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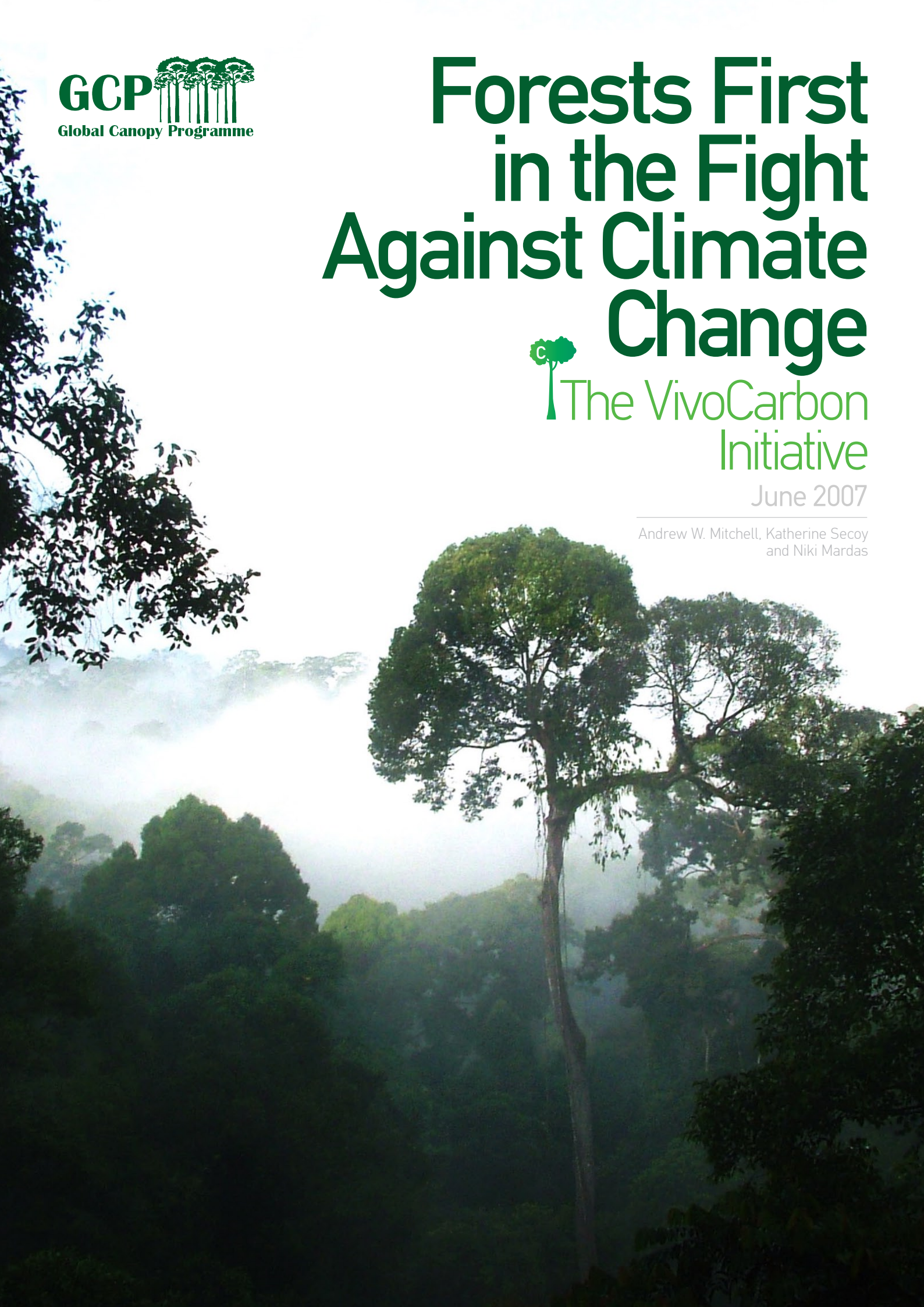
Forests First in the Fight Against Climate Change

The VivoCarbon Initiative

June 2007

Andrew W. Mitchell, Katherine Secoy and Niki Mardas



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First published May 2007
2nd edition June 2007

Published by:
Global Canopy Programme
John Krebs Field Station
Oxford OX2 8QJ
UK

To be cited as: Mitchell, A. W., Secoy, K. and Mardas N. (2007). Forests First in the Fight Against Climate Change. Global Canopy Programme

Forests First in the Fight Against Climate Change

Human induced climate change is real and upon us. We cannot avoid dangerous warming without action on deforestation, which causes 18-25% of global carbon emissions – 2nd only to energy.

Forests offer the single largest opportunity for cost-effective and immediate reductions of carbon emissions. This is confirmed by the Stern Report of 2006, and the McKinsey and IPCC Reports of 2007.

It's not just about carbon! Forests are giant global utilities, supplying humanity with vital ecosystem services such as rainfall generation and biodiversity maintenance at local, regional and global scales.

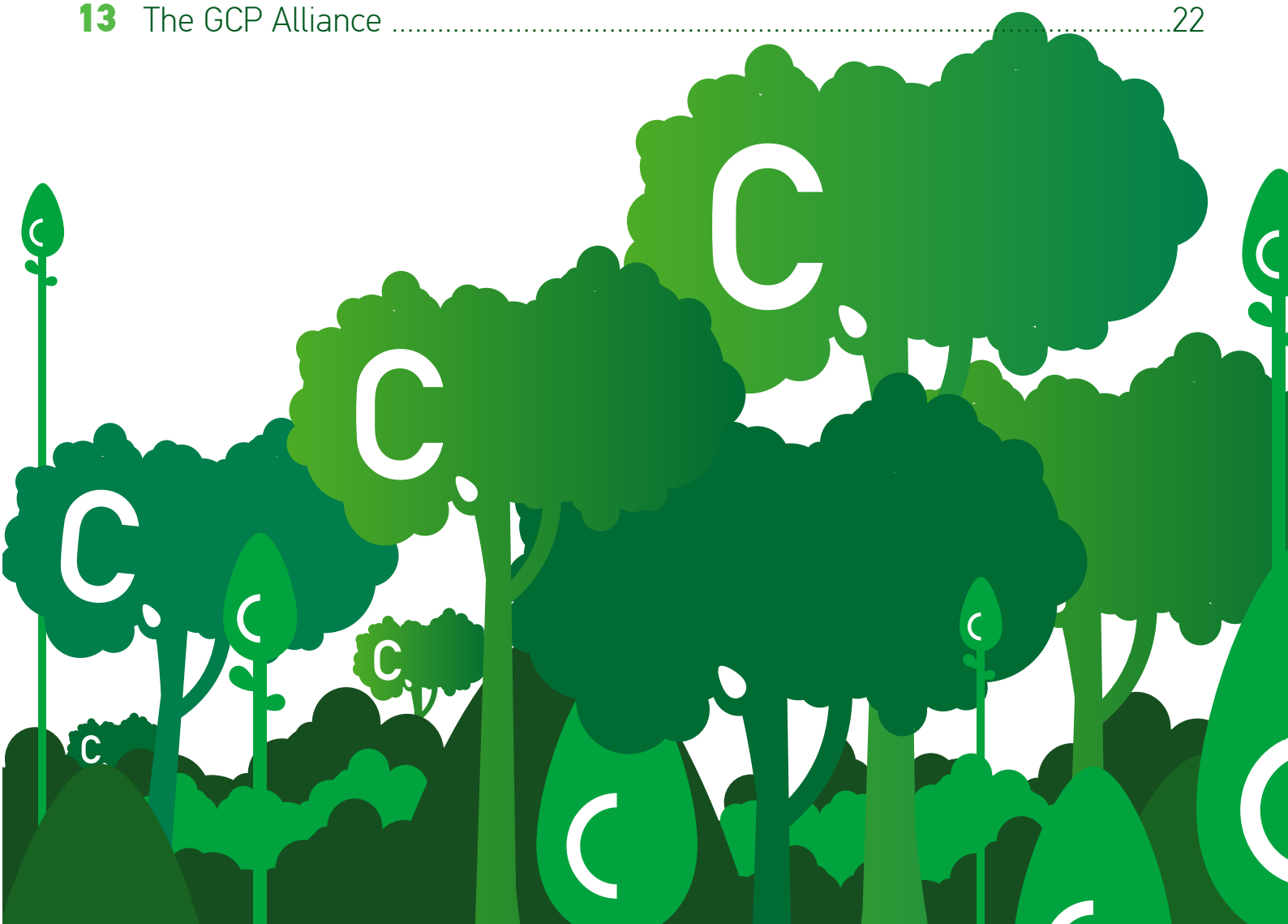
International demand inexorably drives deforestation worldwide, and conservation has proven no match for commerce. Regulated carbon markets which could provide the economic incentives to halt this process currently exclude forests.

