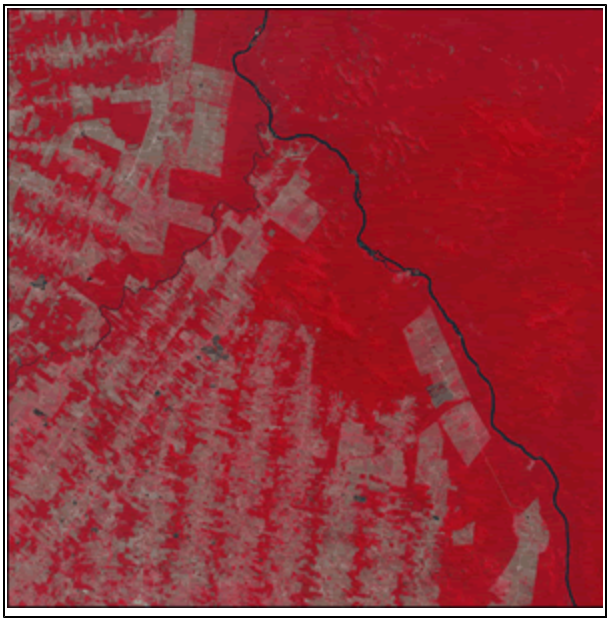
August 2003

Brazil: Environmental Issues

Introduction

Brazil's Amazon rainforest comprises 30% of the world's remaining tropical forests and, besides providing shelter to one tenth of the world's plant and animal species, acts as a significant mechanism (carbon "sink") for removing excess carbon dioxide from the atmosphere. According to the World Bank, an intact acre of Amazon rainforest sequesters about 1,000 pounds of carbon dioxide annually.

In June 2003, Brazil became a partner of the United Stated sponsored **Carbon Sequestration Leadership Forum**. The charter sets the framework for international cooperation in research and development for the separation, capture, transportation and storage of carbon as a means of reducing greenhouse gas emissions. Other global partners of this forum include Australia, Canada, China, Colombia, India, Italy, Japan, Mexico, Norway, Russian Federation, the United Kingdom, and the European Commission.



This image shows the extent of deforestation in the state of Rondonia, Brazil on August 24, 2000. Tropical rainforest appears bright red, while pale red and brown areas represent cleared land. Black and gray areas have probably been recently burned. The Jiparaná River appears blue. Source: NASA

Brazil's environment Minister, Marina Silva, recently announced measures to offset the alarming rate of deforestation in the Amazon rainforest. The Minister cited development projects, particularly for crops and cattle, that are destroying tracks of forest. Satellite photos released from Brazil's National Institute of Space Research showed that that deforestation increased by 40% in 2002 over the previous year.

In recent years, energy-related environmental problems, including oil spills, air pollution, flooding and deforestation have become a threat to Brazil's biodiversity and delicate ecosystems. The Brazilian Ministry of Environment and Natural Resources, Ibama, has been taking an active role in protecting the country's environment through regulation and enforcement. In 1999, fines for environmental damage increased approximately 4,000% from the previous year for unauthorized activities in areas such as hydroelectric power generation, oil drilling and mining. According to Ibama, no project with potentially adverse environmental consequences can be carried out without an environmental impact

study that includes public hearings and licensing. On October 30, 2002, Petrobrás was fined more than $9 million for running oil platforms without a license. The government said that most of Petrobrás' 37 platforms in the Campos basin lack environmental licenses, technical permits or other necessary documentation.

Brazil is a leader in Latin America in the use of renewable energy sources, namely hydroelectricity and ethanol. Although the country's energy shortage in 2001 forced the government to begin restructuring its energy mix, hydroelectricity will remain the main source of electric power in the short-to mid-term. The government continues to struggle with introducing more expensive new thermal power plants (natural gas) into a system dominated by low-cost hydroelectric plants.

