance are among the underlying causes of the vulnerability of the region and the inadequate response capacity to climate change. The potentials for adaptation in West Africa would be greatly enhanced by addressing issues of governance that play a major role in the adaptive capacity of many communities. Governance systems often face the challenge of setting up a framework for the formulation and implementation of adaptation strategies at multiple levels. However, policies, institutions, and the actors that constitute this framework are influenced by a multitude of external and internal factors and drivers. In this dynamic context, there are both opportunities and constraints for adaptation.

In West Africa, all land belongs to the government in principle. However, there is an ongoing process of decentralization in Burkina Faso, whereby the institutional landscape is changing with the reorganization of the administration and local governance during the transfer of natural resource management rights to the local communities. Preliminary results from TroFCCA pilot studies indicate some opportunities and obstacles for adaptation in this changing institutional landscape. There are indications that successful adaptation is driven by actors' personal motivation, depending on other factors such as awareness, risk perception, and knowledge (for example, knowledge about climate risks, adaptation measures, and the available incentive schemes). Two key aspects of governance are essential for climate change adaptation: (a) institutional capacities and willingness for learning and (b) institutional flexibility that reflects local realities. Decentralization, in this regard, offers opportunities for the design and implementation of adaptation strategies through institutional flexibility, higher responsiveness, and selective planning and implementation at the local level. However, success can be hindered by lack of learning capacities, lack of knowledge, and a biased agenda setting for adaptation because of perceived trade-offs among the various sectors and stakeholders. The outcomes are supported by other studies from the region. Government policies, for example, in Burkina Faso, provide access rights to the community to forest reserves especially for subsistence purposes, which increase their capacities to adapt. However, in Ghana, the management policy of forest reserves restricts community access to those reserves, creating constraints for adaptation by the communities.

Decentralization of local governance of resources in West Africa through a community-based approach of natural resource management could be promoted as an adaptation measure in the use of ecosystem goods and services. Current legislation in these countries is undergoing a review process, and trial cases are being implemented at local levels. In Mali, rural markets for wood are generating income for the community that is used for forest management and community development projects. In Burkina Faso, community-based land management is helping communities to acquire effective skills and to develop local institutions necessary for implementing sustainable natural resource–management plans. However, power transfer to the local institutions for processing and resource control is still largely in the hands of the centralized government, with little ground action in rural communities. In Ghana, district assemblies are falling short in their role in decentralized resource management, leaving gaps in accountability to the local communities. Dominance by village elites and the incapacity of the under-resourced system remain major obstacles. However, decentralization still presents unique opportunities for institutional innovations, among others, in integrating adaptation strategies of resource users into community development planning.

Source: Johnson Nkem, TroFCCA coordinator; and Maria Brockhaus and Fobissie Kalame, TroFCCA staff members, personal communication, August 2007.

4.1 A/R CDM EXPERIENCES

Some of the experiences in the A/R CDM follow.

BIOCARBON FUND

The World Bank has mobilized the BioCarbon Fund to demonstrate projects that sequester or conserve carbon in forest ecosystems and agroecosystems (see table 9). The fund, a public–private initiative administered by the World Bank, aims to deliver cost-effective emission reductions, while promoting biodiversity conservation and poverty alleviation. The fund is composed of two tranches: Tranche One began operations in May 2004, has a total capital of US$53.8 million, and is closed to further participation. Tranche Two was operationalized in March 2007 and remains open to contributions.

OTHER EXPERIENCES

The ITTO has funded six pilot projects with regard to the A/R CDM, including a capacity-building program. Some of the projects, especially the San Nicolás Agroforestry project in Colombia, have provided valuable knowledge regarding the need to improve governance in the forest sector when promoting climate change mitigation. In this project, a public–private–civil society partnership was created that ensures the active participation of the more than 12,000 small-forest owners.

Another interesting experience in the context of this paper is the project ENCOFOR (ENvironment and COmmunity based framework for designing afFORestation, reforestation and revegetation projects in the CDM: methodology development

TABLE 9: BIOCARBON FUND PROJECTS: EMISSION REDUCTIONS PURCHASE AGREEMENTS SIGNED

Country and project name	BioCarbon Fund emission reductions (tCO_2e)	Total project emission reductions generation (tCO_2e)
Albania: Assisted Natural Regeneration	*	257,180
China: Pearl River Watershed Management	462,014	462,014
Colombia: San Nicolás Agroforestry	120,000	994,134
Colombia: Caribbean Savannah	246,992	327,341
Costa Rica: Coopeagri Forestry	557,940	613,733
Honduras: Pico Bonito Forest Restoration	450,082	630,000
India: Improving Rural Livelihoods	276,000	534,760
Kenya: Green Belt Movement	375,000	791,825
Madagascar: Andasibe-Mantadia Biodiversity Corridor	200,000	436,637
Mali: Senegal Plantation Project	190,000	1,400,000
Moldova: Soil Conservation	600,000	2,227,024
Nicaragua: Precious Woods	174,796	1,206,883
Niger: Acacia Community Plantations	500,000	1,077,926
Philippines: Watershed Rehabilitation	32,323	53,333
Uganda: Nile Basin Reforestation	261,211	295,050

Source: World Bank, Carbon Finance Unit, "BioCarbon Fund Project Portfolio, http://carbonfinance.org/Router.cfm?Page=BioCF&ft=Projects
** omitted at the request of the project sponsor.*

and case studies), in which different tools for developing A/R CDM projects were designed and tested. ENCOFOR tools include economic, social, and institutional issues, as well as a special tool for selecting the appropriate A/R CDM methodology. It is interesting to note that in the ENCOFOR tools, a stepwise approach was developed for improving many of the governance issues we have considered in this paper.[115]

A considerable number of mitigation projects are being implemented through the so-called voluntary market, including A/R CDM–type offset projects (for example, Scolel Te in Chiapas, Mexico) and deforestation-avoidance projects (for example, Noel Kempff in Bolivia and Mantadia/Zahamena and Makira in Madagascar). These projects have the common aim of providing positive incentives to reduce deforestation or to plant new forests. Lessons can be learned from the implementation of such projects, but there is only limited value regarding development of long-term, international carbon finance schemes, transaction costs, monitoring and verification, and the general question of leakage.