The next 18 months are critical for rainforests and climate change policy, because it is now that the G8 and United Nations are establishing their priorities in the lead up to the renegotiation of the Kyoto Protocol.

If we lose forests we lose the fight against climate change: we must act to put forests first now.

Forests First in the Fight Against Climate Change

The VivoCarbon Initiative



The VivoCarbon Initiative

Letter from the Director

Tropical rainforests are the elephant in the living room of climate change. Forests must come first in efforts to mitigate global carbon emissions because carbon capture or nuclear technology will take decades to have any significant impact on reducing emissions, whilst we can tackle deforestation now, without the need for inventing new and expensive infrastructure. It is unwise for politicians to arm wrestle over rising aircraft emissions when just the next five years of carbon emissions from burning rainforests (18% of global GHG emissions[1]) will be greater than all the emissions from air travel since the Wright brothers, to at least 2025.

Apart from storing 'living carbon', tropical forests act as giant utilities generating rainfall and air-conditioning the atmosphere on a global scale; services which the world community benefits from but does not yet pay for. Historically, developing countries cannot be held to account for causing climate change but now it is their forests which offer the cheapest most efficient immediate solution to the world's rapidly rising carbon emissions as the Stern, McKinsey and International Panel on Climate Change (IPCC) reports have shown. Action here could also help to alleviate poverty among 1.6 billion of the world's poorest of the poor who depend on these forests for their livelihoods. It is time for Governments and the private sector to act.

Conservation is no match for commercialism. After 30 years at the conservation frontline I fear that history may regard our efforts in this battle as no more than the "Charge of the Light Brigade". There is not enough philanthropy around, nor donor appetite, to fix the scale of the problem so we must now use commerce as an ally, not see it as an enemy. New market mechanisms for trading the ecosystem services forests provide to humanity can act quickly through a coalition of sellers and buyers under Government approved frameworks, if necessary. Only markets can sustainably deliver funds on the scale of billions per year for rainforest services, enough to out compete the power of palm oil, beef or soya to convert forests for land. Provisions must be made to share these benefits with those who own the land on which these forests grow and the poor who depend on them, or they will have no choice but to continue felling forests to make money and support their families. There is no need to destroy rainforests to supply the agribusiness products we in the West demand. It is just cheaper than restoring the millions of hectares of already degraded tropical land, where they could be grown instead. This is a scandal! Curiously, climate change may end up giving these forests their best chance for survival. Those countries wise enough to have retained their forests, could find themselves the owners of the new billion dollar ecosystem industries of the future.

The next 18 months are critical for rainforests and climate change policy, and key decisions affecting the future of the world's forests will be taken at the upcoming G8 meeting in Germany, the UNFCCC COP13 in Bali in December, and the CBD COP9 in the summer of next year. Throughout this critical period, the VivoCarbon Initiative will work to deepen our understanding of the vital roles played by living carbon in sustaining life, atmosphere and people and to demonstrate these through the practical actions and projects outlined at the end of this report.

The Global Canopy Programme is an alliance of 29 of the world's leading scientific institutions in 19 countries active in understanding interactions between forests and the atmosphere in relation to climate change. The GCP has been very active in efforts to translate their science into information policy makers can use, both within international fora and across nations in the tropics.

We have compiled this report to give an overview of the ecosystem services provided to humanity, the effects of deforestation and its contribution to climate change, detailing the drivers, implications and potential solutions to reduce it. It is intended to act as a guide for non-specialist stakeholders addressing these issues within Governments and the private sector.

Andrew Mitchell
Founder and Director
Global Canopy Programme

Forests: The Elephant in the Living Room of Climate Change

Deforestation is the 2nd largest cause of global greenhouse gas emissions

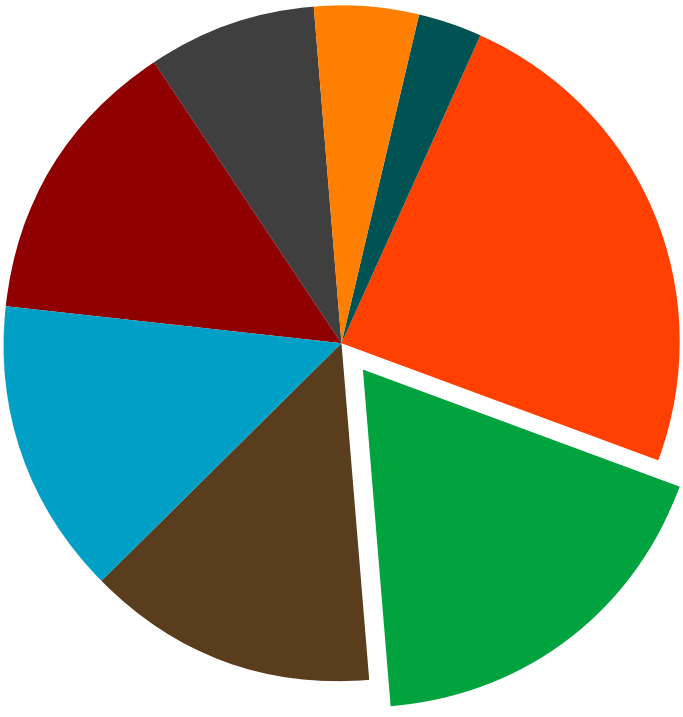
- 18-25% of global GHG emissions are from deforestation[1]. The Food and Agriculture Organization of the UN estimates that this represents 7.32 billion tonnes of CO_2 being released into the atmosphere each year.[32]
- Unless mitigated, these carbon emissions, mainly from poor countries, will negate most of the CO_2 savings planned under the first commitment period of the Kyoto Protocol.
- Aircraft emissions are just 2-3% of global GHG emissions[1].

Even with projected growth in air travel, emissions from deforestation between 2008-2012 are expected to be greater than the total of aviation emissions from the invention of the flying machine until at least 2025[1].

