



postnote

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DEFORESTATION

International attention is focussed on ways to reduce deforestation, prompted by concerns over greenhouse gas emissions and biodiversity loss. However the underlying causes of deforestation are rooted in current economic and development paradigms. This POSTnote looks at the reasons why deforestation occurs and the impact it has on the environment, as well as examining policies to reduce it.

Background

The UK is hoping to reach an international agreement to reduce tropical deforestation by at least 50% by 2020, and to halt global forest cover loss by 2030.¹ This is motivated by the fact that around 16% of global CO₂ emissions are caused by deforestation, and halting it has been proposed as a cost-effective way of mitigating climate change. In 2007, the international community agreed that “Reducing Emissions from Deforestation and Degradation” (REDD) should be part of a global agreement to limit climate change. How this will be achieved is currently under active discussion.

Most economically developed nations cleared their forests in the 19th and 20th centuries, but since the 1950s deforestation has primarily occurred in tropical, developing countries. At present, the major deforesting nations (by CO₂ emissions) are Indonesia, Brazil, Malaysia, Burma, the Democratic Republic of Congo and Zambia. Together these nations account for over two thirds of CO₂ emissions from deforestation.²

Forest loss causes environmental and social damage in many ways. Forests are a large store of carbon, and some of this is released through deforestation and degradation. In addition, forests play a major role in regulating regional and global rainfall patterns. Forests are crucial to the livelihoods of many of the world’s poor, and are home to 350 million people.

Causes of Deforestation

Most tropical deforestation results from clearing of space for agricultural land. This reflects the fact that it is normally more profitable to clear forest and grow crops, than it is to harvest timber and other forest products

sustainably.³ Currently, tropical deforestation is largely caused by demand for subsistence food crops, especially in Africa, but in Latin America commercial cattle ranching and soya cultivation are significant drivers. In SE Asia, palm oil and wood pulp production, along with large scale timber extraction are also important (Box 1). However, underlying these direct causes of deforestation are issues of economic development, land ownership and governance, that have stymied previous international efforts to reduce deforestation.

Box 1. Quantifying the Direct Causes of Deforestation

Reliable data on the causes of deforestation do not exist, partly because of monitoring problems (Box 2), but also because the different causes of deforestation are often entwined. The estimates in Table 1 are known to be highly uncertain. A typical sequence of deforestation in a Latin American rainforest might start with new access due to a road being built, followed by selective logging of the valuable timber species, and some small scale agriculture, causing forest degradation. The subsistence farmers may be evicted by commercial interests, such as cattle ranchers or soy cultivators. This pattern differs widely across continents.

Table 1. UNFCCC Best Estimates of the Direct Causes of Tropical Deforestation. (Approximately 129 000 km² are deforested each year, roughly equal to the area of England.⁴)

Small scale agriculture/shifting cultivation	45%
Commercial crops	20%
Commercial wood extraction	15%
Cattle ranching (large scale)	10%
Fuelwood for own use	5%
Fuelwood and charcoal (traded)	5%

Forests and Economic Development

The pressures to deforest come from the wider economy, not just from the forest sector. Therefore, as an economy develops, the influences change (Fig. 1).

At the early stages of economic development, population and demand for agricultural land rise fast and forests are often cleared to make way for farms. Additionally, poor nations often try to increase exports of raw materials and encourage timber and other primary industries that cause deforestation. Profits from these industries create capital

that is often invested in activities and transport infrastructure which fuel further deforestation. This leads to very rapid and accelerating deforestation.

With further development, deforestation typically slows. This is because, as forest cover decreases, increasing scarcity and awareness of forest resources can prompt policies aimed at reducing its loss. Also, a shortage of rural labour, which makes extensive agriculture less profitable, reduces deforestation rates.⁵ For example:

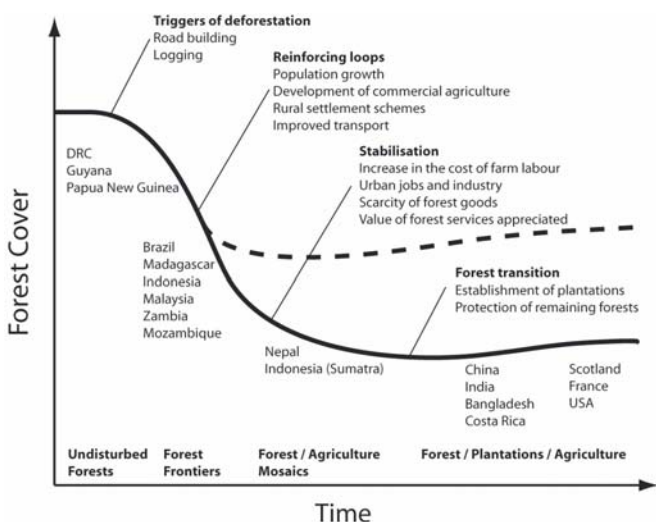
- in Portugal, Ireland and Greece, forest loss stopped because of farm labour scarcity, which increased the costs of agriculture and made forestry more economically attractive
- in China and India, the area of forest started to increase in the 1990s as a result of government policies that emphasised the value of the goods and services provided by the forest,⁵ mainly from flood and soil erosion protection.