4.2 CONCLUSIONS

In conclusion, some observations can be made on the basis of the experiences cited earlier:

- Because of the long-term character of the adaptation and mitigation projects at field level, new challenges in terms of planning, implementing, and monitoring have arisen. Of particular importance is that these projects need to include more socioeconomic, environmental, and institutional aspects, including traditional activities in the sector.
- The forest sector is slowly beginning to consider climate change–related opportunities and challenges. However, because of the complexity of the issue and the intricate requirements, more opportunities for improving capacities are required.
- Active participation of local users in adapting to and mitigating climate change is required to ensure long-term permanence of the corresponding measures. Excluding social groups from sharing in the benefits and responsibilities can only increase social conflicts and is, therefore, against the strategic goal of any adaptation or mitigation measure.
- The agreement on an international framework for addressing climate change through the UNFCCC has promoted a global interest for the potential participation of the forest sector in adapting to and addressing climate change. Nevertheless, the main disadvantage of these international processes is that local specificities are not taken into account. This situation creates some difficulties when implementing adaptation or mitigation activities at the field level.
- The A/R CDM is a highly over-regulated system. This approach has two main effects: (a) a high level of expertise is required in developing A/R CDM projects and (b) new upfront investments are required when initiating an A/R CDM project. These two effects make the design and establishment of an A/R CDM project very expensive and sometimes not feasible for forest-dependent communities.
- Climate change–relevant investment in the forest sector is a long-term undertaking. It needs security with respect to land use and long-term commitment of involved parties. Hence, secured rights and tenure are prerequisites so that such investment can occur and be an effective measure in adapting to and mitigating climate change.

Improving governance in the forest sector is a crucial requirement if measures aimed at adapting to or mitigating climate change are to succeed.

5 RECOMMENDATIONS FOR ACTION

Enhancing governance of the forest sector so that forest-dependent people can fully participate in adapting to and mitigating climate change is a prerequisite to sustainable development in the next decades. The benefits of such governance improvements will extend beyond the forestry sector, providing positive benefits of the agricultural and energy sectors, and will also provide benefits to water resource management. By contrast, **if governance, rights, and tenure challenges in the forest sector are not addressed, the possibility of using forest ecosystems to successfully reduce vulnerabilities of nature and people and to reduce GHG atmospheric concentrations is extremely limited.**

Those seeking to enhance governance of forest resources to facilitate forestry options that contribute to adaptation to and mitigation of climate change must consider the following:

- **Governance goes beyond the traditional notions and includes issues related to all three spheres of society: public sector, private sector, and civil society.** This approach implies the need to create and support governance spaces among representatives of these spheres, so that agreements, norms, legislation, and any other kind of mechanism to be used in the context of managing forest resources for addressing climate change can be designed with consideration of the priorities, possibilities, and constraints of all stakeholders (governance actors). The dialogue in such governance spaces should be aimed at ensuring a better balance in the UNFCCC negotiations, so that all three spheres are equally represented in decision making.
- Any activity in the forest sector aimed at addressing adaptation to or mitigation of climate change must have clear and accountable forest tenure and use rights as a starting point. **Therefore, forest tenure and use rights must be in favor of local stakeholders if forest resources are to be used for addressing climate change.** This approach means that many countries will need support for improving their legislation on forest tenure and use rights, and where adequate legislation already exists, countries will need support for enforcing these legal frameworks in a transparent, equitable, and accountable manner.
- **Parties negotiating in the UNFCCC need to better understand the potential role of and multiple constraints in the forest sector,** so that decisions at the international level can be applied at the local level at an affordable cost. This approach means that more flexibility must be integrated into the UNFCCC's existing mechanisms and in those to be agreed to in a post-2012 mitigation regime. In addition, parties in the negotiation must increase their understanding of forest-related issues and of the priorities for forest users so that any international agreement can be effectively and realistically implemented. **Thus, advocating local forest users' priorities is important when designing any future climate-related strategy that includes the role of forests in climate change adaptation and mitigation.** The major challenge remains the clarification of forest tenure and use rights and ownership of ecosystem services. When considering legislation in the framework of decentraliza-

tion, it is important to define legislation in favor of local users, in a socially inclusive manner, taking the disadvantaged and indigenous people into particular account.

- Pilot actions aimed at addressing climate change while demonstrating how to articulate the three spheres of governance of the forest resources at the international, national, and local levels are particularly required.
- Achieving good governance clarification of forest tenure and use rights in favor of local dependent stakeholders is a priority. Because of their nature, climate change options in forestry will always require high standards regarding implementation, monitoring, and evaluation. Thus, high governance standards are an ultimate requirement. **Unless robust and proactive steps are taken to clarify and strengthen the property rights and use of rural and forest peoples, future climate change initiatives will benefit only a few, primarily wealthy elites and will reinforce existing economic and social disparities.**

ENDNOTES

1 For the purpose of this document, the term *forest* includes both forest ecosystems and forestry activities.

2 Mayers 2007.

3 FAOSTAT, http://faostat.fao.org/default.aspx.

4 This information was derived from background analysis and papers for the preparation of the 2001 World Bank Forest Policy and Strategy, as well as internal files of Jürgen Blaser. For the forest strategy, visit http://go.worldbank.org/1ZAYDUXZ50 .

5 IPCC, "The Physcial Science Basis, " contribution of Working Group I to *Fourth Assessment Report: Climate Change 2007* (Geneva, Switzerland: IPCC, 2007); ; IPCC, "Impacts, Adaptations and Vulnerability," contribution of Working Group II to *Fourth Assessment Report: Climate Change 2007* (Geneva, Switzerland: IPCC, 2007); IPCC, "Mitigation Options," contribution of Working Group III to *Fourth Assessment Report: Climate Change 2007* (Geneva, Switzerland: IPCC, 2007), chapter 9.

6 The IPCC was created in 1988. It is open to all members of the United Nations and World Meteorological Organization. The role of the IPCC is to assess on a comprehensive, objective, open, and transparent basis the scientific, technical, and socioeconomic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential effects, and options for adaptation and mitigation. IPCC, "Impacts, Adaptations and Vulnerability."

7 IPCC 2007c Climate Change 2007: Mitigation options. Contribution of Working Group III to the Fourth Assesment Report of the Intergovernmental Panel on Climate Change. Chapter 9 – Forestry.