Air Pollution

Air pollution in Brazil is due mainly to rapid urbanization in several cities that lack the infrastructure to support rapid population growth. Nonetheless, Brazilian cities are making great strides in reducing air pollution, most notably the city of Curitiba. The city has taken a unique approach in assuring that development can occur without adversely affecting the environment. Curitiba was one of the fastest growing cities in Brazil in the 1970's. The local government responded to pollution problems through initiatives aimed at shaping how and where growth could occur. Thus, although the city's population has doubled since 1974, traffic has decreased by approximately 30%. The main goal of Curitiba's government was to reduce the population's reliance on cars. World famous innovations include dedicated busways, extra large buses for high density routes, tube-shaped waiting areas where passenger fares can be paid in advance **(similar to a subway system)**, and a major road network radiating out from the edge of the central city pedestrian zone. As a result of these innovations, Curitiba has reduced significantly its consumption of fossil fuels and reduced air pollution.

São Paulo, Latin America's second largest city (behind Mexico City), experiences the same problems that many other large cities face when the population grows faster than the infrastructure to support it. Traffic congestion and pollution are two major problems affecting São Paulo. In 1989, 50% of city smog resulted from factories and 50% from motor vehicle emissions. In 1999, the percentages were 10% and 90% respectively. The same year, the local government instituted a pollution control program, whereby motorists are restricted to driving on certain days of the week, based on the last digit on their licenses plates. This system has reduced the volume of cars and cut daily emissions of carbon monoxide by at least 550 tons. However, according to an article by the Economist Intelligent Unit in October 2002, the strict regulations have done little to mitigate air pollution, mainly due to lack of enforcement. Studies in São Paulo, undertaken by the World Health Organization, have shown that increases in concentrations of nitrogen dioxide (NO2) was related to a 30% increase in deaths from respiratory illness in children under five years of age.

By the end of 2003, São Paulo will introduce 16 hybrid buses to one of the city's busiest routes. The buses, made by the Brazilian company **Eletra**, produce up to 90% lower emissions and achieve a 20% to 30% reduction in fuel consumption compared to standard buses.

Oil Spills

Over the years, oil spills have been a frequent occurrence in Brazil, causing severe environmental damage. Brazil's state-owned oil company, Petrobrás, has become infamous for a series of embarrassing oil spills and accidents.

Some of the worst spills have taken place in Guanabara Bay in Rio de Janeiro. In January 2000, a pipeline burst at the Petrobrás Reduc-Duque de Caxias oil refinery, spilling approximately 340,000 gallons of crude oil. In November 2001, a second ruptured underwater pipeline released 30,000

gallons of crude oil into the Bay. The Guanabara Bay has also been continually threatened by ships that dump their fuel tanks inside the bay because the local port lacks the necessary equipment for proper disposal. In February 2002, the state of Rio de Janeiro fined the cruise ship Caronia after it released about 7,500 gallons of gasoline into the Bay.

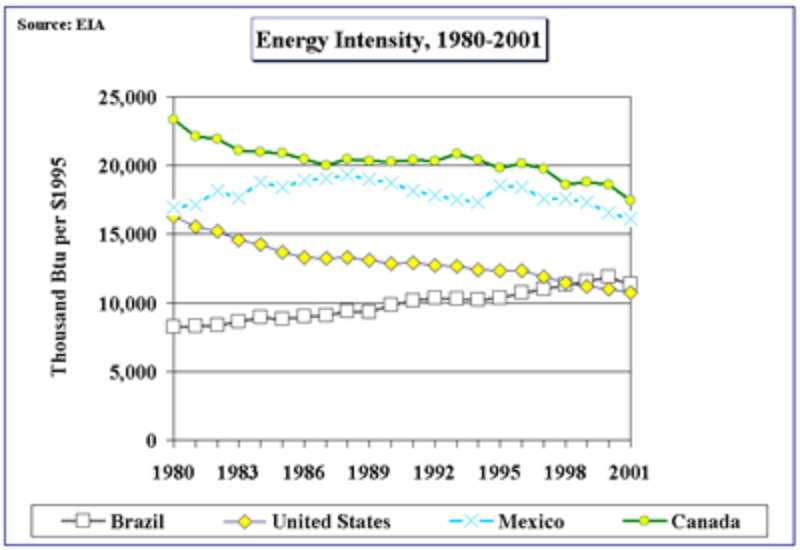
Oil spills have not been isolated to offshore areas. On March 20, 2001, the P-36 platform in the Campos Basin off the coast of Rio de Janeiro exploded and spilled 323,670 gallons of diesel into the sea. The P-7 platform accident occurred on April 12 and spilled another 5,714 gallons of diesel into the basin.

