

6. Amazon region

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Introduction to the amazon basin

6.1



The Amazon is a tropical forest region which extends over close to 8 million km², or an area 14 times the size of France (FAO, 2001). It spans nine countries and territories: Brazil, Bolivia, Peru, Ecuador, Colombia, Venezuela, Suriname,

Guyana and French Guiana. The Amazon River is the life blood of this forest; it supplies two-thirds of the fresh water on the planet.



Burnt primary forest for agricultural land conversion in Brazil

Jamie Dwyer

The Amazon Basin is estimated to contain 50% of global biodiversity and 70% of plant species on the planet (Carazo, 1997). Recent inventories suggest that there are at least 40,000 plant species, 427 species of mammals, 1,294 species of birds, 378 species of reptiles, 427 species of amphibians, 3,000 species of fish and probably more than one million species of insect in the Amazonian tropical forest (WWF, 2007). These estimates are probably conservative, since a large number of ecosystems are as yet completely unexplored. It is believed that at least 50% of the region's species have not as yet been described by science (Carazo, 1997).

Since the last century, the Amazon forest has suffered serious deforestation, which has accelerated considerably over the last few decades. Large areas of forest are still being cleared for their wood, or to make way for agriculture and animal husbandry. According to FAO estimates, the Amazon was deforested at a rate of 4.3 million hectares per year between 2000 and 2005 (FAO, 2005). CO₂ emissions resulting from the destruction of the forest accounted for some 22% of global emissions (IPCC, 2007) and were responsible for a large proportion of the increase in the greenhouse effect. Annual CO₂ emissions resulting from deforestation in the Amazon basin are estimated at between 150 and 200 million tonnes (Houghton et al., 2000).

Box 6.1: The Lungs of the Planet in Danger

Growing forests absorb carbon dioxide from the atmosphere and convert it to wood through a process of photosynthesis. However, trees also emit CO₂ through evapo-transpiration and the decomposition of dead vegetation. Mature forests are thus usually considered carbon neutral because the absorption by photosynthesis is balanced by transpiration. However, it has been demonstrated that mature forests like the Amazon rainforest can react to human-induced increases in atmospheric CO₂ by an increase in their own productivity, and thus by absorbing more CO₂ than they emit. This phenomenon is known as the "CO₂ fertilisation effect" (Norby et al., 1999). Estimates indicate that the Amazon basin "carbon sink" sequestered some 3.1 million tonnes of carbon between 1980 and 1994 (Melillo, 1998). Forests could therefore limit climate change by

reducing the quantity of CO₂ in the atmosphere, thereby acting like a green lung for the planet.

However, by that same token, a possible increase in temperatures in the Amazon basin could also lead to an increase in transpiration thereby increasing the amount of carbon dioxide released into the atmosphere. An increase in the rate of transpiration could also lead to a drop in precipitation in the region and reduce the productivity of the forest and the rate of carbon sequestration (Fearnside, 2000). Thus, variations in temperature and precipitation could transform the Amazon basin carbon sink into a fresh source of carbon, which would add to the already significant emissions caused by the continual deforestation of this forest massif.



Forest absorb Carbon dioxide from the atmosphere through photosynthesis

NASA



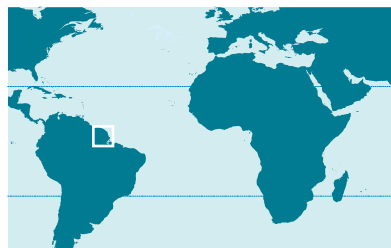
Nicholas Laughlin

French Guiana



6.2 French Guiana (France) RUP

Population:	230 000 inhabitants (2005)
Area:	86 504 km ²
Population density:	2,7 inhabitants/km ²
GDP/inhabitant:	11 935 euros (2006)
Unemployment rate:	24,5 % (2004)
Economic activities:	Aerospace industry, State subsidies



French Guiana is a French overseas territory to the north of Brazil. It is the only European territory in South America and the only outermost region (OR) of the European Union on the continent. Its area of 86,504 km² is the equivalent of one-sixth of the area of France, or the area of Portugal. French Guiana has an equatorial climate, with average temperatures of 27°C and 70 to 90% humidity. The 230,000-strong population of French Guiana is highly multi-cultural and includes: Creoles, Amerindians, Maroons, Metropolitans, Hmongs, Chinese, Lebanese, etc. Population density is low with 2 inhabitants per km², while the demographic growth rate of 3.8% is very high. French Guiana's economy is largely dependent on subsidies from Metropolitan France and the aerospace industry. At 24.5%, the rate of unemployment is one of the highest in overseas Europe.