8 IPCC, "Impacts, Adaptations and Vulnerability"; IPCC, "Mitigation Options"; R. S. Klein, E. H. Eriksen, L. Otto, A. Hammill, T. Tanner, C. Robledo, and K. O'Brien, Portfolio Screening to Support the Mainstreaming of Adaptation to Climate Change into Development Assistance." *Climatic change* 84, no. 1 (September 2007): 23–44; C. Robledo and C. Forner, "Adaptation of Forest Ecosystems and the Forest Sector to Climate Change." Forest and Climate Change Working Paper 2, Food and Agriculture Organization, Rome; Robledo, Kanninen, and Pedroni 2005

9 C. Robledo, M. Fischler, and A. Patiño, "Increasing the Resilience of Hillside Communities in Bolivia: Has Vulnerability to Climate Change Been Reduced as a Result of Previous Sustainable Development Cooperation?" *Mountain Research and Development* 24, no. 1 (February 2004): 14–18.

10 For more information on CRiSTAL (Community-based Risk Screening Tool–Adaptation and Livelihoods) and the reports of the test cases, visit http://www.iisd.org/security/es/resilience/climate_phase2.asp.

11 Ibid.

12 FAO, "Global Forest Resource Assessment 2005: Progress Towards Sustainable Forest Management," Forestry Paper 147, FAO, Rome, 2006.

13 Houghton, R.A., K.T. Lawrence, J.L. Hackler, and S. Brown. 2001. *The spatial distribution of forest biomass in the Brazilian Amazon: a comparison of estimates*. Global Change Biology 7: 731-746.

14 C. Robledo and O. Masera, "Developments in UNFCCC/IPCC Discussions Regarding Reducing Emissions from Forest Degradation and Deforestation and Implications for Tropical Forests and Tropical Timber Producers," paper presented at the XLII Session of the International Tropical Timber Council, Port Moresby, Papua New Guinea, 2007.

15 Houghton, R. A., 2005: *Aboveground forest biomass and the global carbon balance*. Global Change Biology 11(6): 945-958.

16 J. A. Sathaye, W. Makundi, L. Dale, and P. Chan, "GHG Mitigation Potential, Costs and Benefits in Global Forests: A Dynamic Partial Equilibrium Approach. *Energy Journal* (forthcoming).

17 Soares-Filho, Britaldo Silveira, Daniel Curtis Nepstad, Lisa M. Curran, Gustavo Coutinho Cerqueira, Ricardo Alexandrino Garcia, Claudia Azevedo Ramos, Eliane Voll, Alice McDonald, Paul Lefebvre, and Peter Schlesinger. 2006. Modelling Conservation in the Amazon Basin. Nature (440): P520–23..

18 Metz, Bert, Ogunlade Davidson, Peter Bosch, Rutu Dave, and Leo Meyer, eds. 2007. Climate Change 2007 – Mitigation of Climate Change: Working Group III contribution to the Fourth Assessment Report of the IPCC. Cambridge: Cambridge University Press. P553.

19 Wetland International and Delft Hydraulics, "Peatland Degradation Fuels Climate Change," Paper, UNFCCC, Bonn, Germany, 2006) The report estimates that production of 1 metric ton [1.1 tons] of palm oil will result in an average emission of 20 tonnes [22 tons] of CO2 from peat decomposition alone, not including emissions resulting from production or combustion.

20 These issues change the global picture concerning carbon emissions. In the ranking of countries based on their total CO2 emissions, Indonesia is ranked 21st. However, if peatland emissions are included, Indonesia is ranked third. Therefore, the country actually emits more than India or Russia and several times more than the United Kingdom or Germany. It emits more than all the efforts of western countries to reduce greenhouse gases under the Kyoto Protocol. However, emissions from peatlands are currently not calculated in official statistics. Therefore, preventing these emissions does not count as a reduction of a country's emissions, unlike investments in industry, because the Kyoto Protocol does not yet provide any incentives for action.

21 IPCC, "Mitigation Options."

22 FAO, "Global Forest Resource Assessment 2005."

23 J. Blaser and C. Robledo, "Initial Analysis on the Mitigation Potential in the Forestry Sector," report prepared for the Secretariat of the UNFCCC, Bonn, Germany, August 2007, http://unfccc.int/files/cooperation_and_support/financial_mechanism/application/pdf/blaser.pdf.

24 The role of the IPCC is to assess on a comprehensive, objective, open, and transparent basis the scientific, technical, and socio-economic information relevant to understanding the scientific basis of the risk of human-induced climate change, its potential effects, and options for adaptation and mitigation. See IPCC, "Mitigation Options."

25 Ibid.

26 Afforestation and reforestation are understood in this paper in terms of their definitions for the Kyoto Protocol in UNFCCC, "Land Use, Land-Use Change and Forestry," Decision 11/CP.7, UNFCCC, Bonn, Germany, 2001.

27 Ibid.

28 IPCC, "Mitigation Options."

29 R. Zah, H. Böni, M. Gauch, R. Hischier, M. Lehmann, and P. Wäger, *Ökobilanz von Energieprodukten: Ökologische Bewertung von Biotreibstoffen.* (*Ecological Balance of Energy Products: Ecological Assessment of Biofuels*) (Bern, Switzerzerland: Bundesamt für Energie, Bundesamt für Umwelt and Bundesamt für Landwirtschaft, 2007), 206.

30 B. S. Soares-Filho et al., "Modelling Conservation in the Amazon Basin."

31 IPCC, "Mitigation Options."

32 Minkkinen,K., R. Korhonen, I. Savolainen and J. Laine 2002. *Carbon balance and radiative forcing of Finnish peatlands 1900–2100 – the impact of forestry drainage*. Global Change Biology Volume 8 Issue 8, Pages 785–799

33 Werner, K., S.J. Beukema1 and M.J. Apps2. 1998 *Carbon Budget Implications of the Transition from Natural to Managed Disturbance Regimes in Forest Landscapes*. Mitigation and Adaptation Strategies for Global Change IssueVolume 2, Number 4 / December, 1997

34 Forest degradation is the reduction of the capacity of a forest to produce goods and services. Capacity includes the maintenance of ecosystem structure and functions and carbon stocks.

35 Until now, the IPCC has produced four assessment reports: a special report on land use, land use change, and forestry and several specific guidelines concerned with climate change and natural resources.

36 Members meet once a year at the Conference of the Parties to monitor implementation of the UNFCCC and to continue negotiations on how best to tackle climate change.

37 For the full text of the UNFCCC, visit its website at http://unfccc.int/essential_background/convention/background/items/1349.php.