The cumulative total will equal 40 GT of CO_2, and could raise atmospheric levels of CO_2 by ~2ppm[1]. Recently Indonesia has become the third biggest emitter of GHG's on the back of deforestation, which contributes 85% of its emissions. 70% of Brazil's emissions are also caused by deforestation.

Despite these facts, international debate on how to mitigate climate change has been dominated by reducing emissions from the energy and transport sectors, when in fact reducing emissions from forests is likely to be more cost effective and quicker.

GHG emissions in 2000 by source



From the Stern Review of the Economics of climate change
Cambridge University Press, 2006

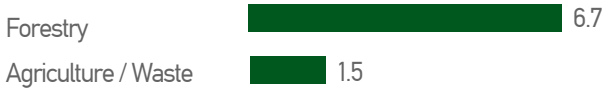
Abatement Potential by 2030

Abatement potential for greenhouse gases by sector, gigaton of carbon dioxide equivalent per year by 2030 (costing up to €40 per ton)

Power, manufacturing

Buildings, transportation

Forestry, agriculture



From 'A cost curve for greenhouse gas reduction.'
McKinsey Quarterly No 1, 2007

Tropical forests and peatlands store vast quantities of carbon

• The world's forest trees and soils contain twice as much carbon as is in the Earth's atmosphere. Tropical forests store 120-400 tonnes of carbon/hectare[2]. Burning them contributes huge quantities of CO_2 emissions (approx. 400 million tonnes/yr from Brazil and 350 million tonnes/yr. from Indonesia[1]).

• Peatlands cover just 3% of the world land area yet are the largest terrestrial store of biomass carbon[4]. 7.6% of this is found in SE Asia, which stores 42 billion tonnes of carbon[3]. Due to the depth of peat, one hectare of tropical peat forest can store 3000 - 6000 tonnes carbon/hectare. When peatlands are drained, cleared and burned for agriculture, there are two sources of emissions, one from peat oxidation, the second from fire. Together these emissions from SE Asian peatlands, which cover just 0.2% of the world's land surface are responsible for 2 billion tonnes of CO_2 released to the atmosphere each year[4]. 75% of this comes from Indonesia alone making it the third largest per capita emitter, after the USA and China. Preventing this source would be equivalent to reducing emissions from global fossil fuels by 8%. Economic losses in SE Asia (closed offices, airports, health) from smoke and aerosols in the 1997/8 Indonesian peat fires exceeded $9 billion[5].

Forests offer the greatest single opportunity to reduce emissions cost-effectively and quickly

• The Stern Review clearly states that improving incentives for forest conservation is "a highly cost effective way of reducing greenhouse gas emissions" and calls for "large scale pilot schemes to explore effective approaches to combining national action and international support".

• The Stern Review also states that to keep global average temperatures from increasing by 2°C by 2030, world emissions of CO_2 must be reduced by 27 billion tonnes below the IPCC business as usual scenario and that action to do this now would be far less costly than action later. Therefore we must begin immediately.

• McKinsey[6] has costed the alternative strategies that would deliver sufficient "abatement" to keep CO_2 levels below 450 ppm by 2030 and therefore keep the rise in global average temperatures below 2°C, at a cost of no more than €40 per tonne of carbon saved. Their results clearly show that the largest single category for action to achieve this is in the forestry sector (25% of all actions needed), split 50:50 between forest conservation (carbon stores) and new plantations (carbon sequestration). (See chart on previous page).

• The IPCC Fourth Assessment Report released in May 2007 goes further still, stating that: "forest related mitigation activities can considerably reduce emissions from sources and increase CO_2 removals by sinks at low cost.....about 65% of the total mitigation potential (up to 100 US$/t$CO_2$-eq) is located in the tropics and about 50% of the total could be achieved by reducing emissions from deforestation".

• Other large-scale mitigation solutions such as carbon capture and nuclear power, that poor nations can ill afford, will have little effect on significantly reducing GHG emissions in the next two decades because of the lag time to get these technologies on stream at scale, but forest action requires no new technology and can begin immediately, at far lower cost.

Photo © 2002 Andrea, Artaxo et al. SMOCC

19 million tonnes of CO_2
enter the atmosphere
from deforestation each day

Photo © James Aldred

Deforestation: Global Demand versus International Regulation

Global Demand

- Deforestation is largely caused by billion dollar agribusiness expansion driven by western demands for cheap palm oil (75% of world supply comes from Indonesia and Malaysia), beef and soya (40% of Brazil's beef exports are to Europe, China's demand for soya to feed chickens and pigs has sky rocketed). These demands stimulate clearance of rainforests for land. In addition the prospect of biofuels as one of the solutions for climate change is backed by massive subsidies which could result in the release of far greater emissions than they are designed to save, by stimulating the clearance of rainforests, to provide land for biofuels. Palm oil grown on cleared peatlands has a life cycle emission of up to 25 tonnes of carbon dioxide per tonne of biofuel – five times more than that of diesel[8].

- 80-90% of timber extraction is illegal under the existing laws of Brazil and Indonesia[2], the biggest GHG emitters from deforestation. New national laws are not always required, rather the political will and resources to enact existing ones must be found. Without economic incentives for standing forests, nations have little alternative to cutting their forests down, to achieve their dreams of prosperity. According to WWF, up to 28% of the EU's imports could be illegal. Britain is the largest importer of illegal timber in the EU. China has protected its own forests but its increasing demands for timber drive deforestation elsewhere. 50% of timber exports from China are to Europe.

Faced with these demands and no alternative economic scenario to alleviate poverty, corruption thrives in many developing nations and despite their best efforts, the forests fall. Conservation has proved no match for commerce.

International Regulation

- The Kyoto Protocol and the European Trading Scheme exclude financial incentives for reducing forest emissions from deforestation or conserving existing rainforests. Both schemes need urgent reform.

- The Kyoto Clean Development Mechanism (CDM) incentivises the sequestration of carbon through forestry, (reforestation and afforestation). It has been almost totally ineffective, as a result of its overly bureaucratic certification rules which create high transaction costs (as much as $250,000 per project) - less than 1% of carbon market investments have been in reforestation projects and to date not one fully commercial project has been approved[56].

- Climate stabilization cannot be achieved by 2030 without significant private sector investment in tropical and sub-tropical forestry[9], therefore the Kyoto CDM rules need to be simplified and the ETS needs to embrace forest credits in developing nations, which it currently excludes. The unregulated Voluntary Carbon Market, where many market innovations begin, should be encouraged by Governments to develop quality standards, and not be excluded for the lack of them.

