The Forests Dialogue

Sustainable Forest Management and Climate Change

Forests and Climate Dialogue Background Paper
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Introduction

This analytical paper summarizes major issues relating to climate change and forests. Forests play four major roles in climate change: (1) they contribute about 20% of total global carbon dioxide emissions when cleared, overused or degraded; (2) forest ecosystems are sensitive to changing climates; (3) when managed sustainably, they can produce fuels with lower emissions than fossil fuels; and (4) they have the potential to absorb significant volumes of carbon in their biomass and soils and products, and to store carbon for extended periods of time.[1]

The purpose of this paper is to stimulate discussion at TFD's next Dialogue on Forests and Climate in Bali, Indonesia, by highlighting key issues that relate to the intersection of climate change with forest management and use. Information is presented to help readers and discussion participants identify areas of current and potential contention and conflict. As such, this paper is not an exhaustive study of all aspects of forest carbon.

This paper does not summarize the established or emerging science on the effects of climate change on forest dynamics and ecosystems. Rather, it provides an overview of the discussions surrounding the role of forests and forest management as a means of addressing climate change. Whereas this paper seeks to address global forests, the forests with the greatest potential impact lie in developing countries that, in turn, lie in the lower latitudes. As such, the natural focus of this paper is often on those forests that lie in tropical and subtropical zones.

Key subjects of interest include (1) the current treatment of forests in the existing climate change regime and carbon markets; (2) emerging issues surrounding reduced emissions from deforestation and degradation (REDD); (3) bioenergy; (4) agroforestry; and (5) competition for forest products, such as timber, non timber forest products (NTFP), and fiber. Broad issues were identified, and an examination was performed as to the effects of each of these issue areas on forest management, climate change, biodiversity, and key stakeholders.

[1] From online article from UN FAO accessed at http://www.fao.org/forestry/site/climatechange/en/.

Research consisted of selected scholarly literature reviews, online research of key stakeholders, and additional information such as lectures given by members of the carbon finance community.

Current treatment of forests under Kyoto Protocol and Voluntary Carbon Markets

Context: Land Use, Land Use Change, and Forestry (LULUCF) projects allowable under the Kyoto Protocol are limited to afforestation and reforestation (A/R) projects for the first commitment period (2008-2012).[2] At this time, projects that include forest conservation, soil sequestration, and fire management are still excluded from the Clean Development Mechanism (CDM).[3] The decision to exclude forest conservation and avoided deforestation was made during COP meeting in Bonn, the Hague, and Marrakesh (COPs-6, -6b, and -7), and was based on a number of reasons, some principled and others political. The reasons for exclusion included:[4]

1. A desire among decision makers to focus mitigation efforts on the energy sector (which accounts for over 75% of carbon dioxide emissions) and on developed countries, which are responsible for the majority of past and current carbon emissions;
2. Concerns that more easily acquired, "cheap" forestry credits would flood the market, thereby depressing the market and decreasing incentives to invest in energy-related emissions;
3. Difficulties in monitoring, and accounting for or preventing leakage;[5]
4. Issues with non-permanence, i.e. how to account for emissions credits should a forest be destroyed, e.g. by fire;
5. Concerns of national sovereignty, and of abdicating control of forest lands to foreign credit buyers;
6. Greater ease to monitor and quantify carbon stocks on a project basis versus assessing carbon sequestration from an existing forest. A/R projects use a project-based approach preferred by the CDM;
7. NGO agitation to exclude forests from the CDM due to concerns over diverting attention from energy sector emissions reductions in Annex 1 countries. The Convention on Biodiversity (CBD), also established at the 1992 Rio Convention, is the UNEP organization that seeks as part of its mandate the preservation of forest biodiversity.