38 Ibid.

39 IPCC, *Third assessment report*, ed. J. T. Houghton, Y. Ding, D. J. Griggs, M. Nouguer, P. J. van der Linden, X. Dai, K. Maskell, and C. A. Johnson (Cambridge, U.K., and New York: Cambridge University Press, 2001).

40 Annex I countries are UNFCCC parties that have emission reduction commitments, mainly industrialized countries. Annex I members are Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Czechoslovakia, Denmark, European Economic Community, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Lithuania, Luxembourg, the Nether-

lands, New Zealand, Norway, Poland, Portugal, Romania, the Russian Federation, Spain, Sweden, Switzerland, Turkey, Ukraine, the United Kingdom, and the United States.

41 Article 6 of the Kyoto Protocol, on Joint Implementation, provides as follows: "[A]ny Party included in Annex I may transfer to, or acquire from, any other such Party emission reduction units resulting from projects aimed at reducing anthropogenic emissions by sources or enhancing anthropogenic removals by sinks of greenhouse gases in any sector of the economy…."

Article 12 of the Kyoto Protocol, on the Clean Development Mechanism, provides as follows: "The purpose of the clean development mechanism shall be to assist Parties not included in Annex I in achieving sustainable development and in contributing to the ultimate objective of the Convention, and to assist Parties included in Annex I in achieving compliance with their quantified emission limitation and reduction commitments under Article 3."

Article 17 of the Kyoto Protocol, on International Emission Trading, provides as follows: "The Parties included in Annex B [Annex I of the UNFCCC] may participate in emissions trading for the purposes of fulfilling their commitments under Article 3. Any such trading shall be supplemental to domestic actions for the purpose of meeting quantified emission limitation and reduction commitments under that Article."

42 Under Articles 4.1 and 12 of the UNFCCC, all parties should submit reports on the steps they are taking to implement the convention. These reports are known as national communications.

43 The term level refers to the concentration of GHGs in the atmosphere (see Article 2 of the UNFCCC).

44 For a list of LDCs, visit http://unfccc.int/files/cooperation_and_support/ldc/application/pdf/ldc-list-31jan08.pdf.

45 For additional information, visit http://unfccc.int/adaptation/napas/items/2679.php.

46 Robledo and Deckens 2006. *Vulnerability and Adaptation to Climate Change and Variability: The role of the Swiss Agency for Development and Cooperation*. Report for the Swiss Agency for Sustainable Development

47 The Nairobi work programme is a five-year program of work that emerged as a result of negotiations under the work of the Subsidiary Body for Scientific and Technological Advice on the scientific, technical, and socioeconomic aspects of the effects of and vulnerability and adaptation to climate change and was adopted by Conference of the Parties 11, "Five-Year Programme of Work of the Subsidiary Body for Scientific and Technological Advice on Impacts, Vulnerability and Adaptation to Climate Change," Decision 2/CP.11, UNFCCC, Bonn, Germany, 2005.

48 United Nations Framework Convention on Climate Change. 2007. The Nairobi Work Programme On Impacts, Vulnerability And Adaptation To Climate Change. Informational brochure. Bonn, Germany: United Nations Framework Convention on Climate Change. P2.

49 Article 3.3 of the Kyoto Protocol provides as follows:

The net changes in greenhouse gas emissions by sources and removals by sinks resulting from direct human-induced land-use change and forestry activities, limited to afforestation, reforestation and deforestation since 1990, measured as verifiable changes in carbon stocks in each commitment period, shall be used to meet the commitments under this Article of each Party included in Annex I. The greenhouse gas emissions by sources and removals by sinks associated with those activities shall be reported in a transparent and verifiable manner and reviewed in accordance with Articles 7 and 8.

Article 3.4 of the Kyoto Protocol provides as follows:

Prior to the first session of the Conference of the Parties serving as the meeting of the Parties to this Protocol, each Party included in Annex I shall provide, for consideration by the Subsidiary Body for Scientific and Technological Advice, data to establish its level of carbon stocks in 1990 and to *enable an estimate to be made of its changes in carbon stocks in subsequent years. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall, at its first session or as soon as* practicable thereafter, decide upon modalities, rules and guidelines as to how, and which, additional human-induced activities related to changes in greenhouse gas emissions by sources and removals by sinks in the agricultural soils and the land-use change and forestry categories shall be added to, or subtracted from, the assigned amounts for Parties included in Annex I, taking into account uncertainties, transparency in reporting, verifiability, the methodological work of the Intergovernmental Panel on Climate Change, the advice provided by the Subsidiary Body for Scientific and Technological Advice in accordance with Article 5 and the decisions of the Conference of the Parties. Such a decision shall apply in the second and subsequent commitment periods. A Party may choose to apply such a decision on these additional human-induced activities for its first commitment period, provided that these activities have taken place since 1990 (emphasis added).

50 The important definitions of LULUCF are contained in UNFCCC, "Land Use, Land-Use Change and Forestry," Decision 11/CP.7,

UNFCCC, Bonn, Germany, 2001.. Definitions include forests, afforestation, reforestation, deforestation, revegetation, forest management, cropland management, and grazing land management. They all are specific for the Kyoto Protocol and must be taken into consideration when dealing with climate change mitigation.

51 The development agencies include, among others, Swedish International Development Cooperation Agency, EuropeAid, Swiss Development Agency, Canadian International Development Agency, and Danish International Development Assistance.

52 L. Mehta, M. Leach, P. Newwll, I Sconnes, K. Sivaamakrishnan, S. Way, "Exploring Understandings of Institutions and Uncertainty: New Directions in Natural Resources Management," Discussion Paper 372, Institute of Development Studies, University of Sussex, Brighton, U.K.

53 J. Gaventa, "Reflections on the Use of the Power Cube Approach for Analyzing the Spaces, Places and Dynamics of Civil Society Participation and Engagement," CFP Evaluation Series 2003-2006: no. 4 (2005), MB Netwerk The Hague.

54 UNDP (United Nations Development Programme), "Governance for Sustainable Human Development," UNDP Policy Document, http://mirror.undp.org/magnet/policy/.

55 F. Cleaver, "Moral Ecological Rationality, Institutions and the Management of Common Property Resources," *Development and Change* 31, no. 2 (2000): 361–83.