This change from deforestation to a stable or increasing forest cover is called the ‘forest transition’ and has occurred in nearly all nations with a GDP greater than \$5,000 per person. Countries that do not develop as they deforest, but remain trapped in a cycle of poverty and subsistence farming (e.g., Ethiopia and Haiti), often continue to lose forest cover.⁵

After the forest transition, forest cover remains stable (although often at low levels) or gradually increases. However, this is often occurs through an expansion of secondary forests and plantations, sometimes with continued loss of old growth (primary) forests. Secondary forests and plantations typically do not have the same biodiversity and carbon storage benefits as primary forests.

In essence, international policy to reduce deforestation in developing countries (Box 3) is attempting to change the pattern described above so that the forest transition occurs sooner, and at a point in time when more forest remains.

Figure 1. The forest transition.⁶ The dashed line shows the goal of international REDD policy.



Governance and Land Ownership

Poor governance and insecure land ownership are major issues which hinder attempts to reduce deforestation in developing countries. Maintaining forests while harvesting timber and other products sustainably can be profitable, but needs a long term approach. This is often impossible in tropical developing nations where land ownership is unclear, forced evictions occur, and law enforcement is weak. In this situation, the rational approach is to seek short term profits, which can normally be achieved by clearing the forest and growing crops. In addition, high levels of corruption and inconsistent legal systems are common in deforesting nations and make long term investments risky. Investors demand a high return on their capital, given such risks, a return which sustainable forest management is typically unable to deliver.

The Impacts of Deforestation

Deforestation and the Carbon Cycle

Forests and their clearance play two, largely separate, roles in the carbon cycle and thus in the climate system:

- when a forest is cleared, carbon stored in wood and soil is lost to the atmosphere. This contributes about 16% of current human CO₂ emissions.⁷
- forests and other vegetation currently absorb 30% of human CO₂ emissions. This is sometimes called the “forest carbon sink”, and when a forest is cleared, it ceases to provide this function.

Over the last 200 years, CO₂ emissions from deforestation have accounted for around 40% of total CO₂ emissions. However, since the 1950s, fossil fuel emissions have grown, and deforestation now accounts for 7-30% of all human CO₂ emissions, with a best estimate of 16%.⁷ This figure is very uncertain because of difficulties in monitoring changes in forest cover and carbon stocks (Box 2).

Box 2. Difficulties in Monitoring Forest Cover

The UN Food and Agriculture Organisation is the main source of data on global forest cover. However, the reports submitted by each member state are often based on sparse information and have been shown to be inconsistent.

This could be improved with the use of satellite technology, but at present this is not being done routinely. Satellite imagery offers the ability to monitor global forest cover continuously, and accurate measurement has been shown to be possible by research scientists, often studying small areas. However there is currently no operational facility providing global satellite data on changes in forest cover. The Brazilian Space Agency has developed a world-leading system to monitor the Amazon, but there is no comparable system for other forested areas. The UK Department for International Development (DfID) is funding an extension to the Brazilian system to cover tropical Africa. There are still major difficulties in monitoring open woodlands and savannas and in detecting forest degradation.

Forests and Rainfall

Forests play a major role in the global water cycle. During the day, trees evaporate vast quantities of water into the atmosphere from the soil, and this leads to cooler, moister air in their vicinity and downwind. Deforestation can disrupt this process and lead to

complex changes in local rainfall and increases in temperature. Large scale deforestation is predicted by climate models to have far reaching effects on rainfall patterns, but the details are uncertain.

At a regional scale, rainfall derived from forests can be critical to agriculture and other industries. For example the La Plata basin of Latin America, which generates 70% of the GDP of 5 countries, is heavily dependent on rainfall carried downwind from the Amazon.

Livelihoods and Poverty

Three hundred and fifty million people live in forests and 1.6 billion depend on forests for their livelihoods and are often among the poorest, most marginalised people on the planet, both economically and politically.³ The links between deforestation and poverty are complex. The rural poor in many developing countries depend on forests for fuel, food, medicine, grazing and fertile soils, and these resources are particularly important in times of stress, for example during droughts or war. However poverty is also a cause of deforestation (see below).