Key Issues: Issues that have emerged with A/R under CDM include the implications of plantation type to forest management, biodiversity, and forest dependent communities. Plant/tree species selection play a determining role in the return, survival, or expansion

[2] The Marrakesh Accords provided the operational rules for implementing the Kyoto Protocol. The accords were adopted during the seventh session of the Conference of Parties (COP) held in Marrakesh in 2001.
[3] The CDM is one of the three flexible mechanisms under the Kyoto Protocol, and allows for projects to take place in non-Annex I countries.
[4] This list summarizes several articles, including: J. Ebeling, *Tropical deforestation and climate change.* Dissertation got Masters degree, August 2006; Tropical Forests and Climate Change, John O. Niles; UNEP CBD Technical Paper, "Interlinkages Between Biological Diversity and Climate Change," October 2003.
[5] Project "leakage" refers to the displacement of an activity that causes carbon emissions to another area. The problem concerns no net reduction in carbon emissions.

of native flora and fauna. This in turn may affect local communities if they value biodiversity, whether for food, income, or another use. However, it is not always clear whether local communities are consulted prior to an A/R project. For example, some A/R projects have sought to re-establish native flora with special attention to replicating pre-existing structure, species mixing, and density. Adjustments have benefited biodiversity. By contrast, the use of exotic species for tree plantations under CDM may have a deleterious effect on the local environment, biodiversity, and subsequently local communities. For example, the use of commercial plantations of eucalyptus in South Africa has adversely affected indigenous birdlife and flora, as well as reducing water yields in water catchments.[6]

Also of concern is the strong bias towards large industrial gases projects within existing carbon markets. Markets prefer cost-effective projects, and industrial gases projects, which represent 67% of the total volumes transacted under CDM in 2006, are currently the most cost effective.[7] LULUCF projects represented just 1% of transactions via CDM. Whereas there is wide acknowledgement among purchasers of the need to diversify projects both sectorally and geographically, the availability and financial attractiveness of large industrial projects in China suggests that LULUCF projects shall remain a market laggard. This is exacerbated by the fact that the CDM rules favor large and easily quantifiable projects, i.e. industrial projects.

Financial markets also are hesitant currently to delve into forest carbon projects due to the perceived high risk. Perceptions include:[8]

1. Additionality is a key problem in attaining project verification;
2. Financial markets are averse to uncertainty and therefore treat harshly science's lack of certainty with respect to forest science;
3. CDM is one-size fits all, which is not ideal for forestry
4. Sovereignty issues;
5. Stability (i.e. non-permanence) of the investment.

That being said, there is growing interest in the investment community for developing markets for ecosystem services, including forestry, biodiversity, wetlands, etc. Indications are that regulations and treaties that encourage land-use change projects greater access to carbon finance would quickly be exploited by the financial community. Markets currently fail to capture the values of biodiversity, carbon storage, water purification, and other "ecosystem services" that forests provide. Financial incentives to clear or destructively log forests are generally stronger than those to conserve, restore, and use them sustainably. In order to exploit this interest, LULUCF projects need increased regulatory support, both at the national and international level.

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[6] UNEP CBD Technical Paper, "Interlinkages Between Biological Diversity and Climate Change," October 2003.
[7] K. Capoor and P. Ambrosi, World Bank. *State and Trends of the Carbon Market 2007*.
[8] Summarized from talks given at Yale University by P. Sweatman, Director of Client Operation at Climate Change Capital (Nov. 11, 2007) and Abyd Karmali, Managing Director and Global Head of Carbon Emissions at Merrill Lynch (Oct. 31, 2007).

In the absence of formal markets for avoided deforestation projects, the voluntary carbon markets have stepped in to fill a market need. In 2006, approximately 36% of projects in the voluntary market were forestry related, indicating a robust market for increased carbon forestry projects. Voluntary carbon markets provide a number of advantages for forestry projects:

1. They are more flexible than the regulated market under the Kyoto Protocol. The flexibility stems from there being fewer controls than in the regulated market. This is both a strength and a weakness; a strength because it allows projects to be completed that otherwise would not have been, and a weakness because there are no accepted standards or practices for certifying the validity of a carbon offset. This raises quality assurance issues for voluntary emissions credits.[9]

2. Buyers are willing to pay a premium for "charismatic carbon" projects, i.e. those projects that have additional value beyond simply carbon offsets. Additional benefits may include local development, protecting biodiversity, etc.

3. Voluntary carbon markets are better suited for small projects. This is especially applicable to small land owners or forestry projects where project transaction costs under CDM may be prohibitive.