56 UNDP, "Governance for Sustainable Human Development."

57 Ibid.

58 F. Schmithüsen, *Tenure and Joint Resources Management Systems on Public Forest Lands: Issues and Trends* (Zürich: Chair Forest Policy and Forest Economics, Department of Forest Sciences, Swiss Federal Institute of Technology, 1997).

59 FAO , "Forest Tenure Assessment," http://www.fao.org/forestry/site/33848/en (accessed 01/10/2007).

60 P. Glück, J. Rayner, and B. Cashore. "Changes in the Governance of Forest Resources," in *Forest in the Global Balance: Changing Paradigms,* World Series vol. 17, ed. G. Mery, R. Alfaro, M. Kanninen, and M. Lobovikov (Vienna, Austria: IUFRO, 2005), 51–74.

61 For more information on initiatives for LDCs within the UNFCCC, visit http://unfccc.int/cooperation_and_support/ldc/items/2666.php.

62 Adaptation funding is based on the rationale that LDCs have limited capacity to adapt to climate change and that they require financial and technical assistance. National adaptation programmes of action are based on the premise that developing countries themselves (rather than donors) should define the support they receive, thus the reason why such programs are submitted to the Global Environment Facility and the UNFCCC but are not approved by those bodies. National adaptation programmes of action are approved at the national level only.

63 For more information on the declaration, visit http://www.oecd.org/dataoecd/44/29/36426943.pdf.

64 Gigli, Simone and Shardul Agrawala. 2007. Stocktaking of Progress on Integrating Adaptation to Climate Change into Development Co-operation Activities, COM/ENV/EPOC/DCD/DAC(2007)1/FINAL. Paris: Organisation for Economic Cooperation and Development.

65 The sections regarding the forest sector are based mainly on two documents:

Blaser, Jürgen and Carmenza Robledo. 2007. Initial Analysis on the Mitigation Potential in the Forestry Sector. Bonn: Secretariat of the United Nations Framework Convention on Climate Change. http://unfccc.int/files/cooperation_and_support/financial_mechanism/application/pdf/blaser.pdf; and

Trines, Eveline. 2007. Investment Flows and Finance Schemes in the Forestry Sector with Particular Reference to Developing Countries' Needs. Bonn: Secretariat of the United Nations Framework Convention on Climate Change. http://unfccc.int/files/cooperation_and_support/financial_mechanism/application/pdf/trines.pdf

To download the dialogue paper and the background papers, visit http://unfccc.int/cooperation_and_support/financial_mechanism/items/4053.php.

66 For more information on the negotiations on REDD and the implications for developing countries, see C. Robledo and O. Masera, "Developments in UNFCCC/IPCC Discussions Regarding Reducing Emissions from Forest Degradation and Deforestation and Implications for Tropical Forests and Tropical Timber Producers," and UNFCCC, "Reducing Emissions from Deforestation in Developing Countries: Approaches to Stimulate Action," Decision -/CP.13, UNFCCC, Bonn, Germany, 2007.

67 UNFCCC , "Bali Action Plan," Decision 1/CP.13, http://unfccc.int/files/meetings/cop_13/application/pdf/cp_bali_action.pdf.

68 UNFCCC, "Land Use, Land-Use Change and Forestry," Decision 11/CP.7, UNFCCC, Bonn, Germany, 2001, http://unfccc.int/re-

source/docs/cop7/13a01.pdf#page=54

69 The term *permanent forest estate* is used for land, whether public or private, that is secured by law and kept under permanent forest cover. This includes land for the production of timber and other forest products, for the protection of soil and water, and for the conservation of biological diversity, as well as land intended to fulfil a combination of these functions. C. Forner, J. Blaser, F. Jotzo, and C. Robledo, "Keeping the Forest for the Climate's Sake: Avoiding Deforestation in Developing Countries under the UNFCCC," Climate Policy 6 (2006): 275–94.

70 Rights and Resources Initiative. www.rightsandresources.org.

71 For more information, visit http://www.iisd.org/security/es/resilience/climate_phase2.asp. Also see Robledo and Deckens 2006. *Vulnerability and Adaptation to Climate Change and Variability: The role of the Swiss Agency for Development and Cooperation*. Report for the Swiss Agency for Sustainable Development

72 G. Brown, J. Ironside, M. Poffenberger, and A. Stephens, *Forest Stewardship in Ratanakiri: Linking Communities and Governmen*t (South Lake Tahoe, CA: Community Forestry International, 2006); A. Larson, *Democratic Decentralisation in the Forestry Sector: Lessons Learned from Africa, Asia and Latin America* (Bogor, Indonesia: Center for International Forestry Research, 2004); Colfer, C. and D. Capistrano (eds) 2005. Politics of Decentralization: Forests, Power and People. London: Earthscan.

B. K. Pokharel, Th. Stadtmüller, and J.-L. Pfund, "From Degradation to Restoration: An Assessment of the Enabling Conditions for Community Forestry in Nepal," Discussion Paper, Intercooperation, Berne, Switzerland, 2006; Regional Community Forestry Training Center for Asia and the Pacific (RECOFTC), *The Contribution of Community Forestry to Protected Area Management: RECOFTC's Position on Collaboration in Protected Area Management in the ASEAN Region* (Bangkok, Thailand: RECOFTC, 2004); Ribot and Larson 2004. *Democratic decentralisation through a natural resource lens: an introduction*. The European Journal of Development Research, Volume 16, Number 1, March 2004 , pp. 1-25(25)

73 Murdiyarso, D., Robledo, C., Brown, S., Coto, O., Drexhage, J., Forner, C., Kanninen, M., Lipper, L., North, N. & Rondón, M. (2005). *Linkages between mitigation and adaptation in Land-Use Change and Forestry activities*. In: C. Robledo, M. Kanninen & L. Pedroni (eds.) Tropical forests and adaptation to climate change. pp. 122-153. Bogor: CIFOR. Reid and Huq 2005. Climate change – Biodiversity and Livelihood impact. In: C. Robledo, M. Kanninen & L. Pedroni (eds.) Tropical forests and adaptation to climate change. pp. 122-153. Bogor: CIFOR.Robledo and Forner, "Adaptation of Forest Ecosystems and the Forest Sector to Climate Change." Working Paper 2. FAO. Rome

74 UNFCCC, "Modalities and Procedures for Afforestation and Reforestation Project Activities under the Clean Development Mechanism in the First Commitment Period of the Kyoto Protocol," Decision 19/CP.9, UNFCCC, Bonn, Germany, 2003.