Canopy Ecosystem Services: This is Not Just About Carbon

Forests are like giant utilities providing ecosystem services to the world that we all benefit from but we don't pay for. Apart from carbon storage and sequestration, they include water storage, rainfall generation, climate buffering, biodiversity, soil stabilisation and more. These services are likely to be worth billions of dollars per year, but need to be valued more accurately. They may not yet be accounted for in markets but their loss would have massive economic impacts.

biodiversity

Tropical forest canopies sustain 40% of all life on earth[10] and all subsequent ecosystem services are a function of interactions between this life, the soil and the atmosphere. Pollination services alone have been estimated to contribute US$12 billion per year to agriculture[10].

climate buffering

Trees act as air conditioners cooling the atmosphere through evapo-transpiration. The trees of the Amazon release 20 billion tonnes of water to the atmosphere each day.[13] The equivalent energy used by this process is equal to the largest hydrodam in the world (in Brazil) operating at maximum power for 145 years[13]. The 2005 drought in the Amazon coincided with a 3°C rise in sea surface temperatures in the Caribbean that stoked hurricane Katrina resulting in US$81.2 billion of insured losses in the Southern US. Scientists believe that these two events may be linked, but this is still much debated.

rainfall generation

Complex chemistry (Volatile Organic Compounds) released by tropical canopies to the atmosphere helps generate the rainfall that stabilises local and regional weather patterns[14]. New research has shown that coastal tropical forests, act as a 'biotic-pump' drawing water from the sea to any distance inland. Coastal deforestation breaks this virtuous cycle leading irrevocably to desertification inland[15].

NASA's TRMM satellite data shows that Brazil's billion dollar soya, beef and bio-fuel industries all depend on rain generated by the Amazon. Amazonian forests store 3 trillion tons of water.[13] 70% of Brazil's electricity is sourced by hydropower, also dependent on Amazonia's rain.

1 square meter of the ocean surface evaporates 1 litre of water. A tree releases 8-10 times more moisture into the atmosphere than the equivalent area of the ocean.

soil stabilisation

The tree root mats beneath tropical forests play a crucial role in holding together the substrate, upon which they grow. Just a century ago 35% of Ethiopia was covered in forest. By 2000, this cover had declined to 4.2%, resulting in desertification which has directly contributed to its decades of famine[16].

health

Undisturbed tropical forests can have a moderating effect on infectious disease. 40% of the world's population lives in malaria infested regions. Heavily deforested areas can see a 300 fold increase in the risk of malaria infection compared to areas of intact forest[17].

If deforestation is not curbed, these services will be lost to humanity[18] with severe impacts on food security, energy security and environmental security at local to global scales.

The ABC of Tropical Forests

Map © mongabay.com

The world has just under 4 billion hectares of forests[32], covering about 30 percent of the world's land area. They are unevenly distributed around the world and 5% of these form the world's tropical rainforests. The largest unbroken stretch of rainforest is found in the Amazon River Basin of South America, and extends over 9 countries. Over half lies in Brazil, which is home to about one-third of the world's remaining tropical rainforests. The Congo Basin's forests extend over six countries and account for approximately 20%[22], and Indonesia's alone for 10%[34]. The remaining rainforests are scattered around the globe in tropical regions and are mainly in SE Asia.

Despite their relatively small area, these forests play a crucial role in the maintenance of the world's environment. We have compiled short case studies from the world's main tropical forest regions – the 'A, B, C of Forests' (SE Asia, Brazil and Congo) – outlining the specific threats they face and the potential consequences for the world's life, atmosphere and people.

SE Asia

Forests in the SE Asian countries of Malaysia, Indonesia and Papua New Guinea cover some 136 million hectares. Yet total conversion of this natural forest into agricultural land, forest plantation and other non-forested uses is predicted to occur before 2050[33].

Rates of annual forest loss in SE Asia from 2000-2005 range from 0.5% for Papua New Guinea to 2% for Indonesia[32].

In 2007, Indonesia was reclassified as the third largest contributor to global greenhouse gas emissions after the US and China, taking into account the enormous emissions from its peatlands which release an estimated 2 billion tonnes of CO_2 into the atmosphere each year[4].

Major threats to SE Asian forests

The degradation of these forests is driven by rapid population and economic growth, and is underpinned by the region's rich mineral, petroleum and forest resources and the favourable conditions for high-yield crops such as oil palm, rubber and coffee[33].

Specific threats

- Industrial logging concessions, valued at approximately US $10.4 billion per annum[32].
- Illegal logging, especially in Indonesia leading to an estimated US$4 billion[36] in lost Government revenues per annum.
- Agriculture, predominantly palm oil & rubber, valued at approximately US$17.8 billion per annum and using some 7.6 million hectares of land cover[34].
- Burning and drainage of carbon-rich forested peatlands, particularly in Malaysia and Indonesia.
- Mining and petroleum, particularly in Papua New Guinea where it contributes 25% of GDP annually[34].

What will be the impact of SE Asian forest ecosystem service loss?

Rainfall generation

SE Asian forests exhibit larger rates of evapo-transpiration than any other tropical forest[34], however the region's maritime climate and the influence of monsoon circulations make accurate predictions difficult.

Although the effect of deforestation on precipitation in SE Asia itself is likely to be small (an estimated 3%), it may have serious effects on precipitation and weather patterns across Southern Europe, the Pacific Northwest of the US and Hawaii[27].

Carbon storage

In addition to the carbon stored in its forests, at least 42 billion tonnes of soil carbon are stored in the forested tropical peatlands of SE Asia.

Peatlands are the most efficient terrestrial ecosystem in storing carbon, and while they cover just 3% of the

globe's surface, they store twice as much carbon as all global forest biomass.

Peatlands in SE Asia cover a mere 0.2% of the globe's surface but contribute some 90% of peat-related emissions – an estimated 8% of the global total[4].

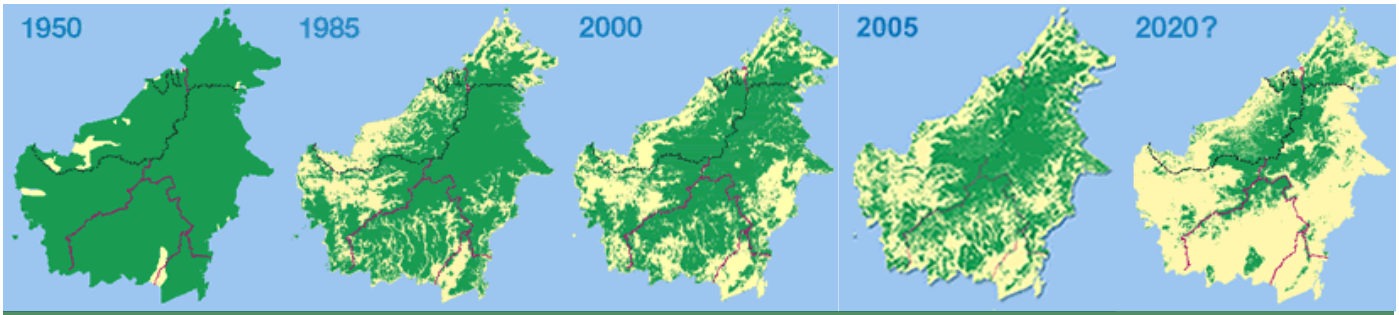
Biodiversity

SE Asia is home to 4 of the world's 25 biodiversity hotspots.

On account of the region's unique geological history, Indonesia and parts of Malaysia reach 60% endemism for plants and reptiles and 80% for amphibians; Papua New Guinea tops 80% endemism for mammals, reptiles and amphibians[43].

The hundreds of critically endangered species in the region inhabit the lowland forest rapidly being destroyed for oil palm cultivation and timber.[4]

Forest Loss in Borneo 1950 - 2020



Bornean forest cover loss from 1950 to the present day and predicted loss to 2020

Palm oil grown on cleared SE Asian peatlands causes 5 times as much carbon to be emitted over its lifecycle as diesel

Brazilian Amazon

The Amazon River basin covers some 7 million km^2 across nine nations and is the largest and most diverse area of contiguous tropical forest on earth. Many millions of hectares of the Brazilian Amazon are protected in reserves, including those gazetted for indigenous communities who have been very successful in defending their lands from large-scale conversion.