There is currently a push within voluntary carbon market practitioners to implement quality standards and project registries. An effective standard would assuage the fears of many potential carbon financiers and could possible free up additional funds for forestry projects, especially from institutional investors.[10]

Reduced Emissions from Deforestation and Degradation

Context: Reducing emissions through avoiding deforestation, and its role in a post-2012 climate regime, will be a key issue at the COP-13 in Bali. One study showed that reducing deforestation rates 50% by 2050, and then maintaining this level of forest cover until 2100, could avoid the release of 50 GtC this century. This amount is equivalent to 12% of the total amount of required reduction through 2100. REDD may also be one of the cheapest ways to mitigate carbon emissions.[11]

REDD was not included in the CDM for the first commitment period for a number of reasons.[12] These included concerns over leakage risk, non-permanence, baselines, monitoring and measurement, governance, and flooding of the carbon market.
REDD resurfaced during COP11 in Montréal in 2005 when the Coalition of Rainforest Nations proposed including emissions from deforestation in a future climate regime by

[9] K. Hamilton et. al., *State of the Voluntary Carbon Market 2007, Picking Up Steam.* Published by Ecosystem Marketplace and New Carbon Finance, July 18, 2007.
[10] From a presentation given by K. Hamilton of Ecosystem Marketplace on Nov. 7, 2007 at Yale University.
[11] Gullison, R.E., et. al. *Tropical Forests and Climate Policy*, Science, Vol 316, May 18, 2007.
[12] REDD is the preferred term as it avoids implications of denying local land-users access to forest products as implied by the term "avoided deforestation."

rewarding developing nations for reducing emissions from deforestation.[13] There is now pervasive support for including forest-based emissions in formal markets and mechanisms in the post-2012 Kyoto regime, including among some groups that previously were opposed to including forest conservation in the CDM. The Stern Review, published in 2006, recommended including avoided deforestation in a climate change regime, suggesting it was relatively cheap, and recommending specialized funds, market based mechanisms, a national approach to the leakage problem, and the need for assuring the property rights of forest-dependent people.[14]

Relevant stakeholders: Carbon-offsets purchasers (including increasingly large investors), small-land owners, forest-dependent communities, World Bank and development agencies, UNFCCC, NGOs.

Issues in Implementation of REDD: There are a number of key issues surrounding the manner in which REDD may be incorporated in a future climate regime. [15]

1. How to define a forest? Countries have defined forests in various ways, including in terms of land use, canopy cover, or carbon density, in addition to other mechanisms. In terms of climate change, however, defining forest loss in terms of canopy loss may not account for degradation through forest thinning or removal of understory, both of which may constitute large carbon emissions.[16]

2. How to define "avoided deforestation" in the context of climate change? From the point of view of climate change, the main purpose is to reduce carbon emissions due to the permanent loss of forest biomass. The UNFCCC currently defines deforestation as "permanent removal." Lost in this definition is a temporal or geographic scale of loss. Land-use practices, and shifting and sustainable cultivation, for instance, could be a means of REDD if properly managed.

3. Baselines: A component of REDD is establishing a national target for reductions (i.e. REDD targets would be tackled at a national level). There are several proposals for establishing historic baselines against which emissions reductions are measured and rewarded; the 'compensated reductions' (CR) approach compares future deforestation rates of countries to their rates in the 1990s; an averaging method; and a normative method that rewards early actors.[17] Establishing reliable baselines, while a critical first step for REDD, would inevitably be subject to significant political negotiation and compromise. There is likely to be friction at sub-national and regional level, too, as different regions try to establish more favourable baselines. This may be exacerbated by pre-existing disputes in a country.

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[13] Article "Rainforest Credits" accessed at www.environmentaldefense.org
[14] The Stern Review accessed at http://www.hm-treasury.gov.uk./independent_reviews/stern_review_economics_climate_change/sternreview_summary.cfm
[15] Key issues were summarized from M. Skutsch et. al., *Clearing the way for reducing emissions from tropical deforestation.* Environmental Science and Policy 10 (2007), p. 322-334.
[16] R. Watson et. al. *IPCC Special Report on Land Use, Land-Use Change And Forestry.* Summary for Policymakers, accessed at http://www.grida.no/climate/ipcc/land_use/index.htm
[17] A more complete discussion of the first two baseline methodologies is presented in M. Skutsch et. al.

