Forest conservation and climate change policy

Deforestation is a major issue, overlooked in climate policy negotiations until recently, although natural forests play vital roles in climate protection. Forests are carbon reservoirs, if deforestation continues at current rates, 12 million hectares annually, major carbon reservoirs will become atmospheric carbon and exacerbate climate change. **SEAN WEAVER** reports on what needs to be done to stop this trend.

Deforestation is a vital climate change issue with a fifth of human-induced carbon emissions arising from deforestation. The rest come from burning fossil fuels. Addressing deforestation has so far been overlooked in international climate policy negotiations. This article reviews the science behind the role of natural forests in regulating the earth's climate, and assesses relevant national and international policies for maintaining forests.

Policy Context

"Avoided deforestation" was excluded from the Kyoto Protocol at the 6th Conference of Parties (COP-6) in 2000. The reasons for this are complex but relate to the way forest projects tend to be categorised in climate change policy language as carbon sink projects, and the fact that carbon sink projects were pushed to the margins of the Kyoto regime during negotiations between member states at COP-6.

By excluding "avoided deforestation" from the Kyoto Protocol, the intergovernmental climate change policy community gave a big green light to logging and forest conversion activities around the world (particularly in the tropics) at a time when we most need a major international push to conserve what remains of natural forests, especially large forest areas like the Amazon basin and Borneo. The Rio Earth Summit failed to deliver a forest conservation convention in 1992 and then the Kyoto Protocol and the World Summit on Sustainable Development failed a decade later. In the meantime logging and land conversion continues apace and a great opportunity is being lost.

In an attempt to remedy this, the Governments of PNG and Costa Rica made a submission to the UN Framework Convention on Climate Change (UNFCCC) to address this policy gap. The convention agreed to put it on the agenda at the 11th Conference of Parties in Montreal in December 2005. The result – Agenda item 6: "Reducing emissions from deforestation in developing countries: approaches to stimulate action" – now called the Montreal Mandate. This marked the start of a two-year policy development window within the UNFCCC (the deadline for a decision being December 2007), and has set in motion a scramble of activity among scientists and analysts seeking to plug this large gap in climate policy.

Forests & Climate Change Mitigation

At the broadest level the United Nations Framework Convention on Climate Change (UNFCCC) invites the international community to work together to stabilise atmospheric CO_2 concentrations at a level that will "avoid dangerous anthropogenic interference of the climate system" (Article 2). From a geophysical point of view there are two ways to lower atmospheric CO_2 concentrations:

- Stop carbon reservoirs getting smaller by slowing their transformation into atmospheric CO_2;
- Help increase the size of carbon reservoirs by soaking up carbon from the atmosphere (sequestration).

Since 1850, about 80% of human-induced carbon emissions have come from burning fossil fuels, which is why the Kyoto Protocol (a mechanism of the UNFCCC) focuses primarily on reducing fossil fuel use. The remaining 20% of emissions stem from "land use change," and are mostly caused by "deforestation." The global task of cutting greenhouse gas emissions, therefore, needs to include measures to slow deforestation rates, particularly in tropical countries.

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In both cases carbon reservoirs are being turned into atmospheric carbon at a rate that is threatening to cause dangerous interference with the climate system. Current CO_2 concentrations are higher than they have been over the last 420,000 years. More recent research by the European Project for Ice Coring in Antarctica pushes this date back to 650,000 years. According to this study, current CO_2 concentrations are 30% higher, CH_4 (methane – a much more potent greenhouse gas) is 130% higher; and the rate of CO_2 increase is 200 times faster than at any time in the last 650,000 years. The

Intergovernmental Panel on Climate Change also points out that current atmospheric CO_2 concentrations are probably higher than any time in the last 20 million years.

Carbon Reservoirs

There are two types of carbon reservoir.

- Fossil carbon (e.g. coal, oil, natural gas, limestone)
- Living carbon (e.g. forests, soil carbon, marine ecosystems)

The loss of natural forests amounts to the loss of a living carbon reservoir, and is currently occurring at a rate of about 15 million hectares annually in the tropics.

