

Deforestation in the Amazon: Pressures and outlook

At the end of last year, the Brazilian government released the news that the deforestation rate in the Amazon was down for the second consecutive year, reaching the lowest levels in a decade. In this analysis of the state of the Amazon, *Diego Martino* considers whether this is a cause for optimism.

DEFORESTATION in the Amazon has been a central concern of the environmental movement for more than three decades. The main factors behind deforestation have been heavily analysed and discussed - from the "hamburger connection" in the 1980s, which linked hamburgers consumed in North America with Amazon deforestation, to the most recent "McNuggets connection", linking soy production to raise chicken with expansion of the agricultural frontier into the Amazon.

The Amazon rainforest is host to an impressive range of cultural and biological diversity. The Amazon holds many of the world's biodiversity hotspots, and is home to many different nations of indigenous peoples, including some yet to come into contact with the Western world.

At the end of 2006, the Brazilian government released good news. The deforestation rate was down for the second consecutive year, reaching the lowest levels for a decade. However, in the context of the trends described in Figure 1, we have an accumulated deforested area of approximately 600,000 square kilometres - more than the combined territories of Belgium, Croatia, Czech Republic, Netherlands, Portugal, Slovakia, Slovenia, Switzerland, and the United Kingdom.

Deforestation in the Amazon has local and global impacts. Deforestation and fragmentation processes at the local level drive to extinction many species not yet known to science. Native peoples also suffer the environmental and social impacts of deforestation. At the global level, enormous amounts of carbon dioxide are released, affecting global climate.

In this article we briefly describe the state of the Amazon, identify the main pressures driving deforestation, and analyse perspectives for the near future.

The Amazon region

The Amazon rainforest, an ecological region with dense, humid and tropical forest, covers between 5 and 7 million square kilometres, and expands through Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Peru, Suriname, and Venezuela. Most of the territory belongs to the basins of the Amazon and Tocantins rivers (see Figure 2). Inside the Amazon region, there is a variety of eco-regions, which have their own identity despite sharing the main characteristics of the tropical forest.

Political or legal limits also exist in the Amazon. One such case is the Amazonia legal (legal Amazon). The Amazonia legal is a 5.5-million-square-kilometre territory defined by the Brazilian government. It expands beyond the Amazon, and holds other types of ecological regions, such as the Cerrado.

Deforestation

Deforestation data is not always available for the entire Amazon. In this article we refer to data from different countries, but since Brazil hosts the most up-to-date and open monitoring system, most of the data provided is for Brazil.

As described in Figure 1, the last two years have shown an important reduction in the deforestation rate in

the Brazilian Amazon. Despite this, during the last monitoring cycle (August 2005-August 2006) 13,100 square kilometres were lost in Brazil alone. In Peru the annual deforestation rate is approximately 150,000 hectares, and the cumulative deforestation is estimated to be between 70,000 and 95,000 square kilometres.

The driving forces behind deforestation vary, from international commodity prices and demand from European consumers to meteorological events and government enforcement (or lack thereof).

In Bolivia the Superintendencia Forestal estimates annual deforestation to be 50,000 hectares (Rojas et al 2003), but other authors consider this estimate very conservative (Pacheco 2006). These relatively outdated figures are important, for they show that outside Brazil, which normally makes the headlines due to the country's size and its advanced monitoring system, deforestation is happening at alarming rates.

Main pressure factors

The driving forces behind deforestation vary, from international commodity prices and demand from European consumers to meteorological events and government enforcement (or lack thereof). The main pressures we will highlight here are road con-

struction, cattle ranching, agriculture, and fires. Wood extraction is related to all these factors. It is the driving force behind construction of many unofficial roads; it represents an important “value added” for cattle ranchers who log more than the maximum 20% of their land allowed by law; and it influences the appearance of fires due to the production of fine residue and the destruction of vegetation cover that acts as a barrier to the expansion of fires (Gerwing and Vidal 2002).

Roads

Roads generally constitute the opening act in the deforestation process [1]. After a road is opened, logging begins, followed by land occupation by small farmers. In some parts of the Amazon, particularly south of the arc of deforestation, industrial agriculture follows, pushing small farmers and cattle ranchers further into the Amazon, in a process known as the expansion of the agricultural frontier.