4. Equity issues: How should financial benefits of reduced deforestation be distributed among the various stakeholders? National targets may lead to financial rewards at the national level. What, if any, mechanisms would be implemented to disperse rewards to the local level where actual emissions reductions are achieved?

5. Opportunity costs: There are significant questions as to whether a financial windfall from carbon credits due to REDD would offset the opportunity costs of timber and NTFPs to local communities.

6. Practicality: Significant financial and institutional capacity is needed in developing countries to assist with establishing baselines, monitoring, and controlling illegal deforestation. Related to this is the high cost of implementing CDM rules that are also expensive, complex and unwieldy, thereby reducing benefits to local land-owners.

In response to this intensifying interest, the World Bank is developing the Forest Carbon Partnership Facility (FCPF) in conjunction with both developing and industrialized countries. The FCPF uses a system of policy approaches and performance-based payments to address REDD. The FCPF may be launched at COP13 in Bali and declared operational in 2008.[18] Following the BioCarbon Fund that was launched in November 2003, this is the second World Bank fund to support forestry projects.[19]

Similarly, the Asian Development Bank (ADB) is starting to assess its response to a possible introduction of REDD into the climate regime. The ADB would seek to establish links to the social dimensions of REDD, such as poverty reduction, biodiversity, and local development. Two emerging problems were identified at a recent talk given by ADB staff: (1) occasional tension between forest management practitioners and those in the financial industry who are seeking a means to develop carbon offset projects; and (2) the related concern that once the U.S. and China enter into a binding emissions agreement (viewed by most as a question of 'when' rather than 'if') there would be a large demand for high volume, low cost credits. This well may not align with the agenda of those interested in forest conservation.[20]

Equity Concerns with REDD: There are concerns with equity due to a rapid expansion of REDD and associated outside investment, such as from the World Bank's FCPF. Concerns center around the need to ensure that benefits extend to local communities and that land rights are assured. Specifically:[21]

1. How to ensure financial benefits are enjoyed by local communities?
2. How to avoid exclusionary conservation practices?

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[18] Capoor and P. Ambrosi, World Bank. *State and Trends of the Carbon Market 2007*.
[19] Information on World Bank Carbon Finance accessed at www.carbonfinance.org.
[20] From a presentation given by D. McCauley of the ADB at Yale University on Nov. 9, 2007.
[21] Drawn for a number of sources; a good summary is at T. Griffiths, *Seeing 'RED'? 'Avoided deforestation' and the rights of Indigenous Peoples and local communities.* Pub. Forest People's Programmed, August 2007.

3. How to avoid violations of customary land rights and land tenure?
4. How would local benefits be measured?
5. Who would monitor and ensure the above?
6. How to develop market mechanisms that channel carbon funds to biodiversity conservation?

Bioenergy

Context: There is large and increasing interest in the development of bioenergy to displace fossil fuels, particularly as bioenergy to replace petro-diesel and petroleum in the transportation sector.[22] Bioenergy is suggested as a means to a more sustainable energy future and to reducing carbon emissions, while providing opportunities for landscape management, conservation farming practices and rural livelihoods development. Conversely, there is also widespread acknowledgement as to the role of bioenergy in deforestation in tropical and sub-tropical countries, and the potential for bioenergy to undermine food security, degrade ecosystems, and prevent rural farmers from benefiting from bioenergy markets.[23]

As such, two issues of bioenergy are central to climate change and forest management; (1) the total reduction in carbon emissions due to the substitution of fossil fuels by bioenergy, and (2) the ensuing change in land use.

Relevant stakeholders: agri-business firms, oil multinationals (increasingly), governments in both developing/exporter and developed/importer countries, industry-groups, small-land owners, forest-dependent communities, NGOs, RSPO, EPFL.

Potential benefits: The most commonly referenced potential benefits of expansion in the bioenergy industry are the following:

1. Reduction in carbon emissions from fossil fuels;
2. Restoration of degraded land;
3. Creation of rural economic opportunities;
4. Improvement in South-South trade relations;
5. Public health (particularly of rural women and children) who are often dependent on burning biomass for cooking and heating needs.