75 Certified Emission Reductions (CER) are the carbon credits coming from CDM projects. One CER corresponds to 1 tCO2e, or tonne of CO2 equivalent.

76 For institutional issues, see the ENCOFOR tool at http://www.joanneum.at/encofor/tools/tool_demonstration/Tools.htm.

77 For more information, see Robledo and Forner, "Adaptation of Forest Dcosystems and the Forest Sector to Climate Change."

78 IPCC, "Impacts, Adaptation and Vulnerability."

79 For more clarification of the term *private sector*, visit http://rru.worldbank.org/.

80 The formal segment of the economy is that regulated by the state, while activities in the informal segment follow these regulations only partially or not at all. Many authors use the terms *informal sector* and *formal sector*. In this text, we use *segments* to avoid any confusion with a more traditional understanding of the sectors of the economy, where the understanding of the forest sector and the private sector are based.

81 *Permanence* relates to the period of time that carbon can stay in the biosphere. Because of different risks, including fires and pests, carbon can be released into the atmosphere, thereby reducing the climate change–mitigation effect of a project.

82 There are many potential benefits of forestry activities aimed at adapting to and mitigating climate change. For this section, however, we focus on business-related benefits, especially payments.

83 As stated before, *permanence* relates to the period of time that carbon can stay in the biosphere. Different risks, including fires and pests, can cause the release of carbon into the atmosphere, thereby reducing the climate change–mitigation effect of a project. In terms of adaptation to climate change, permanence also includes the period of time for which a forest can provide a given service that reduces vulnerability of social and natural systems.

84 According to the London School of Economics and Political Science:

Civil society refers to the arena of uncoerced collective action around shared interests, purposes and values. In theory, its institutional forms are distinct from those of the state, family and market, though in practice, the boundaries between state, civil society, family and market are often complex, blurred and negotiated. Civil society commonly embraces a diversity of spaces, actors and institutional forms, varying in their degree of formality, autonomy and power. Civil societies are often populated by organisations such as registered charities, development non-governmental organisations, community groups, women's organisations, faith-based organisations, professional associations, trades unions, self-help groups, social movements, business associations, coalitions and advocacy group.

London School of Economics and Political Science, "What Is Civil Society?" 2004, http://www.lse.ac.uk/collections/CCS/what_is_civil_society.htm.

85 *Empowerment* refers to increasing the spiritual, political, social, or economic strength of individuals and communities. It often involves the development of confidence in their own capacities. Sociological empowerment often addresses members of groups who have been excluded from decision-making processes through behavior such as discrimination based on race, ethnicity, religion, or gender.

86 *Resilience* is understood as the ability to adapt naturally.

87 IPCC, "Impacts, Adaptation and Vulnerability."

88 C. Boisvenue and S. Running, "Impacts of Climate Change on Natural Forest Productivity: Evidence since the Middle of the 20th Century," *Global Change Biology* 12 (2006): 1–21.

89 The IPCC defines natural primary production as the rate of carbon accumulation in plants after losses from plant respiration and other metabolic processes (necessary to maintain the plant's living systems) are taken into account. It can be calculated as gross primary production minus autotrophic respiration. IPCC, *Definitions and Methodological Options to Inventory Emissions from Human-Induced Degradation of Forest and Devegetation of Other Vegetation Types*, ed. J. Penman, M. Gytarsky, T. Hiraishi, T. Krug, D. Krugger, R. Pipatti, L. Buendia, K. Miwa, T. Ngara, K. Tanabe, and F. Wagner (Kanagawa, Japan: IGES, 2003).

90 See, for example, Mahli, Y. & Grace, j. 2000. *Tropical forests and atmospheric carbon dioxide*. Trends in Ecology and Evolution, 15, 332-337.

91 Clark, D. 2004. *Sources or sinks? The responses of tropical forests to current and future climate and atmospheric composition*. Philos Trans R Soc Lond B Biol Sci. 2004 March 29; 359(1443): 477–491

92 S. L. Lewis, O. L. Phillips, T. R. Baker, J. Lloyd, Y. Malhi, S. Almeida, N. Higuchi, W. F. Laurance, D. A. Neill, J. N. M. Silva, J. Terborgh, A. Torres Lezama, R. Vásquez Martinez, S. Brown, J. Chave, C. Kuebler16, P. Núñez Vargas, B. Vinceti. 2004. *Concerted changes in tropical forest structure and dynamics: evidence from 50 South American long-term plots*. The Royal Society B. Volume 359, Number 1443/March 29, 2004.

93 Ibid.

94 R.Condit, P. S. Ashton, P. Baker, S. Bunyavejchewin, S. Gunatilleke, N. Gunatilleke, S. P. Hubbell, R. B. Foster, A. Itoh, J. V. LaFrankie, H. S. Lee, E. Losos, N. Manokaran, R. Sukumar, Takuo Yamakura. 1995. *Spatial Patterns in the Distribution of Tropical Tree Species*. Science, Vol. 288. no. 5470, pp. 1414 – 1418.

95 Clark, D. 2004. *Sources or sinks? The responses of tropical forests to current and future climate and atmospheric composition*. Philos Trans R Soc Lond B Biol Sci. 2004 March 29; 359(1443): 477–491

96 William F. Laurance and G. Bruce Williamson. 2001. *Positive Feedbacks among Forest Fragmentation, Drought, and Climate Change in the Amazon*. Conservation Biology Volume 15 Issue 6, Pages 1529–1535

97 Leighton, M.; Wirawan, N. 1986. *Catastrophic drought and fire in Borneo tropical rain forest associated with the 1982-1983 El Nino southern oscillation event*. Westview Press. Boulder, Colo. (USA)

98 Clark, D. 2004. *Sources or sinks? The responses of tropical forests to current and future climate and atmospheric composition*. Philos Trans R Soc Lond B Biol Sci. 2004 March 29; 359(1443): 477–491

99 Elements that could not be taken into account for the present report but that are also of importance in the overall context of mitigation options in forests are how to treat reduced impact logging; how to treat *pioneer agroforestry*; how to treat synergies between REDD and adaptation; and how to treat the substitution potential of wood products.

100 In the newer reports from the IPCC and the UNFCCC Secretariat, *agroforestry* has been included in the agricultural sector. Nevertheless, it must be clarified that many A/R CDM projects that count under afforestation and/or reforestation are promoting agroforestry systems.