Biodiversity, Soil Erosion and Flood Risk

Forest and other habitat loss is the major cause of biodiversity loss. Tropical rainforests are the most diverse regions of the planet in terms of plant and invertebrate species. Forests also modify the quantity of water in rivers, its quality and the evenness of flow, and can reduce the severity of floods. In a similar manner, forests prevent soil erosion and landslides.

Policies to Reduce Deforestation

When designing policies to reduce deforestation, it is useful to distinguish between 'planned' deforestation which helps meet broader national policy objectives (such as poverty reduction and economic growth) and 'unplanned' deforestation which does not achieve wider goals, nor bring economic benefits.³ There is an implicit conflict between planned deforestation and climate mitigation objectives, which could be resolved with compensation to forest nations (Box 3). Halting unplanned deforestation typically requires correction of both market and governance failures.

International Approaches

Attempts to reach an international agreement on reducing tropical deforestation have to date achieved little, despite over 30 years of UN negotiations. This is partly due to the different motivations of the economically developed, mainly deforested, nations who see the tropical forests as providing a global service, and the poorer, deforesting nations who see them as a national resource to be exploited as a means to development. The financial support on offer has not been sufficient for deforesting nations to abandon agriculture- or timber-driven development.⁸ The new REDD agreement currently being negotiated in the UN aims to change this (Box 3).

Policies in Deforesting Nations

In areas where law enforcement is weak and land rights are insecure (which includes most tropical forests), criminalising deforestation or providing economic incentives to maintain forests tends to be ineffective. In this situation, the establishment of protected areas is

needed and these often have to be fenced and guarded, which in the past has caused conflict with local and indigenous peoples. In addition, running these protected areas is often beyond the financial means of poor nations. Many conservation organisations are hoping to use REDD finance to improve the effectiveness of protected areas, or to establish new ones. To this end, several large US conservation NGOs have joined with energy companies in lobbying for reductions in tropical deforestation to be used to meet US targets for emissions reductions.¹⁰

Box 3. Reducing Emissions from Deforestation and Degradation (REDD)

Parties to the UN Framework Convention on Climate Change agreed in 2007 that efforts to Reduce Emissions from Deforestation and Degradation (REDD) should play a role in climate change mitigation, partly because of co-benefits such as poverty reduction and biodiversity conservation.

Under REDD, nations would be paid if they achieve a reduction in carbon emissions from deforestation. These payments could either be from a global fund, or as part of an international carbon market. The UK government believes that only a global market can deliver the necessary scale of finance in the long term.¹

How much would need to be paid to deforesting nations to leave the trees standing? A major cost is compensating for profits that would have been made if the land had been cleared for agriculture, estimated by the UK government's 'Eliasch Review' at between \$5-7 billion a year if deforestation were to be halved by 2030. If this was done as part of a carbon market, the costs would be higher – between \$17-33 billion a year.⁹

However, other costs would be incurred under REDD, including those from improving governance, establishing land tenure and legal rights, and monitoring and forest protection. Where opportunity costs are very low (e.g. stopping clearance for subsistence farming in Africa) the set up and monitoring costs are likely to be very high, and lack of capacity and poor governance may make effective action impossible. The UN and World Bank have both set up funds to assist developing countries prepare for REDD.

REDD would leave the national-level policies up to national governments, but could include safeguards promoting forest-peoples' rights as well as biodiversity. The strength of such safeguards is an area of contention.

Where it is possible to establish long term property rights, granting secure land and usage rights to local communities can make sustainable forest management possible (Box 4). Fiscal policy can also be used to make deforestation less financially rewarding by removing subsidies that raise the returns from logging and agriculture, including road and transport subsidies.

Policies to create incentives to maintain forests include:

- lower taxes on land with intact forest
- certification schemes (and higher prices) for forest products harvested sustainably
- credit for, and investment in, non-timber forest products such as honey, medicines and eco tourism
- payments for ecosystem services (see POSTnote 281).

Deforestation often results from poverty and rural population growth, and the consequent need for land for subsistence farming. In such areas, policies to improve

agricultural yields are needed to reduce deforestation. A recent study found that improving agricultural productivity could play as big a role in reducing CO₂ emissions as the development of new energy technologies.¹¹

Box 4. Examples of Attempts to Reduce Deforestation

Brazil's Amazon Fund is the largest attempt to reduce deforestation. Countries, companies and individuals can pay into the Fund, which the Brazilian government uses to finance conservation and rural development projects, and improve monitoring and law enforcement in the Amazon. The Fund aims to raise \$21 billion over 13 years. Norway has pledged up to \$1 billion, contingent on a decrease in deforestation each year. The Fund is designed to avoid the use of market mechanisms and allows Brazil to retain complete sovereignty over its attempts to reduce deforestation. The UK and Norway are also major contributors to the multinational Congo Basin Forest Fund.