The forest carbon reservoir:

- Interacts dynamically with the climate system;
- Sometimes behaves as a source of atmospheric carbon (releasing carbon to the atmosphere); and,
- Sometimes behaves as a carbon sink (sequesters atmospheric carbon by turning CO_2 into wood).

Forests and the Climate System

The forest carbon reservoir provides many ecosystem services, several interacting with the climate system. These include:

- Elevating soil moisture
- Reducing rain impact on soils
- Influencing the planetary boundary layer
- Reducing surface erosion
- Maintaining lower albedo (reflectivity)
- Moderating evapotranspiration
- Reducing sunlight penetration to the forest floor
- Maintaining local precipitation rates
- Slowing and elevating winds
- Inhibiting anaerobic soil conditions
- Increasing the water holding capacity of the ecosystem
- Altering sensible and latent heat fluxes (keeping the land surface cooler)

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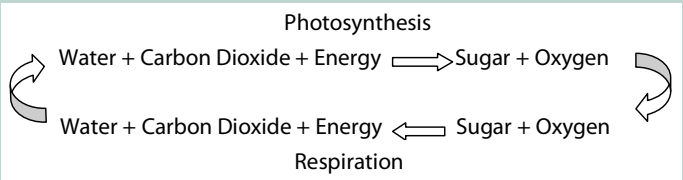
Protecting the forest carbon reservoir produces two sets of benefits for climate change mitigation. It keeps carbon out of the atmosphere and maintains the flow of important climate-related ecosystem services.

Source & Sink

Forests act as a carbon source (releasing carbon to the atmosphere) and a carbon sink (absorbing it from the atmosphere) depending on the relationship between the relative rates of photosynthesis and respiration in the forest ecosystem as a whole. Photosynthesis in plants provides a means of capturing (sequestering) carbon dioxide (CO_2) from the atmosphere and transforming the carbon into a liquid or a solid. It forms the foundation of food webs by capturing a portion of the Sun's energy in organic chemical bonds (sugars) that can be released at a later time in a different location in the organism and/or ecosystem to do physiological work. Oxygen is a by-product of photosynthesis.

The core of the carbon cycle. A simplified representation of the reciprocal relationship between photosynthesis and respiration.



The release of this stored energy takes place in the biochemical process of respiration in both plants and animals, where energy to drive various biochemical reactions is made available. Carbon dioxide is a by-product of respiration. The relationship between photosynthesis and respiration is a dynamic reciprocal centre-piece in biological systems and the carbon cycle. Its key function is energy capture, storage and release.

The carbon cycle is a bio-geo-physical process of capture, accumulation and storage of carbon stocks, and the flows of carbon between these stocks through the biosphere, hydrosphere, lithosphere and atmosphere (in solid, liquid, and gaseous forms). This cycling of carbon occurs at various temporal and spatial scales, from within a single cell (with a flux rate of minutes) to globally (with a flux rate of seasons, years, decades, centuries, millennia, and millions of years).

The fossil fuel energy that is released in combustion engines to drive the global economy is the same Sun's energy that was captured millions of years ago in photosynthesis. It was stored first as sugar molecules and then as wood and peat and finally fossilised to become oil, coal, and natural gas. The key difference is, this carbon has been kept out of the short-term carbon cycle for millions of years. We are now releasing this carbon to the atmosphere at an unprecedented rate and disrupting the balance of the short-term carbon cycle, thus causing climate change.

When the total rate of respiration outpaces the rate of photosynthesis, the ecosystem becomes a carbon source (i.e. there is a net loss of CO_2 to the atmosphere). When the total rate of respiration is slower than the rate of photosynthesis, the ecosystem becomes a carbon sink (i.e. there is a net gain of carbon biomass in the system).