[101] FAO, "Global Forest Resources Assessment 2005"; IPCC, "Mitigating Options."

[102] UNFCCC, "Analysis of Existing and Planned Investment and Financial Flows Relevant to the Development of Effective and Appropriate International Response to Climate Change," Background paper, UNFCCC, Bonn, Germany, 2007.

[103] See Blaser and Robledo, "Initial Analysis on the Mitigation Potential in the Forestry Sector"; and UNFCCC, "Analysis of Existing and Planned Investment and Financial Flows Relevant to the Development of Effective and Appropriate International Response to Climate Change"; UNFCCC, "Report on the Analysis of Existing and Potential Investment and Financial Flows Relevant to the Development of an Effective and Appropriate International Response to Climate Change," Working Paper 8 presented at the Fourth Workshop under the Dialogue on Long-Term Cooperative Action to Address Climate Change by Enhancing Implementation of the Convention, UNFCCC, Vienna, 2007.

[104] US$1 billion equals US$1,000 million.

[105] Blaser and Robledo, "Initial Analysis on the Mitigation Potential in the Forestry Sector"; UNFCCC, "Analysis of Existing and Planned Investment and Financial Flows Relevant to the Development of Effective and Appropriate International Response to Climate Change," Background paper.

[106] Ibid.

[107] Sathaye, J.A., Makundi, W, Dale, L and Chan, P. (2005). *GHG Mitigation Potential, Costs and Benefits in Global Forests: A Dynamic Partial Equilibrium Approach*. Ernest Orlando Lawrence Berkeley National Laboratory. LBNL-58291.

[108] Trienes, E. 2007. "Analysis of Existing and Planned Investment and Financial Flows Relevant to the Development of Effective and Appropriate International Response to Climate Change," Background paper for the UNFCCC Secretariat.

[109] This portion of the paper is based on the report prepared by Blaser and Robledo for the UNFCCC Secretariat that was used as input for the background paper on "Analysis of Existing and Planned Investment and Financial Flows Relevant to the Development of Effective and Appropriate International Response to Climate Change." Blaser and Robledo, "Initial Analysis on the Mitigation Potential in the Forestry Sector"

[110] For further information on the report, visit http://www.itto.or.jp.

[111] *Forest degradation* refers to the reduction of the *capacity* of a forest to produce goods and services. Capacity includes the maintenance of ecosystem structure, functions, and carbon stocks.

[112] This portion of the paper is based completely on UNFCCC, "Analysis of Existing and Planned Investment and Financial Flows Relevant to the Development of Effective and Appropriate International Response to Climate Change," Background paper.

[113] Sathaye, J.A., Makundi, W, Dale, L and Chan, P. (2005). *GHG Mitigation Potential, Costs and Benefits in Global Forests: A Dynamic Partial Equilibrium Approach*. Ernest Orlando Lawrence Berkeley National Laboratory. LBNL-58291.

[114] IPCC, "Mitigation Options."

[115] For more information on ENCOFOR, visit http://www.joanneum.at/encofor/tools/tool_demonstration/Tools.htm.

RECOMMENDED READING

F. Achard, A. S. Belward, H. D. Eva, S. Federici, D. Mollicone, and F. Raes. "Accounting for Avoided Conversion of Intact and Non-intact Forests: Technical Options and a Proposal for a Policy Tool," European Union Joint Research Council, presented at COP11, Montreal, December 1, 2005.

F. Achard, H. D. Eva, H. J. Stibig, P. Mayaux, J. Gallego, T. Richards, and J .P. Malingreau, "Determination of Deforestation Rates of the World's Humid Tropical Forests," *Science* 297 (2002): 999–1002.

S. Angelsen and D. Kaimowitz. 2001. *Agricultural Technologies and Tropical Deforestation* (Wallingford, U.K.: CABI Publishing, 2001).

R. Basnet-Parasai, "Who Owns Carbon in Community Managed Forest?" paper presented to the Amsterdam Summer School, Amsterdam, 2007.

S. P. J. Batterbury and J. L. Fernando, "Rescaling Governance and the Impacts of Political and Environmental Decentralization: An Introduction," *World Development* 34 (2006): 1851–63.

J. Carter, "Natural Resource Governance," in *25 Years of Inspiring Change: Intercooperation 1982–2007*, ed. Intercooperation (Bern, Switzerland: Intercooperation 2007), 17–28.

K. Chomitz, K. and K. Kumari, "The Domestic Benefits of Tropical Forests: A Critical Review," *World Bank Research Observer* 13, no. 1 (1998): 13–35.

K. Chomitz, "At Loggerheads? Agricultural Expansion, Poverty Reduction and Environment in the Tropical Forests," Policy Research Report, World Bank, Washington, DC, 2006.

D. Cogan, *Corporate Governance and Climate Change: Making the Connection* (Boston: Ceres, Inc., 2006).

A. Contreras-Hermosilla, "The Underlying Causes of Deforestation," Occasional Paper 30, Centre for International Forestry Research, Bogor, Indonesia, 2000.

R. DeFries, F. Achard, S. Brown, and M. Herold, "Reducing Greenhouse Gas Emissions from Deforestation in Developing Countries: Considerations for Monitoring and Measuring," Outcome of GOFC-GOLD (Global Observation for Forest and Land Cover Dynamics) workshop on monitoring tropical deforestation for compensated reductions, March 21–22, 2006, draft.

FAO, "FRA 2005 Terms and Definitions," http://www.fao.org/forestry/site/fra2005-terms/en/.

P. Fearnside and W. Laurence, "Tropical Deforestation and Greenhouse-Gas Emissions," *Ecological Applications* 14, no. 4 (2004): 982–86.

E. Frey, "Tropical Deforestation in the Amazon: An Economic Analysis of Rondonia, Brazil," *Issues in Political Economy* 11 (2002).

H. Geist and E. Lambin, "Proximate Causes and Underlying Driving Forces of Tropical Deforestation," *BioScience* 52, no. 2 (2002): 143–50.

M. Grieg-Gran, "The Cost of Avoiding Deforestation," report prepared for the Stern Review of the Economics of Climate Change, International Institute for Environment and Development, London, 2006.

———, *Is Deforestation a Cost-Effective Mitigation Approach?* (London: International Institute for Environment and Development, 2006).