There are currently no industry-wide bioenergy "sustainability" standards. At this time bioenergy production has effectively no accepted standards for growing practices, especially in developing countries. Various standards for sustainable production that account for land use and other environmental impacts, social impacts, and effects on GHG[24] emissions are being developed. The Energy Center at the Swiss Federal Technical Institute (EPFL) is leading an effort to establish multi-stakeholder standards and

[22] Biofuel refers to biomass-based fuels for transport, whereas bioenergy includes bioenergy and biomass fuels for heating, cooling, and power generation.
[23] Conclusions from a side event convened by the World Conservation Union (IUCN), aka the World Conservation Union, during the 15th Session of the UN Commission on Sustainable Development (CSD).
[24] Acronym for greenhouse gas.

certification for sustainable bioenergy production.[25] The Roundtable on Sustainable Bioenergy standards, due out in draft form in 2008, will address (1) the effect of bioenergy on GHG emissions using life-cycle analysis; (2) environmental impacts to forest, biodiversity, and natural resources; (3) social impacts to land rights, poverty alleviation; food security, etc.; and (4) the ease of implementation for small-scale, low-income farmers.[26]

The Global Roundtable on Responsible Soy Association (RTRS) and the Roundtable on Sustainable Palm Oil (RSPO) are international multi-stakeholder organizations dedicated to advancing the production, procurement and use of sustainable palm oil and soy, respectively.[27] With a focus on South America, the RTRS notes soy is an important source of income, development, and employment in the region, but also has entailed high social and environmental costs, such as deforestation, water pollution and soil erosion. As such, it is developing guidelines to promote "economically viable, socially equitable and environmentally sustainable production of soy oil." Guidelines have not been completed at this time.

Similarly, the RSPO notes that palm oil is the second largest oil crop after soy oil and that it is responsible for large scale deforestation in Malaysia, Indonesia, and other parts of Asia. They also acknowledge that it has led to social conflict between local communities and plantation operators. As such, the RSPO has developed Principles and Criteria for Sustainable Palm Oil through "legal, economically viable, environmentally appropriate and socially beneficial management and operations."[28] The RSPO standards are voluntary.

Bioenergy plantations also are suggested as a use for degraded or marginal agricultural land for feedstock. In particular, there is interest in jatropha as it can help restore soil, requires minimal inputs of water, and grows in poor soil. At the same time, it is largely undomesticated, does not yield large amounts of oil, and is toxic.

Concerns with bioenergy: The central concern over bioenergy is the associated deforestation in sub-tropical and tropical countries. There is a significant economic competitive advantage to producing bioenergy in the global South (usually forest-rich countries) as opposed to the North, due to favourable climates, longer growing seasons, higher rainfall, and lower labour costs. Governments in developing, forest-rich countries, such as Brazil, Indonesia, and Malaysia, have and continue to invest heavily into the sector. Whereas Europe and the U.S. produce the majority of the world's bioenergy, substantial government subsidies to the bioenergy industry in the EU and the U.S. maintain the competitiveness of these industries. Regions of the global South are expected to continue their strong growth in this industry.

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[25] Information accessed for the EPFL at cgse.epfl.ch/page65660.html
[26] Information on EPFL standards at http://cgse.epfl.ch/webdav/site/cgse/shared/Biofuels/RSB_Intro.pdf
[27] Information at www.responsiblesoy.org/eng/index.htm and www.rspo.org/ for soy and palm oil, respectively.
[28] The RSPO Principles and Criteria document, issued September 22, 2005, accessed at www.rpso.org.

There is also intense public and private interest in expanding the bioenergy industry. The European Commission recent Renewable Energy Roadmap proposed that bioenergy should provide ten per cent of EU member states' transport fuels by 2020. If adopted, a large amount of that biofuel would come from developing countries, representing a huge opportunity for biofuel growers. Large agro-industrial firms already are partnering with oil companies in the South in order to utilize existing infrastructure.[29] In the absence of standards or rules governing environmental and social impacts, there is concern that least-cost operations would lead to further deforestation, and that local land owners with poor market control would be marginalized. This could lead to increased poverty and possibly greater pressure on local forests.

