Chapter I

CDM forestry and the ultimate objective of the climate convention[1]

Michael Dutschke

Abstract

In its Article 2, the U.N. Framework Convention on Climate Change policymakers gave themselves a long-term dynamic mandate under uncertainty. Taking the example of forestry activities in developing countries, the present chapter discusses whether land-based climate change mitigation measures in the context of compensation mechanisms for human-induced greenhouse gas emissions are covered under the UNFCCC's ultimate objective. Both the problem of climate change and human intervention act over long, yet finite timeframes. The chapter argues for taking a dynamic 100-year timeframe as reference for present-day activities. It concludes that increasing biotic carbon storage is legitimate for measures that contribute to biodiversity conservation, as long as it does not serve as a pretext for neglecting technological change. Among all forestry options, the list of priorities should be avoiding deforestation and devegetation, sustainable forest management, and afforestation. The problem of saturation can be encountered by the combination of forestry with the increased use of wood products and bioenergy. Concluding, the chapter gathers criteria for forest climate activities in the post-2012 regime.

1 Introduction

Forestry as a means of climate change mitigation activities has often been criticized on the grounds that, compared to all other carbon reservoirs, biotic terrestrial carbon stocks are very dynamic, and they are directly influenced by climate change itself. Much criticism against land-use activities under the Clean Development Mechanism (CDM) has been based on the argument that the use of biotic carbon "sinks" for compliance was not covered by the long-term objective expressed in Article 2 of the UN Framework Convention on Climate Change, arguing that developing country parties were unable to guarantee the permanence of land use mitigation projects (Meinshausen and Hare 2000), and that any duration shorter than permanence ("'not permanent' or 'permanent, but not additional over all time"') would not comply with the ultimate objective of the Climate Convention.

Anthropogenic climate change has a time horizon of decades to centuries. Land use is an important source of the greenhouse gases CO_2, CH_4 and N_2O. On the positive side, land use activities have the potential to remove important amounts of CO_2 from the atmosphere to the vegetation cover and to avoid future net emissions from this reservoir. While the role of forests as a source is uncontested, forest carbon source reduction and CO_2 removal by sinks as a means to mitigate climate change are con-

[1] First published in Mitigation and Adaptation Strategies for Global Change Vol. 12, Issue 2: 275-302

tentious. The UN Framework Convention on Climate Change (UNFCCC) mentions the enhancement of sinks as a commitment in its Article 4 (b) and (d). The Kyoto Protocol to the UNFCCC recognises the role of sinks in Art. 3.3 and 3.4, related to the industrialized country Parties enumerated in its Annex B that have taken oven emission limitation and reduction targets. For the first Kyoto commitment period, under the CDM only afforestation and reforestation activities are eligible for generating certificates that can be accounted against Annex B targets. Currently, the CDM is the only Kyoto mechanism that allows accounting for climate change mitigation in developing nations. Its intention is "[. . .] to assist Parties not included in Annex I in achieving sustainable development and in contributing to the ultimate objective of the Convention [. . .]". What this means for project activities is that these shall neither be in conflict with the elements included in the objective, nor with its timeframe. In this article, project permanence will not be understood in the sense of *infinity*, but related to the timeframe indirectly defined in the Convention. The current article takes a step back from the actual climate regime. It takes into account the CDM modalities and procedures, but aims at the long-term perspective with views to a post-Kyoto world.

This article will concentrate on the following issues:

– Forests in developing countries
– The role of time in carbon storage, and
– The criteria land-use based climate change mitigation activities need to fulfill in order to serve the ultimate objective of the Climate Convention.

2 The ultimate objective and its elements

UNFCCC Article 2 is complex, because it touches on a number of interrelated issues that the following paragraphs attempt to disentangle.

> "The ultimate objective of this Convention and any related legal instruments (. . .) is to achieve (. . .) stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level 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."

The following elements can be distinguished:

I. The overall objective is to prevent dangerous anthropogenic interference with the climate system.
II. This is to be done by stabilizing the level of GHGs in the atmosphere. III. The timeframe of stabilization should,
   (a) Allow ecosystems to adapt naturally to climate change;
   (b) Ensure food production;

(c) Enable sustainable economic development.

There is no common understanding about what level of interference can be considered "dangerous". A timeframe is defined by natural adaptation, food production and sustainable development, every single of which underlie a variety of factors and interpretations. The 2002 World Summit on Sustainable Development defined an umbrella concept of essentials called WEHAB – Water, Health, Agriculture and Biodiversity, adding coastal areas. WEHAB comprises the three areas identified in UNFCCC Article 2 and is intended to help operationalize the concept of dangerous interference (Patwardhan et al. 2003). We will examine Article 2 sub-objective by sub-objective, and assess which role forestry could assume in developing countries, with a focus on timing and duration issues.