IPCC (Intergovernmental Panel on Climate Change), *Land Use, Land Use Change, and Forestry: A Special Report of the IPCC*, ed. R. T. Watson, I. R. Noble, B. Bolin, N. H. Ravindranath, D. Verardo, and D. J. Docken (Cambridge, U.K., and New York: Cambridge University Press, 2000).

———, *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (Hayama, Japan: IGES,2003), www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.htm.

ITTO (International Tropical Timber Organization), "Status of Tropical Forest Management 2005," ITTO Technical Series 24, ITTO, Yokohama, Japan, 2006.

D. Kaimowitz and A. Angelsen, "The World Bank and Non-Forest Sector Policies that Affect Forests," Background Paper, World Bank's Forest Policy and Strategy, Center for International Forest Research, Bogor, Indonesia, 1999.

D. Kaufmann, A. Kraay, and M. Mastruzzi, "Governance Matters VI: Aggregate and Individual Governance Indicators," Policy Research Working Paper 4280, World Bank, Washington, DC, 2007.

M. Manguit, R. Verheyen, J. Mackensen, and G. Scholz, "Legal Aspects in the Implementation of CDM Forestry Projects," Environmental Policy and Law Paper 59, International Union for Conservation of Nature, 2005.

L. Marklund and D. Schoene, "Global Assessment of Growing Stock, Biomass, and Carbon Stock," Working Paper 106/E, Forest Resources Assessment Programme, Rome.

Millennium Ecosystem Assessment, "Global Assessment Reports," 2005, http://www.millenniumassessment.org/en/Global.aspx.

D. Mollicone, F. Achard, S. Federici, E. Hugh, G. Grassi, A. Belward, F. Raes, G. Seufert, H. Stibling, G. Mattteucci, and E. Schulze, "An Incentive Mechanism for Reducing Emissions from Conversion of Intact and Non-intact Forest," *Climatic Change* 83, no. 4 (2006): 477–93, DOI 10.1007/s10584-006-9231-2.

P. Moutinho and S. Schwartzam, eds., Tropical Deforestation and Climate Change (Washington, DC: Instituto de Pesquisa Ambiental da Amazônia and Environmental Defense, 2005).

M. Richards, "Poverty Reduction, Equity and Climate Change: Global Governance Synergies or Contradictions?" Background Paper, Globalisation and Poverty Programme, Overseas Development Institute, London, 2003.

W. Sachs, "Climate change and Human Rights." WDEV Special Report 1/2007, European Briefings on Globalisation, North-South Relations and International Ecology, World Economy and Development, 2007, http://www.globalpolicy.org/socecon/envronmt/climate/2007/07climatehumanrights.pdf.

M. Santilli, "Compensated Reduction of Deforestation," paper presented at Conference of the Parties 9, Milan, 2003.

M. Santilli, P. Moutinho, S. Schwartzman, D. Nepstad, L. Curran, C. Nobre, "Tropical Deforestation and the Kyoto Protocol: An Editorial Essay," *Climate Change* 71 (2005): 267–76.

S. Scherr, A. Khare, and A. White, "Current Status and Future Potential of Markets for Ecosystem Services of Tropical Forest," report prepared for International Tropical Timber Organization, Forest Trends, Washington, DC, 2003.

B. Sohngen and R. Beach, "Avoided Deforestation as a Greenhouse Gas Mitigation Tool: Economics Issues for Consideration," Working Paper, 2006.

B. Sohngen, R. Mendelsohn, and R. Sedjo, "The Effect of Climate Change on Global Timber Markets," Working paper, Department of Energy, Washington, DC, http://www-agecon.ag.ohio-state.edu/people/sohngen.1/forests/globcc.pdf

B. Sohngen and R. Sedjo, "Carbon Sequestration Costs in Global Forests," *Energy Journal Special Issue*

N. Stern, *The Economics of Climate Change: The Stern Review* (Cambridge, U.K., and New York: Cambridge University Press, 2006).

M. Tavoni, B. Sohngen, and V. Bosseti, "Forestry and the Carbon Market Response to Stabilize Climate," http://ideas.repec.org/p/fem/femwpa/2007.15.html.

E. Trines, N. Hohne, M. Jung, M., Skutsch, A. Petsonk, G. Silva-Chavez, P. Smith, G.-J. Nabuurs, P. Verweij, and B. Schlamadinger, "Integrating Agriculture, Forestry and Other Land Use in Future Climate Regimes: Climate Change, Scientific Assessment and Policy Analysis," Report 500102002, 2006.

UNFCCC, "Marrakech Accords," FCCC/CP/2001/13/, Bonn, Germany, 2001

———, "Conference of the Parties 8 Report and Delhi Declaration," FCCC/CP/2002, UNFCCC, Bonn, Germany, 2002.

———, "Estimation, Reporting and Accounting of Harvested Wood Products," FCCC/TP/2003/7, UNFCCC, Bonn, Germany.

———, "Conference of the Parties 9 Report," FCCC/CP/2003/6, UNFCCC, Bonn, Germany, 2003.

———, "Background Paper for the Workshop on Reducing Emissions from Deforestation in Developing Countries," Working Paper 1, UNFCCC, Bonn, Germany, 2006, http://unfccc.int/files/methods_and_science/lulucf/application/pdf/part_i_scientific_issues.pdf.

———, "Report of the Subsidiary Body for Scientific and Technological Advice on Its Twenty-Fifth Session," FCCC/SBSTA/2006/11, Nairobi, November 2006, http://unfccc.int/resource/docs/2006/sbsta/eng/11.pdf

——, "Report of Conference of the Parties Serving as the Meeting of the Parties to the Kyoto Protocol on Its First Session, Held at Montreal from 28 November to 10 December 2005: Addendum—Part Two. Action Taken by the Conference of the Parties Serving as the Meeting of the Parties to the Kyoto Protocol at Its First Session," FCCC/KP/CMP/2005/8/Add.3, UNFCCC, Bonn, Germany, 2006, http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=3.

World Bank, *Sustaining Forests; A World Bank Development Strategy* (Washington, DC: World Bank, 2004).

ACKNOWLEDGMENTS

The authors want to express their gratitude to William Sunderlin, Jane Carter, Tamara Levine and Patrick Robinson for their valuable comments.

The authors would like to thank the Swedish International Development Cooperation Agency and the Swiss Agency for Development and Cooperation for the financial support in the preparation of this draft paper.

1238 Wisconsin Ave NW, Suite 204
Washington DC 20007