Between 1995 and 2005 South America lost an average of 4.3 million hectares per year to deforestation,[32] and 2.4 million hectares of the Amazon in Brazil alone disappeared in a single year between 2001 and 2002[45]. In recent years the rate of deforestation has slowed - Brazil is making great efforts to reduce deforestation and since the high of 2003, the rate has fallen by 31% according to Government figures. The long-term picture, however, is one of continuing deforestation. The Amazon will have lost 40% of its original area by 2050 according to a recent study in Nature.[46]

At the same time, Brazil relies on its forests and has become a world-leader in harnessing renewable energy. More than 70% of its electricity is sourced from hydro-electric power and 40% of its cars run on bio-ethanol. It is likely to become an exporter of renewable fuels and related technology in the future. All of these are dependent on rain generated by the Amazon forest.

Major threats to Brazilian forests

The process of deforestation often begins with poor families migrating into an area, and clearing land to establish ownership. Since much of the Amazonian forest grows on sand, agricultural productivity is short-lived and even small-scale agriculture must quickly shift to new areas, causing a domino-effect of deforestation.

Industrial logging for timber soon follows and more settlers move in along newly-established logging roads. The land may then be sold on, cleared and burned for cattle pasture and later used for large-scale agriculture such as soya production. Sugarcane for bioethanol is grown mainly in the south of Brazil and does not yet threaten the Amazon.

Major road projects are providing conduits for development and opening up more forest each year for farming, development and agriculture. It is expected that 22,000 to 49,000 km^2 of rainforest will be cleared by 2050 to make way for pasture and agriculture development, if spatial planning and environmental enforcement measures are not adopted.[39]

Specific threats

- By 2002, pasture for cattle in the Amazon already occupied some 50 million hectares.[40] 40% of Brazilian beef exports are to Europe[38].
- By 2002, soya production in the Amazon already occupie d 4.9 million hectares[40] and Brazil now supplies some 25% of the rapidly growing global soya market[38].
- Road expansion and urban development.
- Unsustainable and illegal timber extraction.
- Potential expansion of biofuel production.
- Mining, oil exploration and hydropower.

More than 70% of Brazil's electricity comes from hydroelectric power.

What will be the impact of Amazon forest ecosystem service loss?

Rainfall generation

The Brazilian Amazon's trees release 20 billion tonnes of water to the atmosphere every day. NASA's TRMM satellite shows that rainfall generated in the Amazon moves south, watering Brazil's metropolises and the entire Rio Plata basin where 70% of the combined GDP of the five countries it stretches over (Argentina, Bolivia, Brazil, Paraguay and Uruguay) is created.[47] Models suggest that severe forest loss in Amazonia, alongside similar loss in the Congo basin will lead to decreased rainfall in the Midwestern United States[34].

Carbon storage

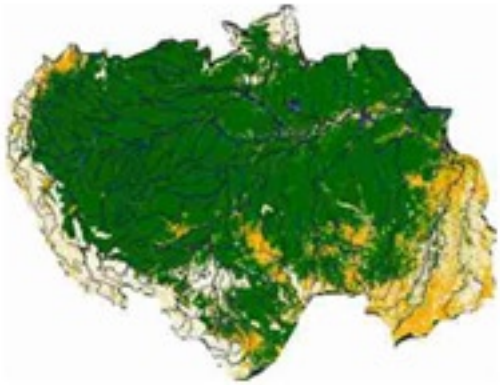
The state of Amazonas alone contains 67 billion tonnes of carbon in its forests. To the South, the arc of destruction in the states of Acre, Mato Grosso & Para is approaching rapidly. Estimated carbon emissions from Brazil's forests run at 400 million tonnes per year.[1]

Biodiversity

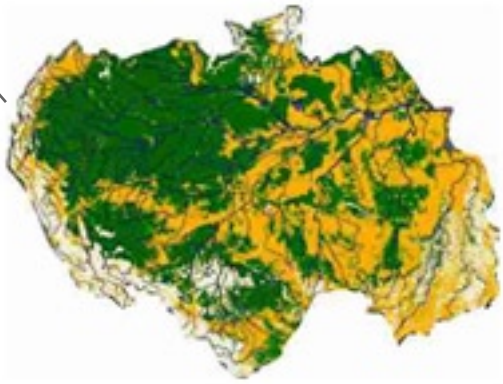
The Amazon is the most species rich of all the tropical rainforests, harbouring some 2.5 million insect species[49] and the world's greatest diversity of plant species.[50]

This complex of biodiversity is crucial to the generation of forest ecosystem services in ways that are still not widely recognised. Research in Brazil and Germany, for example, show that Volatile Organic Compounds (VOCs), which are produced by trees in the Amazon, photo-oxidise to create condensation nuclei for rain.[14].

The Amazon in context



Current Amazonian Forest Cover[52]



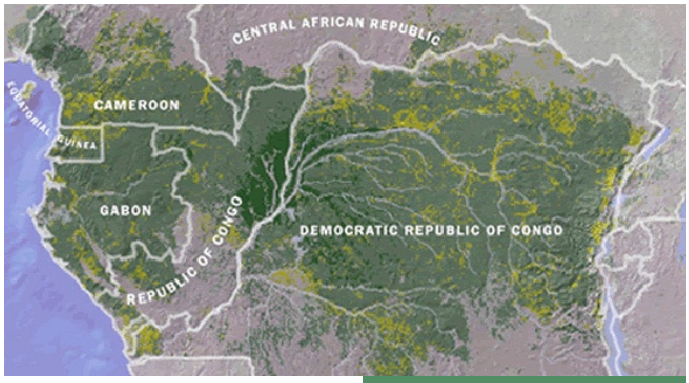
Projected Forest Cover in 2050[52] (Green = remaining forest)

Congo Basin

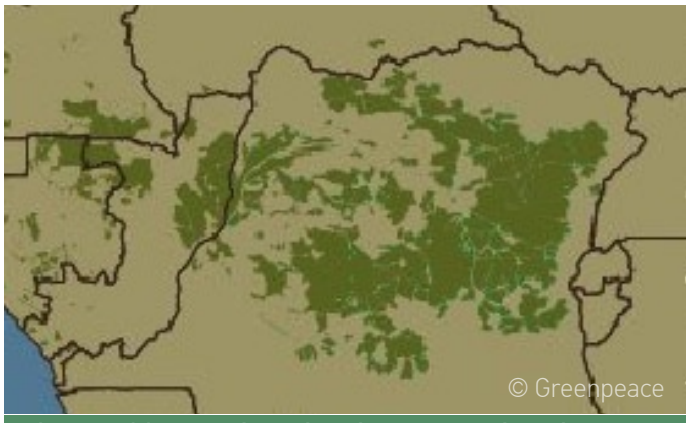
Africa is home to 17% of the world's forests but around 50% of recent global deforestation[1], and has already lost more than two-thirds of its original forest. The Congo Basin is the 2nd largest contiguous humid tropical forest in the world, stretching over six countries. It is the richest ecosystem on the continent, harbouring more than 50% of Africa's flora and fauna[22, 23].