6.2.1 Current state of biodiversity

Remarkable habitats and species

The department of French Guiana is home to an unparalleled biodiversity. This little corner of the Amazon is home to some unique ecosystems which are among the richest and most fragile in the world: primary tropical forests, mangroves, savannahs, and numerous types of wetland area.

With 83.1% of its territory covered by equatorial rainforest, French Guiana is home to the largest forest in France. The under-growth in this region is so dense that it only receives 1% of the sun's light and 25% of rainwater; the rest is captured by the forest canopy. Ironically, French Guiana's tropical forest has grown up on one of the poorest soils in the

world in terms of nutrients and organic matter. However, this region was always preserved from the effects of glaciation, which explains its tremendous biological diversity.

No less than 5,750 plant species, 718 species of birds, 183 species of mammals, 480 species of freshwater fish and 108 species of amphibians have been inventoried in French Guiana (Gargominy, 2003). The inventory of invertebrates is in its infancy, but it is likely that the diversity of this family is 10 times greater than that of mainland France.

Some 92% of French Guiana's coastline and all the banks of its estuaries are covered in mangroves. Subject to the rise and fall of the tides, they provide shelter to a very distinctive fauna and flora. They act as nurseries for the marine fauna that take advantage of the abundant volume of organic matter shed by the mangrove trees. The environments also provide nesting and feeding sites for a large number of birds.

Five species of marine turtle are found in the waters and on the beaches of French Guiana. Awala-Yalimapo beach is the most important breeding ground in the world for the Leatherback turtle (*Dermochelys coriacea*), the largest of the marine turtle species (Gargominy, 2003).

French Guiana National Park, created in February 2007, is the largest protected area in the European Union. It has a surface area of 3.39 million hectares and includes within its perimeter the banks of the largest rivers in French Guiana, the Maroni and the Oyapock, which form the borders of Suriname and Brazil respectively (French Guiana Park site).

Current threats

The main threats to the French Guiana ecosystems include fragmentation by roads, illegal gold panning and poaching.

Road development remains limited in the department when compared with other forests of South America. Forest exploitation is therefore restricted by lack of access. However, recent developments, like the RN2, which crosses the forest

massif through the north-west and joins up with Brazil, have further facilitated the fragmentation of the ecosystems and the introduction of invasive species. The poaching of protected species like the Collared peccary (*Pecari tajacu*), species of Red Spider monkey (*Ateles* sp.) or the Jaguar (*Panthera onca*), has also been facilitated by the opening up of the roads.

Artisanal and industrial gold panning also lead to the local destruction of forest habitats, as well as to significant pollution of the rivers and the water table by mercury (used for extracting gold) and waste mud. Gold panning, especially illegal gold panning, affects all the large rivers and French Guiana, even those within the National Park

6.2.2 New threats resulting from climate change

Climate projections for the region

According to IPCC projections, between now and the end of the century, average annual temperatures in French Guiana could increase by 3.3°C [2.6 to 3.7], with the most marked increase of 3.5°C [+2.7 to +3.9] taking place in June-July-August

Levels of precipitation are also likely to undergo a change, with an increase in rainfall of 4% [+0 to +1] during the months of December-January-February and a reduction of 3% [-10 to +2] in June-July-August, during the dryer months (IPCC, 2007) (see Table 7).

Several recent studies have also highlighted the link between deforestation and precipitation in the Amazon rainforest. High resolution satellite images point to significantly higher levels of rainfall above deforested zones and a change in the patterns of precipitation for the region as a whole (Chagnon, 2004).

Table 8: Variations in climate between now and the end of the century for the Amazon region (IPCC, 2007).