Prevention
After the initial spills and platform accidents in 2000, Petrobrás created the **Program of Excellence in Environmental and Operational Safety Management**. The Company has invested nearly $1.8 billion to improve its ability to prevent and control accidents in all its units. Although major spills have been reduced, Petrobrás nearly lost another platform, P-34, in October 2002.

Energy Use and Carbon Emissions
In 2001, Brazil was the third largest energy consumer in the Western Hemisphere and the largest in Central and South America. In 2001, Brazil consumed approximately 8.8 quadrillion Btus (quads), slightly above Mexico (6.0 quads), but below both the United States (97.1 quads) and Canada (12.5 quads). Petroleum accounts for about 51% of Brazil's total energy consumption, hydroelectric power 31%, renewable energy sources 13%, natural gas 4%, and nuclear 1.7%.

Though Brazil consumes 2.2% of the world total energy, the country is responsible for only 1.5% of total world energy-related carbon emissions, due in part to the country's heavy dependence on hydroelectricity. Brazil emitted 95.8 million metric tons (MMT) of carbon in 2001. Though still the largest carbon emitter in Central and South America, Brazil ranks fourth in the Western Hemisphere behind the United States (1565.3 MMT), Canada (156.2 MMT) and Mexico (96.1 MMT).

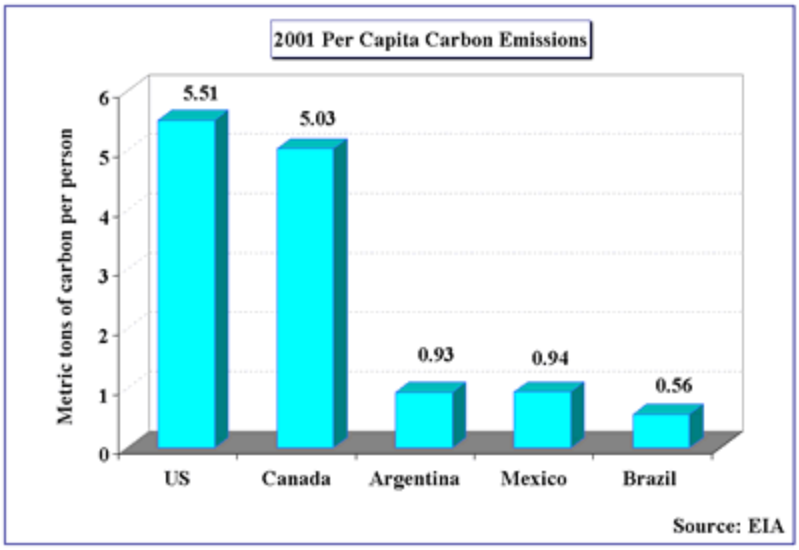
Energy and Carbon Intensity
Brazil's energy consumption per dollar of GDP has increased 37% over the past two decades, from 8.3 thousand Btu per $1995 in 1980 to 11.4 thousand Btu per $1995 in 2001. At the same time, carbon emissions per dollar of GDP have been relatively steady since 1980, remaining at 0.12 million metric tons (per thousand $1995).