When a forest is developing from a previous disturbance (succession), photosynthesis outpaces respiration and the system behaves as a carbon sink. A plantation forest is a

managed version of forest succession and is also a carbon sink. Forests do not grow indefinitely however, eventually they mature to where the volume of biomass approaches a maximum level that can be sustained in that particular location (depending on factors like water and nutrient availability). In a mature forest the rate of both respiration and photosynthesis tend to cancel each other out, and as a result the forest biomass stabilises. At this point, the forest system becomes a reservoir only, being neither a source or a sink. If this forest were to dry out (e.g. as a consequence of drought) or was cut down, it could change from being a carbon reservoir to a carbon source. The carbon then emitted to the atmosphere is both:

a. carbon from wood in trees that die and decompose; from wood which is burnt, or used in products like paper or building materials and then decompose after they have completed their product life (which in biological timescales is usually relatively short i.e. decades), and

b. carbon from the soil (a soil under a forest can usually store more carbon than the same soil without a forest).

Mature natural forests are prime targets for logging interests because this is where the biggest trees and cheapest timber is found. These mature forests are also valuable carbon reservoirs, providing important climate-related ecosystem services – but the reservoirs are disappearing at a rate of 12 million hectares a year. The forests also contain a vast amount of biological diversity, providing various ecosystem services and non-wood forest products. They are also the homes of many indigenous peoples.

International Agreements

Avoiding deforestation was marginalised in the Kyoto Protocol negotiations in order to place more emphasis on reducing carbon emissions from their source (i.e. protecting carbon reservoirs). *But mature forests are carbon reservoirs, and slowing the rate of deforestation amounts to a reduction of carbon emissions at source*. It's just a different source from a tailpipe or factory chimney.

If we do not mitigate climate change (i.e. significantly reduce carbon emissions) we stand to lose the carbon, biodiversity, and ecosystem services contained in rainforests, because global warming is leading to stronger El Niño climate patterns in the Pacific. This is lengthening dry seasons in rainforest regions, resulting in drought and dieback and can lead to these regions switching from being a net carbon reservoir (and sometimes sink) to a net carbon source. Droughts have been intensifying in both South East Asia and Amazonia in recent years, accompanied by large scale forest fires – particularly in the 1997/8 season which coincided with a strong El Niño event. Temperature increases in tropical regions have risen since the 1970s by an estimated average of 0.26°C per decade, and a third of Amazon forests became susceptible to fire during 2001.

Carbon Market Opportunities

Many at risk forests are in developing countries that are under great pressure to earn foreign exchange to meet interest payments on foreign debts. This is a big incentive to exploit natural forests because to conserve them would mean the loss of a great source of income

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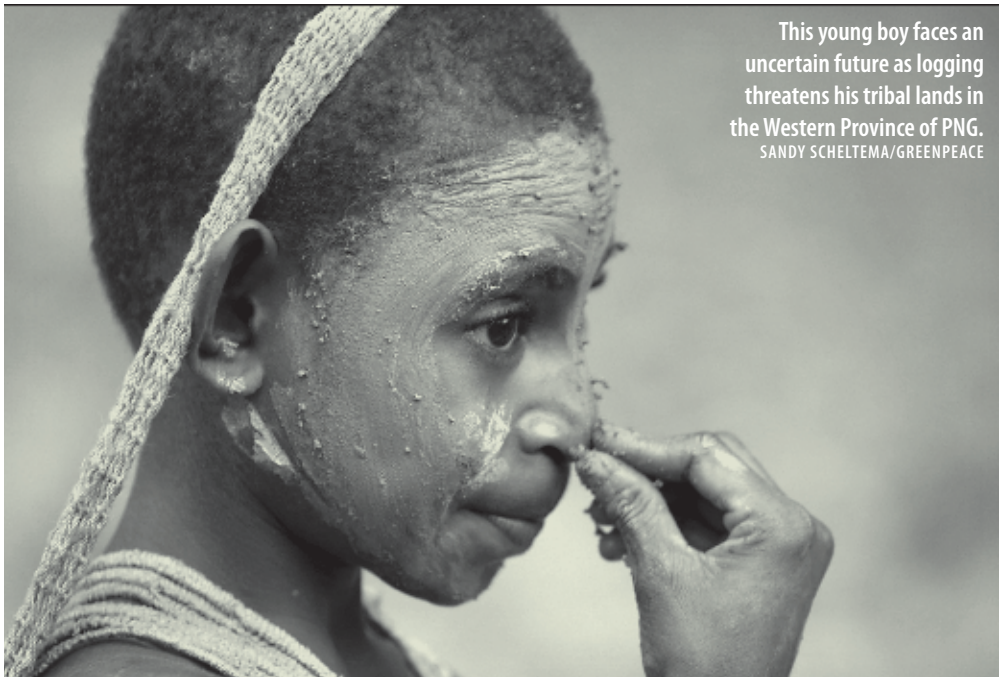
Destroying tropical rainforest on the Transamazonian Highway, Brazil.