The usefulness of bioenergy as an effective means of reducing carbon emissions also is called into question. One study found that reforesting an area would sequester two to nine times more carbon than that avoided by using bioenergy instead of fossil fuels.[30] A 10% fuel substitution would require 43% and 38% of cropland to be used in the U.S. and Europe for bioenergy, respectively. This amount of land obviously is not possible without fundamental shifts in food production, and would result in increased forests and grassland conversion in these two regions. In addition, the Confederation of European Paper Industries (CEPI) issued an assessment of the EU's plan for the use of biomass for energy and concluded that the plan would result in significant competition between paper and energy interests for wood fiber.[31]

The rise of "second generation" bioenergy has important implications to future forest management. Second generation bioenergy consists of the production of ethanol through the bio-chemical breakdown of lignocellulose, and the production of biodiesel from biomass through pyrolysis.[32] Lignocellulose, in particular, is one of the most abundant biological materials on earth. The interest in using switchgrass from the U.S. prairies stems from the potential use of this technology.

Despite enormous investment from biotech and energy companies in the private sector into cellulosic bioenergy, there are still significant political, economic, and technological hurdles preventing the large-scale production of bioenergy from lignocellulose. While estimates vary greatly, production of second generation bioenergy on an industrial scale is from between five to twenty years away.
Were challenges and impediments to production of bioenergy from cellulosic technology to be overcome, bioenergy could be produced in many other parts of world cost-

[29] UN Conference on Trade and Development (UNCAD) Biofuels Initiative, *Emerging Biofuels Market: Regulations, Trade and Development Implications*, 2006. Accessed at http://r0.unctad.org/ghg/events/biofuels/UNCTAD_DITC_TED_2006_4.Final.pdf
[30] R. Righelato and D. Spracklen, *Carbon Mitigation by Biofuels of Saving and Restoring Forests?* Science, 17 August, 2007, Vol. 317, p. 902.
[31] McKinsey & Company and Poyry Forest Industry Consulting, "Bio-energy and the European Pulp and Paper Industry – an impact assessment." Commissioned by CEPI.
[32] Mathews, J. A., *Biofuels: What a Biopact between North and South could achieve.* Energy Policy 35, 2007.

competitively. This in turn would have significant implications for rates of deforestation due to land clearing for bioenergy crops.

Agroforestry

Context: Expansion of mono-crop agriculture and farming is a primary cause of deforestation. Deforestation is a key contributor of global carbon emissions, contributing approximately 20% of total carbon dioxide emissions, and can represent up to 80% of national carbon dioxide emissions from heavily forested countries.[33] Effective agricultural practices at the forest-farm interface are being studied both from the perspective of sustainable forest management and for climate change mitigation and adaptation. Agroforestry is significant to climate change in two ways; (1) as a means of sequestering carbon; and (2) as a land use tool that can preserve cropland and reduce deforestation rates. Critical to the success of agroforestry in addressing both climate change and forestry/land use issues is effective management and implementation plans.

Relevant stakeholders: agri-business firms, governments in developing countries, small-land owners, forest-dependent communities, NGOs, World Agroforestry Centre, Consultative Group on International Agricultural Research, UN FAO, UNCBD.

Possible benefits to agroforestry: Many of the benefits of agroforestry to forest management and climate change are not as direct as, for instance, avoiding deforestation. Rather, they would manifest themselves as ancillary benefits due to effective agricultural practices. Benefits are as follows:[34]

1. Carbon sequestration through growth cycle and curbing land degradation;
2. Provides an alternative to slash-and-burn agriculture;
3. Maintains soil health, avoiding the need for additional land clearance;
4. Provides ecosystem services, such as erosion control and water purifying;
5. Evidence of better disease and pest control with increased plant diversity;
6. Provision of alternative sources of income for farmers providing greater economic resilience;
7. Beneficial effects to biodiversity in degraded or deforested zones;
8. Can provide a functional link between forest fragments as part of regional forest management.