Roads in the Amazon range from opened paths to paved highways; some are official, others are built illegally by loggers. The most important highways are the BR 163 and the BR 364, both located in Brazil. The BR 364 runs from east to west, and after Peru finishes construction work it will link Brazil with the Pacific coast, providing an important route to commercialise products from the Amazon. The BR 163 originates several kilometres south of Cuiaba and runs north up to the Brazilian port of Santarem by the Amazon River.

Studies have identified paved and non-paved roads as the most important deforestation pressure (Kirby et al 2006); 80% of Amazonian deforestation happens less than 30km away from an official road. Paving also improves access to the Amazon and fuels other deforestation pressures. A study by Barreto et al (2006) showed that in a 50km radius from a road, deforestation reaches 60% in paved fragments and up to 10% in unpaved ones of the same road.

Fire

Fires are another important pres-

sure factor behind deforestation. In recent years northern Bolivia, and central and western Brazil have experienced major fires. In 2005 alone, 226,000 fires were recorded in Brazil, in 2006 the figure was 118,000.

Fires are generally related to urban and deforested areas, management by native and mestizo populations, selective logging, and unofficial roads (Barreto et al 2006). Slash-and-burn agriculture is particularly important in Bolivia, where smoke sometimes covers the north of the country and adjacent areas of Brazil. A study conducted in 2002 estimates that only 16% of Amazon fires are intentional and in deforested areas. The rest are either accidental or happen in forested, agricultural or pasture areas. The economic cost of these fires is estimated at US\$100 million by some (Seroa da Motta et al 2002), and between \$10 and \$15 billion by others (UNEP 2003).

Climate plays a substantial role in fire dynamics. Under drought conditions, the death rate of taller trees is higher, therefore generating greater light exposure that increases the likelihood of fire. Moreover, during big fires, smoke can inhibit rain for weeks, feeding a vicious cycle that is accentuated by El Niño, which was responsible for serious droughts in the Amazon in 1998 and 2005.

Cattle ranching

During the last decade, cattle ranching grew at an annual rate of 7%, ten times the rate for the rest of Brazil (Barreto et al 2005). This places cattle ranching among the most important causes of deforestation, and is explained by the high economic returns of this activity in the Amazon (Kaimowitz et al 2004). It is not surprising then that in the Brazilian Amazon there are 6 hectares of pasture for each hectare of agriculture. The ratio in Peru is 2 to 1.

The investment return in largescale cattle ranching establishments is 35% higher in the Amazon than in the centre-south region of Brazil. This differential is a result of low land price, pasture productivity, easy access to public land, good credit, and

higher percentages of forest than permitted by law. These factors together compensate for the 10 to 19% lower prices received by Amazonian ranchers (Barreto et al 2005).

Other relevant factors are the access to foreign markets due to sanitary improvements, better pasture management, and the genetic improvements carried out by the cattle ranching industry in the southeast. Although the emergence of foot and mouth disease in some states closed more than 52 markets in 2005, many states have since been declared free of the disease, and will soon regain access.

Agriculture

Between 1970 and 2002, more than 1,300 settlements were created. These settlements are closely related to agriculture, were located in the arc of deforestation, and occupy more than 230,000 square kilometres. Deforestation rates around these settlements are four times higher than deforestation rates for the rest of the Amazon.

Industrial agriculture, mainly soy monocultures, represents another important pressure factor. However, it should be understood as an indirect pressure, albeit an important one. Soy is produced mainly south of the Amazon, in the Cerrado eco-region, where it is creating an ecological devastation that grabs fewer headlines than the Amazonian one but is happening at much higher and worrisome rates. It is the expansion of this agribusiness that is pushing small landholders and cattle ranchers further north into the Amazon (Laurence et al 2004).

The main driving force behind this expansion of the soy monoculture is demand from China and from European feedlots, hence the McNugget connection mentioned at the beginning of the article. Most recently, the search for alternative energy sources is also turning into a major demand factor. Biofuels, produced from soy, corn and other crops, provide energy alternatives both for a region immersed in an energy crisis, and for a world hungry for a less polluting energy source. However, in order to produce enough

crops to meet the energy needs of 45% of the Brazilian transport sector, more than 224 million hectares would be needed, which is as much as planted today in the country for the entire agricultural sector.