2.1 Preventing dangerous interference with the climate system

The majority of scientists agree that dangerous anthropogenic interference with the climate system is mainly related to GHG emissions. No definition has yet been agreed, at what point anthropogenic interference with the climate system shall be considered *dangerous*. Climate change will affect different countries, regions, and sectors in different ways. Some sectors in specific countries (like food production in parts of Russia) may even benefit from higher temperatures or increased rainfalls, while an increased sea level will threaten the existence of whole island states. Both types of countries will support different concepts of "dangerous human interference". Ultimately, any risk definition on a global level will be a political one (Ott et al. 2004). Unless there are certain absolute temperature values that trigger major catastrophic events, the rate of temperature change seems to be more important than the ultimate temperature level after stabilization is reached. The German Advisory Council on Global Change suggests that the global mean temperature should not stabilize at a level higher than 2 degrees above pre-industrial levels, given that it has already increased in 1.4 degrees since the beginning of industrialization. The rate of change acceptable is estimated at 0.2 degrees per decade (Graßl et al. 1995). Latest findings indicate that, in order to achieve this goal, GHG concentration levels should remain below 400 ppm CO_2 equivalents in order to achieve the 2-degree goal (Meinshausen and Hare 2004). This result contradicts the current EU negotiation position that aims for stabilization at 450 ppm.

2.2 Stabilizing GHG concentrations in the atmosphere

A stabilization target limits absolute total atmospheric loads to the rate of natural CO_2 absorption by biosphere and oceans, plus the uptake by persistent geological sinks. It has been questioned, whether a concentration target can be the ultimate objective, rather than a tolerable human-induced temperature limit above the pre-industrial level

(Graßl et al. 2003). On the other hand, trace gas concentrations can be measured and attributed to a higher degree of confidentiality than global temperature variations. This pragmatic approach however limits the imposition of possible refinements. Several more gases than mentioned in Annex A of the Kyoto Protocol can be subject to future regulation, most prominently water vapor, which shows different levels of radiative forcing, depending on which level of the atmosphere it occurs. Several anthropogenic precursor gases in the atmospheric chemistry can be identified and limited. What is not considered under Article 2 is the radiative forcing effect of land use, even though it may potentially reach orders of magnitude comparable to the effects of afforestation on a specific area (Pielke Sr et al. 2002; Marland et al. 2003). It is interesting to observe that concerns about albedo effect (Hadley-Centre 2000), surface roughness and surface heat fluxes (Marland et al. 2003) are only uttered in relation to forestry land use, while any large-scale land use intervention may cause similar effects, like road infrastructure, airfields, water reservoirs, or large urbanizations, as well as agriculture. Today's knowledge does not seem sufficient to reliably quantify and attribute these effects to determined activities. Once science advances on the issue, an amendment to the Climate Convention may be needed, thereby changing the metrics for the achievement of the ultimate objective.

2.3 Impact of forestry on GHG concentrations

Presently, around 23 percent of all CO_2 emissions emanate from worldwide deforestation and devegetation. Most prominently, Brazil and Indonesia contribute to the destruction of natural forests. There are even opinions that data on the global warming effect of deforestation understate, on the grounds that the IPCC calculation of relative global warming potentials (GWP) underestimates CH_4 and Kyoto does not account for CO_2 emissions, acting indirectly towards global warming, by hindering the decay of CH_4 in the atmosphere (Fearnside 2002a). On the other hand, there are doubts whether industrial emissions can really be compared to land-use related ones, considering that forests are living ecosystems. Much destruction is followed by spontaneous regeneration, leading to increased carbon uptake. This effect depends on the cause of destruction and its mid-term effects (Chazdon 2003). Natural succession in the tropics has the potential to recover carbon stocks on deforested areas within 15–30 years, while from biodiversity and soil indicators human intervention can be traced back over several centuries (Chazdon 2003).

If the area deforested is used for reforestation with fast-growing commercial species, it is likely that the eventual level of carbon stocks does not reach the biological potential of the area. The long-term effect depends on the size of the plantation and the proximity of natural biodiversity reservoirs. Examples for this type of deforestation with the purpose of establishing plantations can be found in Indonesia, where the remaining natural forests are seriously threatened in many regions.

Long-term destruction occurs, if after deforestation the land is used for cattle grazing, or, even worse, for mining activities that drain water resources and contaminate soils and water with heavy metal residues. These activities may lead to irreversible damage on large areas. A direct comparison between the emissions due to burning of fossil fuels and the ones related to forest destruction is inconsistent, because there are chances for recovery in the destruction of forests as depicted above, It would be interesting to quantify anthropogenic deforestation and degradation damages compared to the actual recovery induced by them.

