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Deforestation in Amazonia

Lead Author: **Philip M. Fearnside** **(other articles)**
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This article has been **reviewed and approved** *by the following Topic Editor:* **Mryka Hall-Beyer** **(other articles)**
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Introduction

Tropical forests in Amazonia are being cleared rapidly, representing an important contribution to land-use and land-cover change. While some processes are common to forests throughout the world, others are not. Amazonian clearing is dominated by large cattle ranchers, with an increasing role being played by soybeans. Small farmers and estate crops such as oil palm have less relative importance here than elsewhere. Deforestation in Brazilian Amazonia has a significant contribution from “ulterior” motives such as land speculation, money laundering and tax evasion. Infrastructure projects, especially highway construction and improvement, represent key governmental decisions unleashing chains of activity that escape from government control. Deforestation sacrifices environmental services such as maintenance of biodiversity, water cycling and carbon stocks. The substantial impact of this deforestation on loss of environmental services has so far not entered into decision-making on infrastructure projects, making strengthening of the environmental assessment and licensing system a high priority for containing future loss of forest.

Transamazon Highway. (Source: Philip M. Fearnside)

History

Names of Amazonian states. (Source: Philip

Deforestation has been a feature of Amazonian landscape since long before the arrival of Europeans in the 1500s. Indeed, no forest in the region can be considered “virgin” in the sense of being unaffected by past human activities. Prior to decimation of their populations by disease and violence from the Europeans, indigenous peoples maintained extensive areas of agriculture and they enriched the surrounding forest with useful species such as Brazil nuts. These human influences would be merged with forest regrowth during the lapse of three centuries before non-tribal populations reached levels sufficient to begin exerting significant pressure on the forest. Contrary to the claims of some, this history of past human disturbance in no way diminishes the rationale for conserving Amazonian forests today. Likewise, the exuberant forests that now stand on formerly cleared areas do not justify the myth of a future recovery-that forests being cleared today may one day regrow to their former stature. In practice, secondary forests are recleared for cattle pasture or other uses long before they regain the biomass and diversity of “primary” forests.

In Brazil, deforestation over the course of several centuries destroyed the Atlantic forest of the south-central part of the country (note: the names of Brazil’s regions treat Rio de Janeiro as the “center” of the country). The pace of clearing was especially dramatic in the case of state of Paraná, where the forest was almost completely cleared in less than 30 years in the middle of the 20th century. At the beginning of this period prominent citizens frequently made statements to the effect that Paraná’s forests were so vast that human efforts would “never” put more than a dent in them. The similarity of these statements to those sometimes made today with reference to the Amazon forest is evident, as is the irony of their baselessness.

Deforestation in Amazonia has proceeded with a succession of different forces in different periods. The Amazon rubber boom lasted from the invention of the pneumatic tire in the 1880s to the

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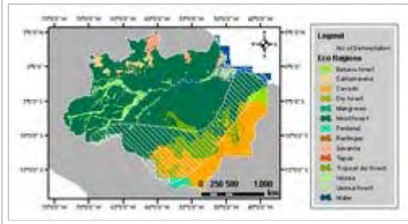
beginning of commercial rubber production from plantations in Southeast Asia in 1914. During this period “agricultural colonies” such as those in the 35,000-square-kilometer (km^2) Zona Bragantina near Belém, in the state of Pará, supplied the rapidly growing urban centers, and, to a certain extent, the population engaged full-time in exploitation of the natural rubber trees in the Amazonian interior. Much of the agricultural land was abandoned to secondary forest when the rubber boom collapsed. More recent clearing surges occurred with the opening of the Belém-Brasília Highway in the late 1950s, and especially the Transamazon Highway in 1970 (the event often taken as the beginning of the “modern” period of Amazonian clearing). The Transamazon Highway was settled by small farmers, many of whom were brought from other parts of Brazil by the federal government and settled in official colonization projects. This much-publicized initiative was soon overshadowed in terms of its impact on deforestation by the large cattle ranchers who received generous tax incentives and subsidized financing from the government though the Superintendency for the Development of Amazonia (SUDAM). Large and medium-sized ranchers continue to account for the bulk of clearing in Brazilian Amazonia. The relative role of small versus large actors is an important difference between different locations in Brazilian Amazonia, between different historical periods, and between Brazil and other countries.