Brazilian carbon intensity historically has been lower than in Mexico, Canada and the United States. However, since 1999, energy intensity in Brazil has exceeded U.S. levels, yet still remains below Canada and Mexico.

Per Capita Energy Consumption and Carbon Emissions
Brazil emits low levels of carbon dioxide relative to its size and population. The energy demand caused by rapid growth and industrialization has been met mostly with increasing hydroelectric generation, while gasoline demand is held down by policies requiring a percentage of ethanol in the

fuel mix.



Brazil's per capita carbon emissions remained low in 2001 at 0.56 million metric tons per person, while per capita energy use was about 50.9 million Btu per person. Per capita figures are again considerably less than in Canada (402.6 million Btu) and in the U.S. (341.8 million Btu), but are relatively close to Argentina (71.0 million Btu) and Mexico (59.0 million Btu).

Renewable Energy

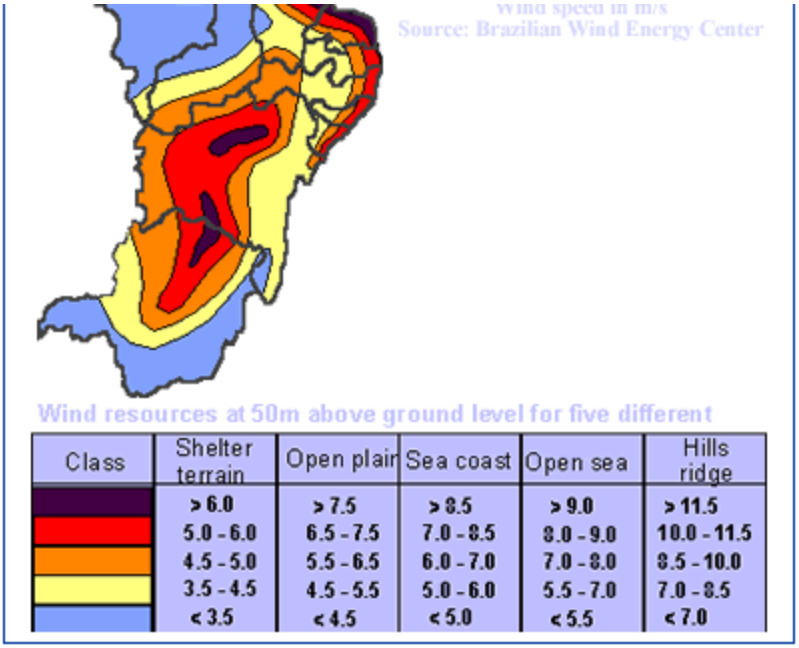
Renewable energy likely will continue to play an important role in Brazil's electrification plans. High oil prices, electrical shortages and air pollution problems have led to the development of several projects designed for environmentally sustainable development in rural areas. Ethanol, biomass, hydroelectricity, wind and solar power generation are to be the main sources for rural electrification projects throughout the country.

Proinfa Alternative Electricity Sources Program

In April 2002, the Brazilian government passed Law 10.438 (or Proinfa). Proinfa is an energy program designed to stimulate development of biomass cogeneration, wind, small hydro generators by guaranteeing power sale contracts to the first 3300 MW of projects which use these technologies. Under the program, Electrobrás will buy electricity produced from the different renewable resources under contracts up to 15 years. In July 2003, the Brazilian Ministry of Energy and Mines published preliminary prices for power to be purchased through the Proinfa program. The government did not indicate when these prices would be definite.

Wind

The Brazilian government has made substantial efforts to promote the development of wind-generated electricity. Brazil is one of the pilot countries under the **Solar and Wind Energy Resource Assessment (SWERA)** program, which United Nations Environment Program (UNEP) heads. The program helps countries assess their wind and solar energy resources potential. In Brazil, most of the emphais has been developing wind atlases for the country (please see map). The **Brazilian Wind Energy Center (CBEE)** supports these activities.