4 million hectares of central African forests are destroyed each year due to the effects of poverty, population increase, illegal logging and conversion of forest land for agriculture.[53] However this may be the tip of an ever-increasing iceberg as the forests of the Congo Basin also harbour vast mineral wealth which remains to be exploited[24].

Models predict that the Congo Basin will shrink towards the interior over the next 50 years. Unless current trends are halted, this currently contiguous forested area will fragment into three separate blocks,[24] with devastating effects for the people who rely on them directly and for the ecosystem services they provide the world[24].



Current Forest Cover[42]



Areas of forest where logging concessions have not yet been assigned to timber companies[48]

Major threats to the Congo Basin forests

Threats to these forests are complex and diverse, and cannot be understood without considering the different national and regional factors at play. A moratorium on new logging concessions in the Democratic Republic of Congo has been in place since 2002, but this has been repeatedly breached[48]. However, much of the current threat is from the poverty which drives people to cut down forest for land and charcoal production. Fuelwood meets 80% of all Democratic Republic of Congo's energy needs[57], and unless alternative income sources are found widespread forest destruction will continue.

Specific threats

- Small scale agriculture, the primary cause of deforestation since 1980.
- Major industrial logging.
- Illegal logging for charcoal production and wood for fuel.
- Land for populations displaced by conflict.
- Urban expansion.
- Oil extraction.
- Mining for minerals, mainly gold, coltan, diamonds, uranium, manganese and copper.

Photos © James Aldred

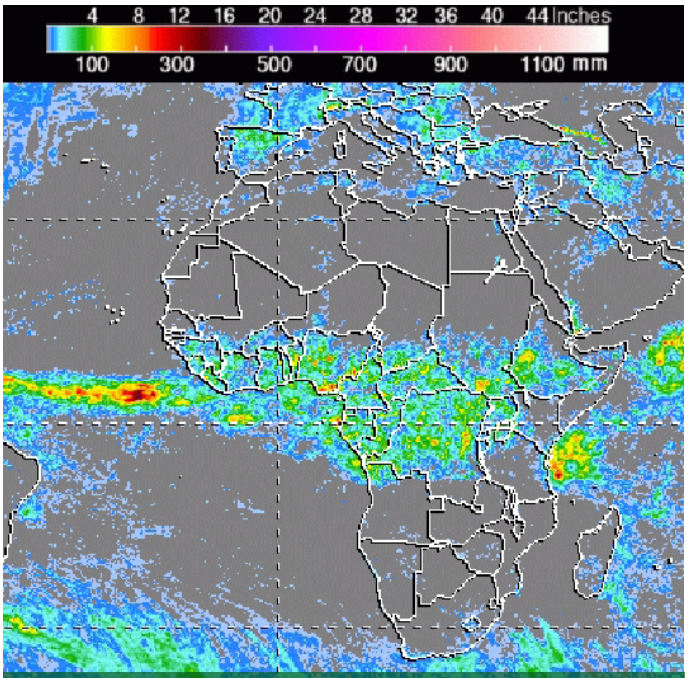
What will be the impact of Congo Basin ecosystem service loss?

Rainfall generation

Deforestation and forest degradation are likely to have severe effects on regional[26] and global[27] rainfall generation and on the lives and livelihoods of people in Africa and around the world. A large part of the rainfall in the Congo Basin comes from recycling of moisture by the forest, and 75-95% of rainfall is recycled within the Basin[26] itself. Regional deforestation is likely to have a particularly strong effect on local rainfall, reducing precipitation by 30% and 10-20% in the wet and dry seasons respectively[27].

The hydroelectric generation potential of the Basin amounts to 1/6th of the estimated global total.[28] The Democratic Republic of Congo alone has the potential to produce 150,000 Megawatts of power[54].

Recent studies also show that deforestation in the Congo Basin causes a 5 to 15% decrease in precipitation as far away as the US Great Lakes region, mostly centered in Illinois, with a peak decrease of about 35% in February, and reductions of up to 25% in May in Ukraine and Russia (north of the Black Sea)[27,29].



NASA image showing the huge rainfall generating capacity of the Congo Basin.

Carbon storage

The region's forests are a sink of an estimated 24-39 billion tonnes of carbon and release 237 million tonnes of carbon into the atmosphere annually[30]. If totally deforested and burned the forests of the Congo Basin would put more than 135 billion tonnes of carbon dioxide into the atmosphere.

Biodiversity

The Congo Basin harbours over 400 mammal species, 1300 bird species, 336 amphibian species, 400 reptile species and 20,000 inventoried plant species, of which approximately 8000 are endemic[25]. In addition, the region's forests are the only home of many great ape species such as the Eastern and Western mountain gorilla, the bonobo and the Central and Eastern chimpanzee. These species are being directly targeted by the burgeoning bush-meat trade, while accelerating deforestation poses a threat to the functioning of the forest ecosystem as a whole.

Researchers have used regional-scale atmospheric simulation experiments to investigate how deforestation in timber concession areas could affect precipitation inside bordering, undisturbed national parks in the Republic of Congo and Gabon. Results showed that in some parks rainfall reduced as much as 15%, while others showed slight increases[55]. Moreover, the study revealed that rainfall inside parks was especially sensitive to upwind deforestation along the path of airborne moisture traveling inland from the ocean. The magnitude of rainfall reduction observed in the simulations would be large enough to shift the vegetation of some parks across the transition zone from forest to woodland or savannah, with a consequent crash in biodiversity.

Solutions: New Market Mechanisms

The simple problem is that the economic incentives to convert forests are greater than the incentives to conserve or wisely manage them. Stern has called for urgent annual funding of US$10-15 billion/year to reduce deforestation by half. There is not enough philanthropy or donor appetite around to fix the problem. Only markets can sustain funds at this scale.

Therefore a combination of Governmental and private sector action is immediately needed to get emissions reductions from forest sources into the market and to protect the services this 'living carbon' provides to humanity. We support the following three new market mechanisms and one existing one, which could do this. The first three are all outside the Kyoto process at present but could become tradable commodities in the future.

1 Reducing Emissions from Deforestation

A proposal for discussing Reducing Emissions from Deforestation (RED) in Developing Countries was presented by Papua New Guinea during the UNFCCC COP 11, Dec 2005 and was later supported by Brazil at COP 12 in Nairobi, Nov 2006. This focuses on reducing emissions through trading carbon credits that would be earned by nations that reduce deforestation below an agreed reference scenario (baseline)[19]. Brazil has proposed an international fund to pay for these credits. The World Bank is proposing a Global Forest Alliance of donors (the buyers) and an associated Forest Carbon Partnership Facility (the sellers). PNG and the Coalition of Rainforest Nations favour in addition, a more market based approach.

2 Carbon Stocks

Markets must be created in the future for conservation of carbon stocks in standing forests. Credits for reduced emissions alone merely reward nations with high deforestation rates but not those who have large stocks of forests that they have well protected. Amazonas State has 1/5th of the world's remaining rainforest of which just 2% has been deforested. As conservation has proved no match for commerce, without commercial support for the rest, 2.6 million sq.km. is predicted to be destroyed by 2050 releasing 115 billion tonnes of CO_2 to the atmosphere.

3 Payments for Ecosystem Services

Payments for Ecosystem services are currently not accounted for economically or in markets, therefore scientists need to define the benefits they provide more accurately and economists must value them.

