Greenhouse Gas Policy Development in the Land Use, Land-Use Change and Forestry (LULUCF) Sector

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North American power generators and others have sponsored forestry and agricultural projects to address global greenhouse gases, particularly carbon dioxide (CO_2). Well-designed projects can be important tools because of their multiple attributes: reducing emissions and increasing uptake of carbon; contributing to sustainable development goals; providing substantial ancillary environmental benefits; and cost-effectiveness in managing CO_2. Principles for development of credible projects and programs are discussed.

Introduction

Land use, land-use change and forestry (LULUCF) activities such as reforestation and reducing deforestation can yield large carbon benefits, be among the most economical ways to address CO_2 emissions (Sedjo et al., 1995), contribute to sustainable development goals and create secondary environmental and social benefits unrelated to carbon (such as restoration of degraded lands; habitat improvement with benefits for biodiversity, wildlife and birds; and reduced erosion, reduced soil compaction, improved stream quality and fisheries improvement). For these benefits to be accepted internationally, there are several key areas that need to be addressed such as: rules regarding eligibility, the permanence of carbon storage, appropriate accounting, the potential displacement of CO_2 benefits, and reduction of project risks.

This paper discusses the Kyoto Protocol, estimates of carbon benefits of forestry activities, key issues and uncertainties, and principles for credible forestry activities.

The Kyoto Protocol

The Kyoto Protocol sets greenhouse gas (GHG) emission reduction targets for developed country parties. While the Protocol is far from having the level of support needed for entry into force, many analysts believe it, or a similar agreement, will eventually enter into force. The Protocol requires national commitments, comparing 1990 greenhouse gas emission levels to 2008-2012 "first commitment period (CP)" emissions for 38 signatory nations. Nations agreed to different levels of reductions based on expectations of how the Protocol's different mechanisms, or Articles, would affect them.

The Protocol addresses forestry actions taken: 1) domestically (Article 3); 2) jointly with other developed nation treaty signatories, *vis-a-vis* emissions trading (Article 17) or "joint implementation" projects (Article 6); and 3) jointly with developing country non-signatories via

the Clean Development Mechanism (Article 12). Articles 3 and 17 are generally thought of as being based at the national level, while Articles 6 and 12 are more project-based.

Article 3.3 includes in determinations of net national emissions "afforestation, reforestation and deforestation" (ARD). Under Article 3.3 carbon implications of forestry activities since 1990 are quantified by the subtraction of 2008 carbon stocks from 2012 stocks. Since ARD represent but a portion of forestry activities, Article 3.3 addresses limited forestry activities. After the Protocol enters into force, the Parties are authorized by Article 3.4 to consider whether additional activities such as the preservation, conservation and management of forest resources or other human-induced activities such as agricultural soils management can be included in determinations of net national emissions, possibly in the first CP. Unfortunately, details of the Protocol mechanisms still are being worked out, long after the targets were agreed to. If definitions, interpretations and guidelines end up changing the way the Protocol would affect nations, compared to the nation's expectations when they agreed to specific Protocol targets, then the targets may not longer be considered equitable.

Reactions to the forestry provisions in the Protocol vary. Some parties oppose forestry activities making up more than a small portion of carbon reduction activities, believing that this is essentially a "band-aid" approach that fails to address fossil fuel emissions. Other parties would limit the amount of forestry "credits" due to concerns about scientific credibility (although it should be noted that of the major challenges discussed later, only permanence is unique to forestry). Some nations would limit forestry activities because they do not want other nations to be able to use such credits to keep the cost of compliance lower. Environmental and conservation group positions vary, with some seeking to limit forestry severely while others seek to ensure credible activities. Domestic governmental considerations are also very important. While the U.S. has signed the Protocol, the U.S. Senate must ratify it. Senate Resolution 98, passed by a vote of 95:0 in 1997, leads one to question whether the U.S. will ratify the Protocol and, if the U.S. fails to ratify the Protocol, whether there will be sufficient support by other nations to bring it into force.

Regarding the Clean Development Mechanism (CDM), there is concern that long-term forestry projects could restrict economic development, but this must be balanced against the benefits from economic assistance and from preserving ecological resources (Schlamadinger and Marland, 2000). Some developing nations may prefer economic assistance to be in the form of energy technologies.

Estimates of Potential Carbon Sequestration by Anthropogenic Activities

The technical potential for forest carbon management is great, able to counteract a meaningful portion of anthropogenic contribution to CO_2 in the atmosphere. The Intergovernmental Panel on Climate Change (IPCC) estimated that, during 1995-2050, slowing deforestation, promoting natural forest regeneration and global reforestation could offset about 60 to 90 billion tons (12-15%) of fossil fuel-related CO_2 emissions (as carbon, C), with three-quarters of this in the tropics (Brown et al., 1996). The reduction of deforestation-related CO_2 emissions is especially important because these emissions currently represent about 20 percent of man-made CO_2 emissions and have made up one-third of man-made emissions since 1850 (IPCC, 2000).