The DFID-Nepal Livelihood and Forestry Programme enables rural communities to rehabilitate and manage their forests through community-based Forest User Groups (FUGs). These, which have legal status, have replanted and restored forests in a way that improves rural livelihoods by sustainable harvesting of timber, fuelwood, and fodder. The project has decentralised decision making power to 4,600 FUGs (11% of Nepal's population), which manage 370,000ha of forest. The project has lifted 25,000 households out of poverty between 2003 and 2008 and increased household income by 61%.

The Nhambita Community Carbon Project is a privately-run rural development project in central Mozambique. It uses funding from the voluntary carbon market to provide an economic incentive for local communities to manage their woodlands sustainably. The project also supports improvements in subsistence agriculture through agroforestry techniques, reducing the need for new agricultural land and increasing food security. Since 2003, the project has involved over 1,755 farmers in tree planting and woodland management and more than doubled the income of project participants.

Reducing Demand for the Products of Deforestation

Reducing demand for the products of deforestation is a key part of any attempt to reduce the economic incentive to deforest. However government action on this front faces many hurdles, not least the lack of political will to risk confrontations with international trade law, and suspicions of the use of environmental issues as a pretext for protectionism. In 2006, the UK government rejected a suggestion by the House of Commons Environmental Audit Committee that sustainability indicators needed to be developed for globally traded commodities, citing political difficulties.¹² However, in 2007 the UK government's Renewable Fuels Agency set out indicative targets for the proportion of biofuels used in the UK that should be certified to a sustainability standard. The aim is for 80% of such fuels to be certified by 2011. Currently the proportion is 33%. It is not clear if this approach will be expanded to other commodities.

In the absence of government action, NGOs and businesses have developed sustainability standards, most widely for timber, but they are also being developed for palm oil and soya. These, alongside other environmental and social criteria, should guarantee that the products

are not grown on recently deforested land. However sustainability standards have not been widely adopted: globally around 8% of timber production is certified, and less with other products. This is partly due to a lack of consumer demand for certified products. Consumers may not be aware that a product contains ingredients that drive deforestation. For example, Brazilian soya is fed to many UK chickens and pigs, and palm oil is used in 1 in 10 products on UK supermarket shelves.^{13,14} In the UK, there is high demand for certified timber and currently over 80% of timber imported into the UK is certified, although the figure is much lower for tropical hardwood.¹⁵

Overview

- Deforestation contributes around 16% of human CO₂ emissions and threatens to alter rainfall patterns.
- The underlying causes of deforestation are the need for economic development and governance failure. The direct cause is normally conversion of forest land to agriculture.
- Deforestation has accompanied economic growth in nearly all countries, but typically forest cover stabilises as GDP per capita climbs above \$5,000 a year.
- Policies to reduce deforestation have been a longstanding goal of the international community, but have been ineffective to date. Current proposals will need to provide an economic incentive to maintain forest cover as well as to address other market and governance failures.
- Policies that improve agricultural yields and lower demand for soy, beef, palm oil and wood products are needed to reduce deforestation.

Endnotes

1. DECC. *The Road to Copenhagen*, June 2009.
2. WRI. *The Climate Analysis Indicators Tool*, 2009
3. World Bank. *At Loggerheads? 2007*
4. UNFCCC. *Initial analysis on the mitigation potential in the forestry sector*, 2007
5. Rudel, TK., et al. *Global Environmental Change*. 15 (2005) pp 23–31
6. CIFOR. *Do trees grow on money? 2007*
7. IPCC. *4th Assessment Report*, updated with data from the Global Carbon Project, 2007.
8. Humphreys, D. *Logjam: Deforestation and the Crisis of Global Governance*, 2008
9. The Eliasch Review. *Climate Change: Financing Global Forests*, 2008.
10. Tropical Forest-Climate Unity Agreement. *Consensus Principles on International Forests for U.S. Climate Legislation*.
11. Wise, M., et al. *Science* 324, (2009), pp 1183.
12. Environmental Audit Committee. *Reducing greenhouse gas emissions from deforestation: No hope without forests*. 2009
13. Forest Footprint Disclosure Project
14. JNCC, www.ukglobalinfluence.org
15. Timber Trade Federation. *The 2008 Certification Study*.

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The Parliamentary Office of Science and Technology, 7 Millbank, London SW1P 3JA. Tel 020 7219 2840.

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