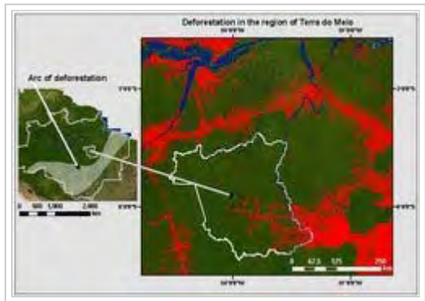


Ecoregions in Amazonia. (Source: Philip M. Fearnside)

Current rates and causes

Global generalizations about the role of “poverty” in tropical deforestation generally do not apply to Brazil, where most clearing is done by the rich. Cattle ranching is the use put to the great majority of land cleared, either immediately upon clearing in the case of large ranchers, or after a harvest or two of an annual crop in the case of small farmers. Although the government incentives programs of the 1970s and 1980s have been either discontinued or have diminished in importance, government infrastructure investment and agricultural credit continue to encourage clearing. Logging has a key role in serving as a source of funds for landholders to pay for deforestation. Logging also provides initial access roads, which can then be used and improved by those who later deforest the areas. Unlike the clear cutting that is done for timber harvesting in temperate and boreal forests, logging in Amazonia is always selective because only a few species have commercial value. The disturbed forest that remains after logging is much more susceptible to fire than are unlogged forests.

Deforestation in Amazonia is often not “rational” from the normal financial perspective of paying an attractive return on money invested, at least when only legal money flows are considered. In practice, deforesters make their decisions based on the combined total of all benefit streams, including those that may be undeclared and/or illegal. Investment in Amazonian land can serve as a means of laundering money from illegal sources such as drug trafficking, corruption, sale of stolen goods and income from legitimate activities that is undeclared to tax authorities. For money from these sources the sale of any beef or other products produced in the Amazonian landholdings represents legal income, whereas the investment needed to produce it is highly variable and easily underdeclared to tax authorities.



Arc of Deforestation in the region of Terra do Meio. (Source: Philip M. Fearnside)

Burning and deforestation of the Amazon forest to make grazing lands. Source: (NASA LBA-ECO Project)

“Ulterior” motives for clearing also include potential returns from land speculation. The value of land in Amazonia has generally climbed upward and invariably shoots to much higher levels where a road is built or improved. Buying land or claims to land at low prices and reselling it later at much higher prices can give greater returns to a landholder than do the ranching and agriculture that are undertaken during his tenure. Clearing a portion of the land is the only practical way to maintain claim to the area and avoid it being invaded by landless peasants, taken over by another large operator, or confiscated by the government for agrarian reform. Prior to the 1994 “Plano Real” economic reform, Brazil’s rate of inflation was much higher than it is today and land speculation represented a more powerful force, as was shown by the drop by over 50% in the deforestation rate in 1996 and 1997 in parallel with falling land values resulting from the removal of inflation as a driving force. Today, although there is no longer a need to invest funds in real estate as an escape from inflation, profits can still be made by individual landholders when infrastructure projects lead to increasing land values.

A state of lawlessness prevails in substantial areas in Amazonia, leading to distinctive “leaps” in the deforestation frontier. Most notorious is the “Terra do Meio”, or “Middle Lands” to the west of the Xingu River encompassing the Iriri River basin. This area, the size of Switzerland, has effectively been outside of the control of the Brazilian government and is the realm of drug traffickers, illegal loggers and grileiros, or large land thieves who appropriate land through fraudulent (and sometimes violent) means. Declaration of a series of reserves in the area in 2005, following the assassination of Sister Dorothy Stang, is a hopeful sign that the lawless condition is subject to change. The activities of grileiros continue in other locations, most recently increasing in the southern part of the state of Amazonas.

A new and increasing force driving deforestation is export commodities such as soybeans and beef. Soybeans have taken over much of the cerrado (central Brazilian savanna) and are advancing in some rainforest areas such as Santarém, Pará. Soybeans have a large indirect force on deforestation by providing economic justification for highway construction projects that spur forest loss through cattle ranching, logging and land speculation. Beef export has traditionally not been a force behind deforestation in Brazil (in sharp contrast to the “hamburger connection” of Central America) because the presence of foot-and-mouth disease made major markets in Europe, Japan and North America unwilling to import beef in frozen form. Since 1996 states in Brazil have successively been certified as free of foot-and-mouth disease, starting in the extreme south of the country and now including three of the nine Amazonian states. The impact of beef export on deforestation already affects all of Amazonia, even though most of the area is still uncertified and cannot export beef directly. Instead, beef produced outside of Amazonia, for example in the state of São Paulo, can be exported while the people in São Paulo eat beef raised in Pará.

Over 80% of both the cumulative clearing and the current clearing activity is concentrated in the “arc of deforestation,” which is a band along the eastern and southern edges of the forest. Deforestation advances from this band towards the center of the region. However, in addition to the expansion from existing clearings in the arc of deforestation, smaller clearings that appear far from the existing frontier have an importance that is much greater than their small area would suggest. These new clearings can serve as the seeds for much greater clearing activity in the future in the remaining blocks of undisturbed forest. Decisions on building highways that open these areas to migration and to investment are critical in speeding the deforestation process.