The temperate region countries of the world, during the first CP, will most likely be a net source of carbon through ARD in Article 3.3, with estimates ranging from being a source of 99 million tons carbon/year to being a sink of 41 million tons carbon/year (IPCC, 2000). In August 2000, many nations submitted data on the expected national carbon consequences of Articles 3.3 and 3.4 in the first CP, with some projecting high potential carbon biotic management benefits.

Forestry activities will not be "the" tool to address greenhouse gases. There is limited land available to be protected or reforested because of population growth, agricultural needs, etc. Further, the "carrying capacity" for carbon is limited and ecosystems eventually can become saturated with regard to storing carbon. The IPCC (2000) reported that newly planted or regenerating forests in the absence of major disturbances will continue to uptake carbon for 20 to 50 years or more after reestablishment. However, even after saturation would occur, biomass can be used directly as a fuel, reducing the use of fossil fuel (Sampson et al., 1993). In addition, carbon can be sequestered in some wood products for long periods.

Land-use activities can help, especially in the near term, to solve the issue of increasing atmospheric CO_2, at a reasonable cost and with secondary environmental and other benefits. They also can allow more time for developing new energy technologies that require long lead times, including lower-emitting energy technologies, and to avoid the premature retirement (at high costs) of existing energy infrastructure.

Key Issues and Uncertainties

Some of the key issues of the Protocol and forestry are discussed below.

1. **Duration/Permanence**

Critics of forestry efforts observe that these do not provide the same long-term benefits as reducing energy-related emissions. This can be true if stored carbon is released within a few decades, due to natural disaster, land ownership changes, etc. This is largely an issue unique to biotic projects. However, there also are ways to address the issue of duration or permanence. Ton-year accounting is difficult and arbitrary, disadvantaging forestry projects. Preferable is risk reduction, through such practices as: project pooling, buffers and contingency credits (*i.e.*, making the project larger as a safety margin), and external insurance. The best approach, scientifically, is full carbon accounting, the complete accounting of all changes in carbon stocks in all important carbon pools on all lands. In this approach, any shortfall must be addressed by purchasing credits or undertaking other projects. It should be kept in mind that even if a forestry activity is short-lived, e.g., a few decades, it could be valuable, since it may serve as a bridge to future measures.

2. **Activities Other than Afforestation, Reforestation and Deforestation (Article 3.4)**

Article 3.3 by itself will only address a small portion of lands affected by direct human-induced activities, thus leading to accounted-for emissions and sequestration being much different than that experienced by the atmosphere. A more comprehensive accounting will be needed to fully establish incentives to reduce emissions from the land-use sector and to encourage sequestration

of CO_2 through activities such as forest restoration. To consider the impacts of land use decisions on the atmosphere in a balanced way, full carbon accounting, joining Articles 3.3 and 3.4 together, must be adopted. It will be a challenge for many nations to collect the necessary information on their forests and other lands, but with international cooperation this obstacle can be overcome. To create a complete accounting system requires Article 3.4 to address numerous activities in categories such as forest management, agroforestry, urban land management, agricultural land management and rangeland management (Watson et al., 2000). For the developed nation signatory parties, forest management and agroforestry were estimated in 2010 to have the potential to increase carbon stock by 100 and 12 million tons carbon per year, respectively (Watson et al., 2000).

In August 2000, the U.S. reported a large potential (about 300 million metric tons C) for Article 3.4 activities (U.S. Department of State, 2000), which caused controversy amongst those who would prefer a lower level of forestry/agriculture/rangeland management "credits" for the U.S. This became one of the most contentious aspects of the 6th session of the Conference of the Parties (COP) to the Kyoto Protocol in November 2000. At these negotiating sessions and in subsequent meetings into December 2000, the European Union and the U.S. unsuccessfully tried to address Article 3.4 and other issues, reportedly almost coming to an agreement that would have limited U.S. credits under Article 3.4 in the first CP to well under 50 million metric tons C.

3. **Leakage**

Leakage occurs when man's efforts produce a direct greenhouse gas benefit in one location/time but also a contradictory (or amplifying) effect elsewhere. For example, if one area of forest is protected or increased, negative leakage would occur if, due to demand for forest products, a corresponding area of forest elsewhere was harvested, reducing the net greenhouse gas benefit. Positive leakage can occur where an activity leads to amplified or "spillover" benefits in other situations. Leakage is an issue for all types of projects, including energy projects (Trexler and Associates, 1997; Chomitz, 2000; Danish and Rotter, 2000).