Agroforestry could be eligible for funding via the CDM mechanism for A/R projects. Two types of agroforestry projects are recognized by IPCC; (1) land conversion and (2) improved land use. Land conversion requires converting degraded land into agroforests

[33] Article "Avoided Deforestation with Sustainable Benefits," accessed at www.worldagroforestry.org.
[34] This list is from a variety of sources, including: (1) S. Kandji et. al., *World Agroforestry into the Future,* Chap. 13, "Opportunities for linking climate change adaptation and mitigation through agroforestry systems." Publication of World Agroforestry Center; (2) CGIAR Briefing Dossier Global Climate Change: Can Agriculture Cope?" Chapter, "Managing Tropical Land to Mitigate Climate Change" accessed at http://www.cgiar.org/impact/global/cc_managingtropicallands.html; (3) UNEP CBD Technical Paper, "Interlinkages Between Biological Diversity and Climate Change," October 2003.

and improved land use refers to practices that would increase carbon stocks, such as high-density plantings.[35]

An issue for agriculture that has obvious implications for agroforestry and climate change is sequestration of soil-based carbon through improved land management. Central to this is conservation tillage, where land is not tilled prior to planting of each crop. Conventional land management exposes organic matter in the soil to the air and results in large-scale CO_2 emissions. Conservation tillage involves minimum- or zero-tillage and results in increased carbon sequestration in soils.

In addition to climate change mitigation, agroforestry also has implications for adaptation. Integrated forest practices could provide erosion control and watershed services. Soil-water retention is greater in agroforestry areas that in a monocrop system. Reduced evapotranspiration and better microclimates also may help farmers' yields in dry or low-rainfall years.

Concerns with agroforestry: Despite the large potential gains in reducing carbon emissions, each of the benefits noted above rely on effective management. Large investment is needed in technological and institutional infrastructure before benefits can be realized on a large scale. Conversion from present, mono-crop agricultural practices would require upfront capital investment. An underexploited means of investment is through the CDM. Numerous carbon funds, such as the World Bank's BioCarbon Fund and the Forest Carbon Partnership Facility (functional in 2008), are available for forestry projects.

Other problems include those that are common to much of forest carbon; there is a need for better methods of assessing carbon stocks and sequestration by standing biomass. Local communities do not have access to viable markets for the various crops they may grow in an agroforestry regime. CDM has strict rules for project methodologies as well as high transaction costs which often preclude effective participation by forest-dependent communities.[36]

Forest Products

Context: Forest management and climate change issues relating to timber and non-timber forest products (NTFP) fall into two broad but related categories; (1) emissions from deforestation and (2) maximizing carbon mitigations through effective forests' management.

Relevant stakeholders: forest-dependent communities, UN FAO, paper industries and industry groups, NGOs, World Business Council for Sustainable Development-Sustainable Forests Products Industry group.

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[35] UNEP CBD Technical Paper, "Interlinkages Between Biological Diversity and Climate Change," October 2003.

[36] S. Kandji et. al.

Key Issues: If implemented, global forests and land-use measures have the potential to significantly reduce carbon emissions by the equivalent of 10-20% of projected carbon dioxide emissions from fossil fuels through 2050.[37] The central issues are how to avoid emissions from deforestation and how to effectively manage forests in a manner that maximizes the storage and sequestration of carbon while still allowing for the needed production of timber, fiber, and energy from forests. In developing countries, particularly forest rich nations in the low latitudes, deforestation is attributable more to bioenergy production. However, illegal logging for timber and NTFP also occurs.

One means of management is through forest certification. Forest certifications promote sustainably managed forests through third-party certification. Certifications provide consumers of forest-products assurances that originating forests were managed to minimize environmental impacts, and maximize social and economic benefits to forest stakeholders. There are numerous certifications available, with the Forest Stewardship Council (FSC) and The PEFC Council (Programme for the Endorsement of Forest Certification schemes) being the two most widely used. Both FSC and PEFC are independent, non-profit, non-governmental organizations. The PEFC is an umbrella group of 35 national forest certification groups.[38] There is increasing demand for certified forest products, especially in the U.S, Canada, Europe, and Japan. This demand is driven largely by business and government procurement practices, increased consumer interest in "sustainable" products, and the recent surge in "green buildings."