Future paths

The future path of deforestation depends on human decisions. It is not foreordained that the Amazon forest will be destroyed, although this is obviously the endpoint if present trends continue unchanged. Various modeling efforts have projected clearing patterns in Amazonia and agree that vast areas would be cleared if trends continue and planned infrastruture projects are built. Attempts to model what might happen under hypothetical “governance” scenarios are less convincing, since they rely on simple assumptions of restraint and obedience to environmental regulations that are at variance with observed behavior to date. Nevertheless, the potential to change deforestation behavior is real, both through creation of protected areas and through command and control measures to repress illegal clearing. An important historical example is the deforestation licensing and control program that was carried out by the state government in Mato Grosso over the 1999-2001 period, where clearing patterns indicated that the program had a real effect on deforestation rates. This is important as a demonstration that deforestation can be controlled if government authorities are serious about doing so. The example is historical, as the election of Brazil’s largest soybean entrepreneur as state governor in 2002 put an end to the program in practice.

Intact Amazon forest near Manaus. (Source: Philip M. Fearnside)

So far the principal measures that have been used to limit deforestation are creation of reserves and repression by fining those who clear without required authorizations. These are the measures that agencies such as the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA) are empowered to implement. However, the better-funded government agencies such as the Ministry of Transportation continue to plan and build roads and other infrastructure projects without regard for impact on deforestation. While the environmental licensing process for infrastructure projects may lead to compensatory actions, such as creation of reserves and funding of programs for monitoring and enforcement of regulations, the licensing has on many occasions shown itself to be incapable of stopping damaging projects and either diverting development efforts to less-damaging alternatives to achieve the same objectives or forcing a rethinking of the wisdom of the objectives themselves. Environmental impact studies (EIS) have only been required in Brazil since 1986 and the system is still subject to continual challenges and (often successful) attempts to build infrastructure with either no EIS (e.g., the proposed BR-319 Highway) or with an inadequate EIS that is effectively replaced with a package of parallel activities that escape from the legal requirement of serving as prerequisites for the infrastructure (e.g., the proposed BR-163 Highway). Building and improving highways is one of the principal ways that government decisions affect the deforestation process; the consequences of these decisions are much more far reaching than are the effects of any compensatory programs such as environmental education, promotion of agroforestry and the like. One of the most basic measures needed is strengthening the environmental impact assessment and licensing system such that it serves its intended role of informing major decisions before they are made, rather than as a formality to legalize decisions that have already been made.

Indigenous lands and various categories of parks and reserves represent a primary defense against deforestation. Indigenous peoples, whose officially recognized lands represent approximately 20% of Brazilian Amazonia, actively defend their territories against invasion. An essential complement to this is the general understanding that invasion of indigenous land will not be rewarded by a land title or by any sort of compensation. In many places in the arc of deforestation the only forest that remains standing is what is in indigenous areas.

Since the mid 1990s tremendous progress has been made in “demarcating” indigenous areas, that is, marking the limits of these areas on the ground (as opposed to merely drawing them on a map). At the same time, large areas have been protected in newly created conservation units, both by federal and state governments. These include an increasing number of “sustainable use” reserves, although a number of new reserves have also been created in the “integral protection” category. Conservation units now total roughly 10% of Brazilian Amazonia. Decreeing a reserve, even if only on paper, can have a significant effect in discouraging both small squatters and large grileiros from clearing forest with the expectation of eventually receiving legal title to their claims. In the longer term “paper parks” are not enough—the reserves must be adequately guarded. Expansion of the reserve network must be done quickly because the opportunity to create reserves is often lost once deforestation advances into an area. Reserve creation is a critical step in guiding the development of Amazonia towards a future that maintains substantial areas of tropical forest.

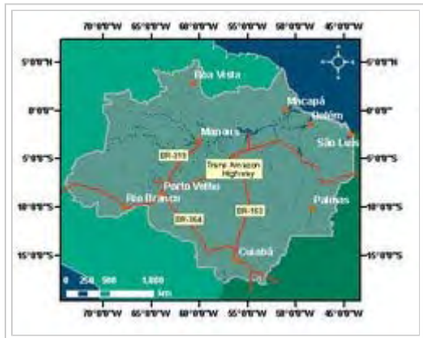
Impacts

Amazonian deforestation causes serious impacts that, if counted in decision making, would often be seen to outweigh the benefits derived from clearing. Loss of biodiversity is one such impact, which implies both loss of the value of the direct uses to which the species lost might be put by humans and the loss of existence values that are independent of such direct uses. Deforestation impacts are magnified by the pattern of clearing that leaves the remaining forest divided into fragments, which then degrade both biodiversity and carbon stocks.