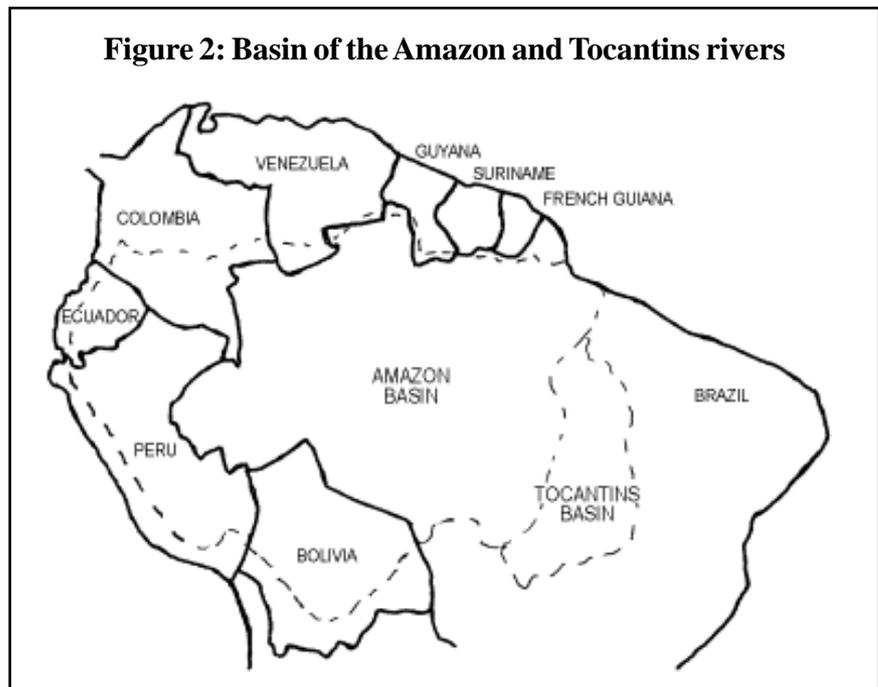
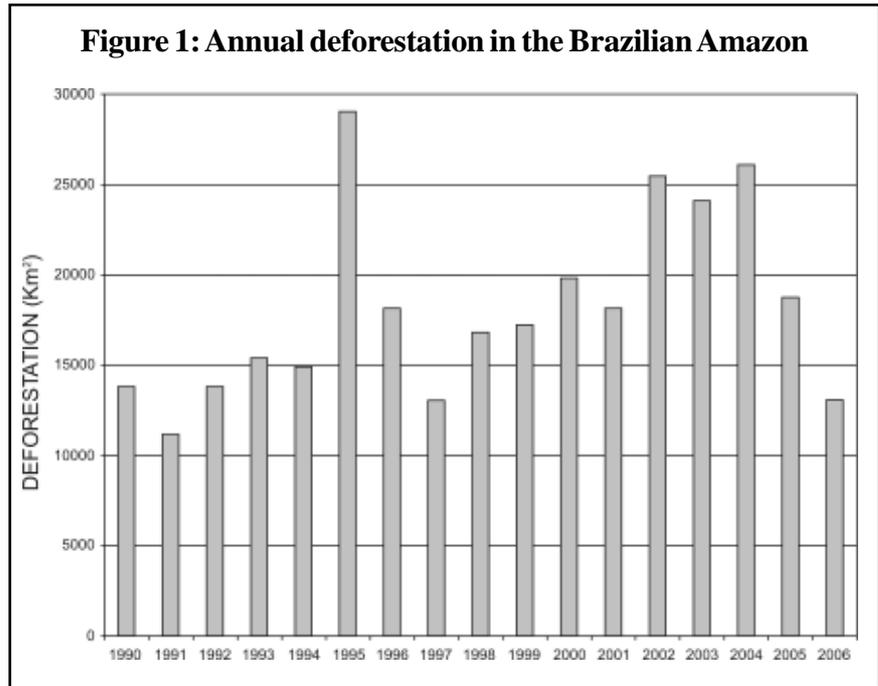
In Peru, Bolivia and Colombia, coca crops and the fight against them are an important deforestation factor. Studies have shown that coca crops are responsible for as much as 24% of deforestation in the Peruvian Amazon (Garnica 2001). In Colombia talking about Amazon deforestation is synonymous with talking about Plan Colombia, which is based on aerial fumigation of coca plantations with glyphosate.