Average for 21 global simulation models (scenario A1B). Likely range of uncertainty in square brackets (25/75% quartiles).

Climate indicator:	Variation between 1980-1999 to 2080-2099
Air temperature:	Increase of 3.3°C [2.6 to 3.7]
Precipitation:	Annual stagnation, but with an increase of 4% [0 to 11] in winter and a decrease of 3% [-10 to +2] in summer
Sea level:	Rise of 0.35 metres [+0.23 to +0.47]

Impacts on biodiversity

Higher temperatures and a drop in precipitation during the dry season will in all likelihood lead to longer and more severe droughts in the Amazon region, giving rise to a drying out of the tropical forests (see Box 6.2). Such conditions will considerably increase the risk of forest fires (Nepstad et al., 2004). Some studies already show that the number of fires has increased significantly in the region on account of a change in climate conditions (Cochrane, 2003). Furthermore, ecosystemic modelling



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using climate projections has pointed to a potential decline in the productivity of the tropical forest, that is to say, in the amount of carbon sequestered, as a result of a reduction in precipitation. This decline could have major repercussions on the global carbon cycle (Cox et al., 2004). In fact, climate change could modify the current status of the Amazon

forest from a carbon sink to a source of carbon, which would eventually result in an increase in the global level of CO₂ in the atmosphere.

In addition, an increase in sea levels could lead to a reduction in the area of mangroves of about 1% per year (WWF, 2007).

Box 6.2: The Amazon Forest: A Future Savannah?

According to Brazilian researchers, between now and 2100 the Amazon could become a savannah. During the course of 2005, the surface temperatures of the tropical North Atlantic were particularly high; this led to the formation of a depression above this zone. This depression modified the wind regime above the entire Amazon region and significantly reduced the amount of rainfall, leading to the most serious drought ever observed in the region. Rivers dried up, thousands of km² of fires burned, releasing 100 million tonnes of CO₂ into the atmosphere (Marengo, 2008). A sustained increase in Atlantic Ocean temperatures, such as those observed in 2005, could profoundly affect the Amazon forest. A study undertaken in Brazil analysed the effects of climate change on the Amazon forest using IPCC predictions. The results are alarming. Under the worst case scenario put forward by the IPCC, an increase in temperatures of between 5 and 8 degrees accompanied by a 15% drop in precipitation could transform the Amazon landscape into a savannah (Marengo, 2006). The consequences would be considerable, not just for the biodiversity of this region, but also for the global carbon cycle.



In 2005, Amazon experienced the biggest drought never observed

V. G. S. / AFP

Box 6.3: Biodiversity of the Threatened Tropical Forest

The Amazon forest is home to highly specialized plant and animal species, at times with a very limited geographical distribution. A recent scientific study analysed the spatial distribution of 69 species of angiosperm plants (seed plants) in relation to IPCC climate predictions between now and the end of the century. A map of the potential distribution of these species was drawn up taking into account the temperature and rainfall conditions necessary for their germination, their growth and their survival. The results showed that 43% of the species studied would become non-viable between now and 2095 on account of a radical change in their spatial distribution caused by temperature and rainfall variations. Under the predicted climate change variations, these species would have no more areas to which to migrate, or their new spatial distribution would be too removed from their current habitats to enable migration. Plants with a limited spatial distribution and short generations are likely to be the most impacted (Miles, 2004). This study clearly illustrates that the complex ecosystems of the tropical forest and the highly adapted species will not always be able to acclimatize themselves to changes, even very minor ones, in climate conditions (Woodward, 2004).



Tresor Natural Reserve

IUCN/Jean-Philippe Palesi

Socio- economic implications

A change in climate conditions in the region will no doubt affect agriculture. A drop in precipitation during the critical months could reduce harvests and facilitate the spread of pests. Under these conditions greater surface areas will be needed to feed the population, which will speed up the process of deforestation (WWF 2007).

Furthermore, it has already been shown that extreme climatic conditions, which sometimes lead to floods, can engender important epidemics of insect-borne diseases like malaria and dengue fever, as well as other infectious diseases like cholera or meningitis (ONERC, 2006). The incidence of dengue fever has increased in French Guiana since the 1960s (Gagnon, 2001).

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