A key challenge is in expanding the implementation of certification schemes to forests worldwide. Certification is increasing but still only represents 10% of the world's forests. Most certification has occurred in OECD countries with much less implementation occurring in developing countries. Russia and Indonesia, for instance, have deficient or poorly enforced forest governance systems. Both of these countries are supplying increasing amounts of forest products to China. China accounts for approximately 50% of global growth in paper production since 1990. Whereas most (~60%) of China's forest imports are from managed forests, large and increasing volumes come from unmanaged or undocumented sources.[39]

The forests-products industry has acknowledged the need to address climate change. Industry leaders are presenting themselves as partners in addressing climate change and are aggressively advertising the benefits of carbon forestry through sequestration, storage, and energy efficiencies. The World Business Council for Sustainable Development (WBCSD) Sustainable Forest Products Industry (SPFI), for instance, consists of leading international forestry and forest products companies representing approximately 50% of global forest, paper, and packaging sales.[40] SPFI has issued

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[37] Online article "Recognizing Forests' Role in Climate Change" accessed at www.ucsusa.org
[38] A summary matrix of forest certification programs is available at http://www.certifiedwoodsearch.org/matrix/matrix.aspx
[39] Stafford, B., *China and Forest Trade in the Asia-Pacific Region: Implications for Forests and Livelihoods.* Developed for Forest Trends, July 2007.
[40] WBCSD SPFI Publication, *SPFI Carbon and climate Change – Key messages for policy-makers.* Developed by NCASI, September 2007.

periodic reports reviewing industry practices and operations within the context of carbon and climate change. In March 2007, member companies committed to Membership Principles and Responsibilities. The following recommendations from the Principles and Guidelines and from SFPI reports are of note with respect to carbon forestry: [41]

1. A/R projects for timber and NTFP should be managed to maximize carbon sequestration;

2. Advance the use of market-based mechanisms (e.g. tradable credits, carbon taxes) to reduce deforestation and increase A/R;

3. Increase development aid to improve local forest governance;

4. The forestry industry is energy intensive; however, much of the energy comes from biomass. The industry intends to improve that trend with greater R&D and technological innovation;

5. Improve recycling of fiber. Production of paper from recycled fiber is less energy intensive than for production from virgin fiber, and reduction in landfilling will decrease methane emissions, which is a far more potent GHG.

6. Increase incentives to improve markets for timber and NTFP as a means f keeping land in forests as opposed to conversion to land uses with higher associated carbon emissions (e.g. conversion to agricultural land).

The Union of Concerned Scientists produced a paper with respect to forests grown for timber production that, while broadly agreeing with some industry positions, recommended the following suggestions (among others):[42]

1. <u>Manage timber production forests for carbon and other environmental values.</u> Forests should be managed for climate mitigation and other environmental values in addition to timber production. There should be attention to regeneration of native trees and establishing conservation set-asides to increase the average long-term quantity of stored carbon. To maximize carbon sequestration, harvesting should occur only annual growth rate falls below the average growth rate.

2. <u>Preserve the integrity of mature forests when managing for timber or biomass.</u> Assuming that younger trees sequester carbon more quickly does not account for the fate of stored carbon when mature forests are logged. Large quantities of carbon dioxide are also released through the disturbance of forest soils, and over time through the decomposition of leaves, branches, and other detritus of timber production.

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[41] *Carbon and climate Change – Key messages for policy-makers*, September 2007.
[42]Summarized from online article "Recognizing Forests' Role in Climate Change" accessed at www.ucsusa.org .

3. Maintain historical fire regimes. Historical forest fire regimes should not be altered to increase carbon storage. Fire is a natural disturbance factor that guards against catastrophic wildfire and unpredictable carbon storage and release. Fire management and logging practices should consider carbon emissions.

4. Markets fail to capture the values of biodiversity, carbon storage, water purification, and other "ecosystem services" that forests provide. Effective approaches to addressing the "market failure" for forest goods and services should address the fact that financial incentives to clear or destructively log forests are generally stronger than those to conserve, restore, and use them sustainably.

The work of The Forests Dialogue is implemented by a Secretariat hosted by the School of Forestry and Environmental Studies (F&ES) at Yale University in the United States. TFD is an autonomous program composed of individuals and governed by a Steering Committee with representatives from major forest stakeholder groups. The statements, reports, and findings of TFD do not necessarily represent the views of F&ES Faculty. All enquires should be directed to Gary Dunning at TFD - info@theforestsdialogue.org