BR-319 Highway. (Source: Philip M. Fearnside)

Deforestation also affects water cycling, because conversion of forest to cattle pasture results in the water running off into the rivers and flowing directly to the ocean without being recycled through the trees. A significant part of the rainfall in Amazonia, especially in the dry season, depends on water that has been recycled through the trees of the forest. This water is critical to preventing droughts from exceeding the forest’s tolerance for water stress, leading to death of trees and degradation of the forest through fire and further drought. Water from Amazonia is also critical to maintaining rainfall in the heavily populated regions in south-central Brazil, such as São Paulo, and in neighboring countries such as Argentina.

Global warming receives a substantial input of greenhouse gases from Amazonian deforestation, although the majority of the gases released by humanity as a whole come from burning fossil fuels such as petroleum and coal rather than from deforestation. However, over three-fourths of Brazil’s contribution to this global problem is the result of Amazonian deforestation. Half of the dry weight of the trees is carbon, and when forest is cut this carbon is released to the atmosphere either as carbon dioxide or as methane, both from burning and from decomposition of wood that fails to burn. The fact that most deforestation is for cattle pastures that do little either for the national economy or for providing employment to the population offers an opportunity to slow deforestation as part of a program for mitigating global warming. The value of the damage done by greenhouse-gas emissions from deforestation far exceeds the value of the timber, beef and other products that are sold as a result of the clearing.



Roads throughout Amazonia. (Source: Philip M. Fearnside)

Alternatives

Discussion of “alternatives to deforestation” often focuses on the extraction of non-timber forest products such as rubber and Brazil nuts, sustainable forest management for timber, and increasing the production and sustainability of land uses in already deforested areas, for example by encouraging agroforestry. These “alternatives” all have their places, but they also have limitations and are often misrepresented with respect to their role in slowing deforestation. The economic logic that activities expand

when they prove to be profitable applies to those undertaken in deforested areas, and what may be intended as an “alternative” can, if it proves highly successful, advance into the forest and have the opposite effect on deforestation. Proposals for intensified pasture production and for extensive production of biofuels are subject to these reservations. The same applies to annual crops: the notion that farmers and ranchers who reap greater per-hectare yields will be satisfied with their harvests and refrain from further deforestation is unrealistic as a basis for programs aimed at reducing deforestation. Unfortunately, people do not stop clearing when their stomachs are full, but instead use their increased wealth to expand their clearings.

Uses of standing forest such as sustainable (i.e., low intensity) harvesting of both non-timber and timber products often produce low financial returns. This is to be expected, but the rationale for promoting and subsidizing these uses lies in their role in maintaining environmental services, not in their efficiency as commodity sources. These activities are valuable as transitional mechanisms for maintaining traditional populations who can serve as forest guardians. The same activities can also serve as parts of future mechanisms whereby environmental services of standing forest become the primary means of generating income to support the rural population, and the basis of the economy is shifted from its present reliance on forest destruction. Among the environmental services of the forest, carbon storage is the closest to becoming the basis of substantial financial flows through international negotiations, but the equally valuable services of maintaining biodiversity and water cycling can eventually be expected to gain similar status.

Further Reading

- Publications on Human Carrying Capacity, Agroecosystems, Deforestation, and Development Planning in Brazilian Amazonia, National Institute for Research in the Amazon (INPA.
- Expanding Deforestation in Mato Grosso, Brazil, NASA Earth Observatory
- Deforestation in the Amazon, Rhett A Butler, Mongabay.com.

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Contributor: Philip M. Fearnside

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Philip M. Fearnside is a Research Professor in the Department of Ecology at the National Institute for Research in the Amazon (INPA) in Manaus, Amazonas, Brazil. He is a permanent resident in Brazil where he has lived in Amazonia for over 30 years doing ecological research. He also has field experience in India, Indonesia and China. He completed his Ph.D. in 1978 in the Department of Ecology and Evolutionary Biology, Division of Biological Sciences, University of Michigan, Ann Arbor, Michigan, U.S.A. Fearnside's research since 1974 has been directed at the estimation of human carrying capacity of tropical agro-ecosystems. His work since 1992 has been organized around the objective of converting the environmental services of Amazonian forests into a basis for sustainable development for the rural population of the region, taking the place of the current pattern of forest destruction. He has authored over 350 publications on these and related problems of environment and development. Honors include Brazil's National Ecology Prize, the UN Global 500 award, the Conrad Wessel prize, the Chico Mendes prize and membership in the Brazilian Academy of Sciences. In 2006 he was identified by Thompson-ISI as the world's second most-cited scientist on the subject of global warming.

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