Markets in the voluntary sector are already beginning to develop in watershed protection and even rain. Because of the extra services it provides, 'living carbon' is likely to trade at a premium in future voluntary markets and later in regulated ones, compared to dead carbon, such as liquid CO_2 stored under ground. Nations and landowners that maintain the forests which provide these services could become the owners of billion dollar ecosystem industries of the future.

4 Plantation Forestry

Whilst new plantations can sequester carbon from the atmosphere at the rate of between 5-15 tonnes/ha/yr, this can be no substitute for the dangers of losing living carbon stocks in existing rainforests and the ecosystem services they provide. Conversely, illegal timber supplies from existing tropical forests, cannot be halted without creating an alternative source of supply. Therefore, there is a pressing need to expand plantation forestry (afforestation, new forests; reforestation, replacement forests) to supply sustainably managed timber meeting the highest certification standards, with carbon credits for carbon sequestration as a bonus on top. Afforestation in the tropics has also been associated with net benefits in mitigating global-scale warming due to changes in albedo and evapotranspiration[20].

Stern has called for "large-scale pilot projects to inform the policy development process" and Governments must encourage these to begin right away. We cannot afford to wait.

Carbon Farmers of the future

Why isn't it Happening?

Overview

Sir Nicholas Stern has suggested that annual funding of $10-15 billion is required to reduce deforestation by half by 2030. While some countries still argue for donor or tax-based approaches to pay for this, most recognise that the scale of investment required can only sustainably be delivered by markets. So what are some of the factors which have meant that forests have been so slow to be embraced by the developing carbon markets and what can we do to overcome them?

Political Roadblocks

• Sovereignty

Ever since the British stole rubber plants from Brazil and planted them in Malaysia to enrich themselves, the idea of markets and foreign investors owning or controlling Brazilian forests has understandably created deep concern amongst governments and electorates in the world's largest forested nation, and has slowed the evolution of positive incentive mechanisms. Whilst some may argue that they are a global common, Brazilians argue that their forests belong to them alone. Credits for reduced emissions from deforestation can defuse this problem and have got the political ball rolling at the UNFCCC, since they do not entail investment in tangible carbon stocks, but rather in an intangible reduction of emissions. However, land rights and ownership go to the heart of who gets the benefits to be distributed and in frontier communities these issues can be hard to sort out. Sovereignty need not be an issue, as long as large scale foreign land ownership is not at stake.

• The Ethical Dimension

Developing nations believe that industrialised nations (known as Annex 1 countries in the UNFCCC), responsible for the climate change problem in the first place, should not be allowed to buy their way out of their own emissions reduction commitments by obtaining forest offset credits from the developing world, whilst continuing to pollute in their own. This ultimately kept forests out of the first Kyoto commitment period beginning in 2008, but negotiated a decade before. A renegotiation of reduction targets in Annex 1 countries, including tropical forest credits as part of their own commitment, coupled with recognition of financial benefits available for forest credits in non-Annex 1 countries, may solve this problem in the second commitment period starting in 2012.

• Differing National Contexts

Paying countries to reduce their emissions by lowering their deforestation rates against some reference point, rewards countries that are doing badly (have high deforestation rates) rather than those who have done well (have well protected forests). In the world of biodiversity banking, curbing deforestation remains the most immediate incentive needed in the 'current account' activity at the deforestation frontier, but nations with a 'deposit account' of intact forest also deserve financial reward or they will have little alternative but to invite in timber or agribusiness to create value for development, often at the expense of the poor. The methodologies for the former are better worked out than for the latter and this has set up tensions at the UNFCCC between nations who have chosen forest conversion rather than forest conservation as a road to development. Markets need to evolve a price for forest stocks and the services this 'living carbon' provides to humanity and not just for the 'dead carbon' in the emissions derived from burning them.

• Voluntary Markets

While it seems increasingly likely that some form of international agreement in regulated markets on reduced emissions from deforestation will at last be reached by 2012, urgent measures are still needed to ensure that the vast 'business as usual' emissions of the next four years are curbed. Only the voluntary carbon market, coalitions of buyers and sellers, can tackle this immediately. Governments should therefore foster trading in the voluntary market, rather than hinder it, or worse, exclude it from recognition. Even though it is relatively small ($100 million) and of variable quality, it is highly innovative (already moving beyond carbon to experiment with payments for ecosystem services, for instance) and growing rapidly. Large scale pilot projects here will inform the policy development process defining the large scale regulated markets of high value in the future.

Technical Roadblocks

• Permanence

Perhaps the most often cited concern with plantation projects (but which applies also to carbon stock and payment for ecosystem services projects going forward) is the issue of permanence: the notion that because forests are susceptible to fire and other disturbances, any carbon sequestered as new trees grow and stored will inevitably be released back into the atmosphere should they burn. As a result, the regulated carbon markets issue temporary credits for forestry projects which expire after a set number of years, and must be repurchased. This has dampened investor interest. Permanence is a serious obstacle, but singling out forests in this respect is illogical. Industrial installations also have a limited life span. The Hancock Timberland Investor reported in 2004 that the risk of loss from a natural event in managed forests averages 0.04% of loss per year. A new hydropower plant,

for example, that earns full credits in the markets, may only be expected to function for 40 years, a predictably shorter period than a well-managed forest which can survive for generations and beyond. Remote areas of 'living carbon' are harder to monitor than, say, a high tech power plant, but it is becoming easier and cheaper to do so. Well-tested methods are also available to address permanence issues, including maintenance of forest buffers to counter losses in carbon stocks, insurance, market discounts to factor in risk, pest control and fire management.

• Leakage

Another valid concern is that positive incentives to keep forests standing in one place may result in deforestation being shifted to another, unprotected, area. This is particularly problematic in vast forested regions like the Amazon, Congo or Borneo, spanning different state boundaries as well as national boundaries with other countries. This is a serious problem but its impact can be reduced by carbon accounting at national or sub-national level as opposed to project level so that any leakage is still caught within the catchment area. Methodologies have also been demonstrated in pilot projects that effectively reduce leakage, or else identify and measure it where it occurs, so that it can be deducted from the project's total carbon benefits. Leakage across national boundaries can be contained by regional agreements.

• Additionality

Additionality is the principle that any activities which earn credits in a carbon market by reducing emissions, must be additional to activities which would have happened anyway without the positive incentive. In other words, ensuring that commercial or already funded projects do not freeload subsidies in the name of climate change. In common with the other technical roadblocks and perhaps even more than the others described here, overcoming additionality concerns relies on effective forest management and monitoring, so that only projects that are certifiably proven to meet these requirements receive finance.

• Flooding the Market

Could the sheer volume of carbon stored in the world's forests undermine the efficacy of carbon markets by flooding them with cheap credits? In terms of the scale of mitigation action needed, credits for carbon stocks and for reduced emissions from deforestation (RED), and also forest degradation, (REDD), which may come into the market after 2012 in a re-negotiated instrument under UNFCCC or its Kyoto Protocol, cannot produce runaway volumes of credits. Over the long term, the IPCC estimates that forestry-based mitigation is biologically constrained to offering some 15-20% of overall reductions needed, suggesting that ongoing integrity of the markets are ensured as long as the introduction of carbon stocks from forests is carefully managed and suficient political will exists to meet the required and increasingly stringent emission reduction targets. This will keep demand for credits high.