What can be done, and what has been done?

No single instrument can be enough to preserve the Amazon. Land-use planning is key for the survival of the forest. The protected-area network needs to be extended, and enforcement of existing regulations has to be improved and sustained over time. Consumer education in both Europe and other countries importing Amazon goods should also be part of the equation.

One-third of the Amazon is under some kind of protection; of this 33%, 21% corresponds to indigenous lands, 5.5% to protected *áreas strictu sensu* and 6% to sustainable use. Protected areas have proven to be an effective instrument for safeguarding against deforestation. Recent studies suggest that without protected areas we would have 17% more deforestation by the year 2015 (Silveira Soares-Filho et al 2006). Another important aspect of protected areas is their role in mitigating the impacts of fragmentation (Ferraz et al 2007). Finally, the growth rate of unofficial roads is three times lower inside protected areas (Barreto et al 2006).

Establishing protected areas alone is not enough, however. Management plans need to be implemented for each protected area. Coordination among all countries sharing the forest is needed.



A mammal distribution study concluded that a Brazilian network of protected areas is not going to ensure their survival, and an international network is needed. Finally, enforcement inside and outside protected areas is crucial. Brazilian Environment Minister, Marina Silva, has linked the recent fall in the deforestation rate to the new enforcement plan in place. This plan was coordinated with the federal police, the army, the highway police and other ministries. The enforcement plan has

probably been partly responsible for the recent trend, but other elements, such as the recent agricultural crisis in Brazil, commodity prices and climatic events, cannot be overruled.

Outlook and conclusion

Improved enforcement, lower commodity prices, and a mild El Niño were key in the recent lowering of the deforestation rate. To gauge the future trend, an analysis of the elements

affecting the main pressure factors described above will help provide an outlook for 2007 and beyond.

During 2007 several important national projects will start rolling. Bolivia has launched its Amazon Integral Development Plan. Peru has important projects related to milk and rice production in the Amazon, and Brazilian President Lula da Silva has expressed his intention to pave the BR163. For agribusiness, pavement would entail a strong reduction in the cost of transporting their inputs and exporting their harvests. As an example, the costs of transporting soy from Mato Grosso to Cargill's facilities located by the Amazon River are US\$82 per ton with the BR163 unpaved and US\$50 to \$60 with the BR163 paved.

Regarding agriculture, in Brazil it is expected that during the next four years the national and international demand for sugarcane will grow from 390 to 610 million tons (Ministerio de Agricultura 2006). Many natural gas plants are being transformed to biofuels. As I write this article, President Bush is in Brazil visiting a biofuel plant. Soy prices are expected to go up during 2007, and it is expected that exchange rates will improve for Brazilian agribusiness. Despite this, some agricultural analysts in Brazil state that the crisis in the sector is not over yet.

World demand for meat is expected to continue rising. To this we must add that sanitary improvements will open new markets, and that soy production is likely to continue expanding and pushing cattle ranchers into the forest.

Meteorological predictions for 2007 indicate higher temperatures for Brazil and the possibility of lower precipitation (IRI 2006). Moreover, extreme temperatures are expected for eastern South America, the Brazilian Meteorological Institute has announced a possible drought for the northeast, and the World Meteorological Organisation has anticipated another El Niño event (IRI 2006; WMO 2006).

Environment Minister Silva labelled as reductionists all those who attributed the recent reduction in the deforestation rate to lower commod-

ity prices. It cannot be denied that increased enforcement has had an impact on Amazon deforestation. However, the environmental and protected-area budgets for 2007 have fallen 25% and 11% respectively compared to 2006. If to this fact we add the trends outlined above for the main deforestation pressure factors, the outlook for 2007 and the near future is not very appealing.

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Endnote

[1] In Colombia, and until recently in Ecuador, deforestation was associated with rivers, which act as transportation corridors (Armenteras et al 2006).

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