This young boy faces an uncertain future as logging threatens his tribal lands in the Western Province of PNG.
SANDY SCHELTEMA/GREENPEACE

Developing countries could benefit from their comparative advantage in gaining carbon credits through avoided deforestation and trade in carbon markets

from timber and agricultural or forestry development on converted lands. This means an international agreement on forest conservation would need to be accompanied by measures to relieve the economic pressures on developing countries forests and assist countries in their development goals, without loss of their forests.

So if rich countries want poor countries to play their part in protecting the global climate commons, they will need to help finance it, or create conditions to remove the pressure to exploit forests.

One way of doing this would be to adopt an intergovernmental policy on avoided deforestation that awarded carbon credits to nations that protected forest carbon stocks in natural forests. These carbon credits could then be sold on the international carbon market for hard currency, which could be used to finance sustainable development in communities at the forest margin in developing countries. Alternatively, developing countries could enter into direct barter arrangements with developed nations seeking to help protect the forests. In other words, developing countries (non-Annex I countries under the UNFCCC) with large natural forest endowments could undertake bi-lateral funding or trade deals with developed countries (Annex I countries) to reduce deforestation rates.

It is crucial however, that we do not allow forest conservation (or reforestation) efforts to distract us from the need to cut fossil fuel emissions. After all, fossil fuels account for 80% of our problem. This is not an "either/or" situation. We must include forest protection as an integral part of an intergovernmental effort to reduce greenhouse gas emissions.

A climate policy regime that included incentives to protect natural forest carbon reservoirs (as it currently does for fossil fuel emission reductions), would enable developing countries to actively participate in global climate change mitigation efforts, because this is where most of the deforestation is occurring. In this way developing countries could benefit from their comparative advantage in gaining carbon credits through avoided deforestation and trade in carbon markets with some standing. Currently there is little opportunity for developing countries to benefit from the carbon trading system, which is why PNG and Costa Rica put this item on the UNFCCC agenda in 2005.

Mechanisms will need to be built into any future intergovernmental protocol on forests to prevent industrialised nations from using reforestation and forest protection projects as tradeoffs against any realistic fossil fuel emission reductions. New Zealand fell into this trap by pinning its mitigation hopes on credits from forestry projects. But an official recalculation of Kyoto-compliant forest carbon stocks in 2005 showed:

a. New Zealand was in carbon deficit instead of credit (to the tune of about NZ$500 million), and consequently

b. Because New Zealand relied on forest credits to meet its Kyoto target, it failed to invest in effective emissions reduction strategies in agriculture and fossil fuel sectors. If it had invested sufficiently in the latter, the cost of meeting its Kyoto target would have been substantially reduced along with its carbon footprint.

There are many opportunities to develop policy solutions for emissions from deforestation but it will require a concentrated effort to recognise the value of forest-based ecosystem services to the global climate commons, and the threat to these services. It will also require significant international negotiations to enable developing countries to achieve their development goals without damaging the climate system further for all nations. Above all, we need to waste no further time and act as a world community to stop killing the goose that lays the golden eggs. PE

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