• Monitoring

Monitoring deforestation has moved from time-consuming reliance on direct field-measurements, to the use of satellites with real-time surveillance. Some systems are so advanced that even selective logging can be tracked. NASA, ESA, Japan, Brazil and India all have good systems, though most countries lag behind. Computer modelling can predict deforestation trends. New radar sensors will improve measurements of carbon stocks directly from space. It is therefore possible to know if a forest is there or not and what condition it is in, with increasing accuracy. This will be no substitute for ground truth checks at regular intervals by reliable bodies. New satellite based tracking systems, such as Helveta, can monitor bar-coded timber from Borneo to Britain, improving certification and squeezing illegal timber from markets.

• Standards

The voluntary carbon market has got off to a difficult start. Like any new market, few reliable standards exist and some suppliers of forest credits have been found wanting. Reliable models of good practice are now growing. The Nature Conservancy and local partners have conducted and documented a working example of how carbon stocks and emissions reductions can be scientifically quantified, monitored and certified through their Noel Kempff Climate Action Project in Bolivia. Rainforest Concern has done the same with its projects in old growth forests in Ecuador. The IPCC has developed widely tested and broadly accepted guidelines for measuring carbon-project benefits and improved standards are appearing, but few relate to forests. The Climate Community and Biodiversity Standard (CCB) {www.climate-standard.org} is accepted as one of the best for forest credits and includes sustainability and local livelihood criteria.

There is good reason to be optimistic that as the carbon market matures, more and more projects will follow evolving best-practice and strive to overcome these technical challenges.

Overcoming Obstacles: Incentives in Amazonas

Implementation of an innovative 'green free trade zone' in the State of Amazonas in Brazil resulted in a 53% reduction in deforestation in just three years (2003-5) alongside strong economic growth. The Secretary of State for Environment, Virgilio Viana, has reported "We've proven that we can reduce deforestation when the political will and the right incentives for people who live in the forests are there. With more incentives, this model could be applied in forests around the world."

Calls to Action

We call on Governments to urgently undertake the following actions:

- Include carbon credits for Reduced Emissions from Deforestation against a reference point (baseline) as a new regulated market mechanism under the UNFCCC and build in clear incentives for early action, so that the time between now and 2012 is not lost.

- Encourage new markets in ecosystem services, including for carbon stocks in tropical forests, through the voluntary sector initially and later in regulated markets to secure all forest stocks and the services they provide to humanity.

- Significantly simplify rules for crediting afforestation and reforestation under the Kyoto Protocol's Clean Development Mechanism to develop sustainable timber supplies without the need to extract them from existing rainforests.

- Provide support for research and capacity building to understand the interactions between forests and the atmosphere and their economic values to human livelihoods and to underpin the development of new markets in ecosystem services at local to global scales.

- The EU should repeal its ban on forestry and land use credits from developing nations in its European Trading Scheme to encourage sustainable forest management and adopt any new measures on RED under the UNFCCC.

In addition we support the following positions which also aim to reduce deforestation:

- The EU should phase in a ban on illegal timber entering the supply chain accompanied by a credible certification and tracking mechanism. Other Governments should follow suit. Developing nations should be provided with assistance during this transition period. Governments should also insist on a public procurement policy that excludes illegal timber products, thus helping to ensure a market for sustainably grown wood.

- A certification scheme for new biofuels, especially palm oil, should be implemented which takes account of the emissions life cycle in their production, to ensure they do not release more CO_2 than they save.

Photo © James Aldred

Our Commitment

The Global Canopy Programme is an alliance of 29 scientific institutions in 19 countries, which lead the world in forest canopy research.

We bring the cutting-edge science of canopy ecosystem services to decision-makers in Government and finance. Together, we work on policy and positive incentive mechanisms which help to mitigate climate change by preserving these vital forest utilities for humanity.

In addition to our ongoing activities in research, capacity building and conservation, we are working to achieve the objectives set out in this report through large-scale projects in each of our areas of expertise:

SCIENCE

The Whole Forest Observatory Project:

Dedicated observatories across the tropics will enable joined-up thinking on the science and economics of forest ecosystem services.

The WFO is a $20 million network of scientific Observatories across the tropics, designed to investigate forest ecosystem services from leaf tip to root tip. It will evaluate these services in terms of their contribution to the global economy and their wider significance for humanity.

The Observatories, each with a canopy crane, atmospheric tower, training programme, and suite of research projects will revolutionise capacity for canopy science in the world's biodiversity hotspots.

In February 2005, the United Nations Environment Programme and the Governments of Brazil, Ghana, Madagascar, India and Malaysia approved the plan, and talks are ongoing with China. $8 million has been pledged towards the launch phase, which will focus on carbon storage and sequestration services, and the interactions between forests and the atmosphere.

POLICY

VivoCarbon Initiative:


THE INDEPENDENT

BATTLE OF THE IT GIRLS

THE HIGH SOCIETY DRAMA TEARING NEW YORK APART, IN EXTRA

The hidden cause of global warming

Survival Sunday

West Ham stay up in day of drama

Sport, Pages 62-64

Enduring joy

The Independent newspaper set the VivoCarbon Initiative in motion by bringing forests – the elephant in the living room of climate change – to the attention of the world.

In May 2007 the GCP launched its VivoCarbon Initiative, which seeks to deepen understanding amongst Governments, parties to the UN Conventions on Climate Change and Biological Diversity, financial investors and the media concerning the roles played by 'living carbon' in sustaining life, atmosphere and people.

The principle aim of the VivoCarbon Initiative is to put forests first in the fight against climate change. Forests are being treated without urgency and are often missed altogether in the political and public debates on climate change – despite deforestation causing up to one quarter of global carbon emissions.

Ultimately, carbon sequestration and carbon storage are just two amongst the many ecosystem services which forests provide. Accordingly, the VivoCarbon Initiative will communicate the scientific and economic values of forest ecosystem services such as rainfall generation, biodiversity maintenance, oxygen production and others.

FINANCE

Amazonas Initiative:

Photo © Claudio Soriano

A meeting in January 2007 between (from left) Amazonas Secretary of State for Environment Virgilio Viana, Governor Eduardo Braga, and UK Minister for Biodiversity Barry Gardiner was coordinated by Andrew Mitchell and Hylton Murray-Philipson of the Global Canopy Programme

We are working with the private sector investment community to design innovative market mechanisms to increase positive incentives for the wise use of forests, and to value the 'living carbon' and ecosystem services they provide.

The Amazonas Initiative is bringing together the Government of the State of Amazonas in Brazil with the UK Government and the carbon markets in London. Amazonas state has 16.9 million hectares of forest under protected areas, which contains the equivalent of 7 billion tonnes of CO_2. Between 2003-2005 the State grew economically by 12.8% per annum whilst their deforestation rate fell by 53% due to pioneering fiscal and social mechanisms.

Following roll-out and assessment, the financial model will be expanded into the tropical rainforests of Congo and SE Asia in a planned collaboration with UNEP.

The GCP Alliance

The GCP operates with the support of the following groups of people:

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This report has been produced with the generous support of the Rufford Maurice Laing Foundation, CHK Charities, the John Ellerman Foundation, Libertas Capital, and Engelfield Capital

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**Scientists have had to think differently about forests.
The global community must now do the same.**

For further information see:

www.globalcanopy.org
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