The overall dynamic effect of deforestation on carbon fluxes F_{total} is thus

$$F_{total} = C - V - D + R_{nat} + R_{anth}$$

whereby *C* is inorganic “black carbon” deposited after a fire, *V* is the carbon embodied in the part of the aboveground vegetation destroyed, *D* is the soil carbon deposition deferred by human disturbance. R_{nat} is the increased natural re-growth induced by removal, and R_{anth} the carbon embodied in the anthropogenic use of the area, if any.

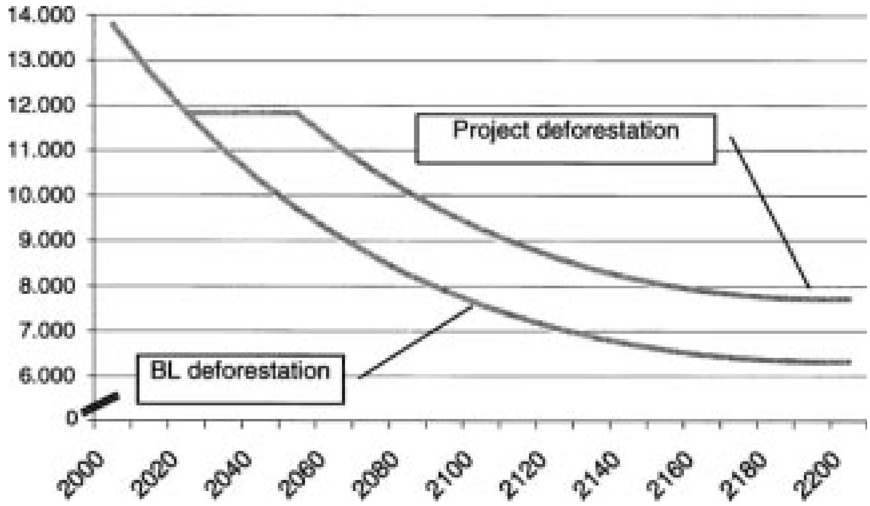
2.3.1 Deforestation and devegetation avoidance baselines and permanence

Deforestation can be explained by the low value of unused land. In developing countries, there is a high social discount rate. Thus, incentives for forest protection need to be more profitable for the landowner on the short term than alternative uses for cash crops or pastures.

Deforestation avoidance has its highest immediate and long-term benefits if started at the earliest point in time possible. Its permanence can however only be granted, if ecosystems’ adaptation is achieved. In case combined efforts of energy, transport, and land use mitigation fail to achieve this target, the effect will be aggravated by GHG emissions from a part of the earth’s natural forests and other fragile ecosystems. On the other hand, failing to protect natural forests will result in an emissions increase at an earlier point in time. Some observers argue that deforestation does not matter, because today’s sinks will turn to sources anyway during this century (Hadley-Centre 2000; Cramer et al. 2001). This statement is imprecise, as it does not attach any value to time. Climate change is only *one* driver of deforestation. Besides, areas that are today most threatened by deforestation will not necessarily be the ones most threatened by future climate change, and vice-versa.

Deforestation avoidance bears more similarities with avoided fuel emissions. One ton of fossil fuel avoided for energy production may be used in the future and thereby delay the end of oil drilling. Emission avoidance in this case could create temporal leakage. The same could happen with the hectare of forest protected and chopped down in the future.

Figure 1: Permanent gain of a 30 years forest conservation



If we assume however the world economy to de-carbonize, then the resource will not be used up, and future energy demand will be covered by less fossil inputs. The same is true for deforestation: The erosion of the terms of trade for goods from agriculture and forestry and the diminishing GDP contribution of the primary sector in developing economies are expected to lead to decreasing deforestation rates over time (Sathaye et al. 2003).[2] The benefit from deforestation avoidance will thus be permanent, because one hectare of forest saved from deforestation for one or two decades will be exposed to a lower deforestation rate in the future. In the example in Figure 1, an area of 15,000 ha was forested in 1990, with a 10-year deforestation of eight percent detected in the year 2000, a rate assumed to decline to zero until the end of this century. A conservation project protects the area against deforestation between the years 2020 and 2050. In our example, 7,710 ha will remain in 2100, as compared to the baseline case of 6,322. Temporary protection has led to a permanent carbon gain. In real life however, it may be difficult to clearly attribute this gain to the protection activity, if it went on for a short period only.

[2] Sathaye et al. use 1990s deforestation trends as a basis for estimating those until 2100. E.g., before 2020 they expect the South American deforestation trend to decrease, for which there are no indications in the actuality. Anyway, the assumption that economic development and deforestation trends are negatively related is a valid thesis.