Leakage can be avoided or minimized by proper project design, including: 1) maintaining needed resources and providing socioeconomic benefits, including alternative economic opportunities, to local populations; 2) monitoring key products, such as timber extraction, to quantify and reduce carbon benefits if necessary; and 3) monitoring deforestation rates during the project life and quantifying them to determine actual project carbon benefits. Many projects clearly present no leakage concern to begin with; e.g., the UtiliTree Carbon Company's projects in the Mississippi River Valley of the U.S. do not significantly alter the millions of acres of agricultural land in the region and do not contain a commercial forestry aspect that would alter forest product markets (Kinsman et al., 2000).

4. **Definitions - Forest and Reforestation**

Lund (1999) found 130 different definitions of forest, which were based on land or canopy cover, legal criteria, land use, etc. The choice of definition is very difficult but crucial since major changes in carbon stock, both positive and negative, can be unaccounted for under different definitions. For example, suppose that an area is defined as forest if it has 75% canopy

cover. Then an area with 74% canopy cover can be deforested without emissions being addressed, or an area with no forest cover could be expanded to 74% without sequestration being credited. Many nations suggest tailoring the definition to specific national circumstances. Similarly, there can be many different interpretations of reforestation. The most controversial issue related to reforestation is whether to include the harvest-regeneration cycle as deforestation and reforestation. Unless both are fully accounted for, resulting credits or debits will be misleading. Specific rules to address these situations, which might be relevant only during the first CP, are being considered.

5. **Direct Human-Induced**

The terrestrial biosphere is believed to be accumulating about 2 billion tons of carbon annually, much of it in the temperate regions of the Northern Hemisphere (Watson et al., 2000), and much due to natural regrowth after disturbance as well as indirect fertilization by CO_2 and nitrogen. It would be possible that a nation with substantial biotic sinks could balance substantial man-made greenhouse gas emissions and this could relieve a country of the need to address its fossil fuel emissions. Article 3.3 of the Protocol only allows "direct human-induced" activities since 1990 to count toward mitigating emissions. It can be difficult to distinguish the portion of observed carbon stock change that is directly human-induced from that caused by indirect and natural factors (Watson et al., 2000). However, one could argue that if trees are planted on land that was unforested, then the human influence has in effect created the opportunity for the entire carbon stock increase.

6. **Activities in Article 12**

Watson et al. (2000) found that trial forestry joint implementation projects, mostly with tropical partner nations, exist in about 20 nations. The Clean Development Mechanism (CDM) does not explicitly include or exclude forestry projects but a group of 14 Central and South American nations has rejected claims that forestry projects are ineligible under Article 12 (Costa Rica, 2000). Reducing deforestation, primarily in the tropics, is one of the greatest environmental challenges that the world faces and forest conservation projects are a valuable supplement to reducing fossil fuel emissions. The CDM can help developing nations achieve sustainable development and provide non-greenhouse gas environmental benefits.

7. **Additionality**

Additionality, or supplementarity, is a criterion that is particularly an issue for international projects (of all types, not just forestry) in nations that are not required to take on emission reduction commitments. If a project in a nation without a commitment fails to create valid GHG credits, but a party in another nation claims such credits, then net GHG would likely be higher. Additionality is addressed in both Articles 6 and 12 of the Kyoto Protocol. The key additionality issues are financial and emissions additionality. Financial additionality can be relevant for government assistance if existing financial assistance is simply reprogrammed, but private sector investment in forestry activities should only increase mitigation efforts in developing nations. Financial additionality can be a murky issue, if a project has a commercial aspect to it, but only went forward due to the additional impetus of the GHG management aspect. Emissions

additionality requires that net emissions be lower with the project or activity than without it; careful evaluation of project baselines/reference cases or benchmarks can address emissions additionality.

8. **Maintaining Benefits While Reducing Risks**

While there are great opportunities for land-use projects to result in significant benefits outside of their GHG impact, there is also some risk of unintended or otherwise adverse impacts. The issue of primary concern is the conversion of native ecosystems to other systems that store more carbon but are poor in terms of biodiversity (e.g., conversion of grasslands to timber plantations). A well-designed program will ensure that the vast majority of the adverse impacts are avoided while maintaining the opportunities.

Principles for Credible Forestry Activities

The following principles will help in development of credible projects and programs:

- Carbon benefits must be real, compared to reasonable baselines or reference cases.
- Only actual project results can be used to comply with emission reduction requirements.
- Projects must be monitored and verified routinely.
- The carbon accounting system should provide transparent, consistent, comparable, complete, accurate, verifiable and efficient reporting of changes in carbon stocks (Watson et al., 2000).
- Monitoring should balance cost and accuracy to attain reasonable accuracy.
- Projects should be consistent with maintaining or enhancing ecosystems and biodiversity, while avoiding generally the conversion of native ecosystems.
- Negative leakage must be evaluated, quantified and addressed in project accounting.
- Full carbon accounting is necessary over a long period of time for all lands with forestry activities related to the Protocol to address the issue of permanence.

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