Class	Shelter terrain	Open plain	Sea coast	Open sea	Hills ridge
	> 6.0	> 7.5	> 8.5	> 9.0	> 11.5
	5.0 - 6.0	6.5 - 7.5	7.0 - 8.5	8.0 - 9.0	10.0 - 11.5
	4.5 - 5.0	5.5 - 6.5	6.0 - 7.0	7.0 - 8.0	8.5 - 10.0
	3.5 - 4.5	4.5 - 5.5	5.0 - 6.0	5.5 - 7.0	7.0 - 8.5
	< 3.5	< 4.5	< 5.0	< 5.5	< 7.0

According to CBEE, Brazil

currently is operating nine wind
plants, with a combined installed capacity of 20.3 MW. Wind power is excepted to grow substantially in the coming years. Since 2001, ANEEL, Brazil's energy regulator, has approved 88 wind projects. (**Please click the following link to see a list of approved project**). By 2005, the country plans to increase installed capacity to 1000 MW.

Hydroelectricity

In 2001, hydroelectricity accounted for approximately 83% of electric power generation in Brazil. While it is the most important source of power generation in Brazil, hydroelectricity has negative impacts on the environment. Flooding of delicate ecosystems and the displacement of indigenous people has led to strong opposition to new large-scale development projects. For example, the Brazilian Movement of Dam-Affected People (MAB), created in the 1980s, works to defend the rights of dam-affected populations by demanding fair compensation for losses or participation in planning and implementing resettlement.

The Tocantis River is an example of potential problems caused by hydroelectric dams. The river already has been affected by the building of two large dams, the Tucurui and the Serra da Mesa, and the Brazilian government plans to build more dams on the river in coming years. In early 2003, Electrobrás, Brazil's federal power company, announced plans to create a working group to examine the environmental impact of hydroelectric power projects located in the Amazon region. The working group is trying to make the environmental impact evaluation one of the first stages of a project's development, rather than waiting until the project is about to be built.

Nonetheless, the federal government continues to support both large and small-scale plants that meet environmental requirements set by the government. According to the Brazilian government, hydroelectric generators must implement four basic measures to compensate for environmental liabilities: invest in efficiency and move away from huge scale projects; decrease transmission and distribution losses; invest in environmental improvements such as forestation and soil conservation; and use water in a sustainable manner.

Ethanol and other biomass

The energy crisis in 2001 underlined Brazil's need to diversify its energy sources away from hydropower and to invest in new sources. Biomass, particularly sugarcane waste, or bagasse, plays an important role in the Brazilian energy mix. Brazil currently is the world's largest consumer and producer of ethanol from sugar cane. According to the Brazilian government, biomass power, which will mainly come from bagasse, is expected to increase by around 56% by 2007. Some analysts suggest that biomass will eventually be more important to power generation in Brazil than other sources, except natural gas and hydro. The Brazilian National Development Bank (BNDES) has been a strong supporter of bagasse co-generation power projects and has helped finance many of them. In 2001, the bank announced that it expected to finance enough projects to generate 3,000 MW by 2003.

The use of ethanol to fuel automobiles was initiated partially in response to the oil shock of 1973, and as an alternative to oil to promote self-sufficiency. In 1975, the government created the Brazilian National Alcohol Program to regulate the ethanol market and encourage the production and use of fuel ethanol. The program guaranteed that all gasoline sold in the country would be blended with 22% anhydrous ethanol and that the pump price would remain competitive with gasoline. Past sugarcane crop problems have slightly altered the percentage of ethanol in Brazilian gasoline, however, mandated levels have usually remained at around 20%. On June 1, 2003, the Brazilian government raised the ethanol mix in gasoline from 20% to 25%. In July 2003, Volkswagen announced plans to have its entire Brazilian fleet's engine converted from conventional

to bi-fuel version by 2006. A bi-fuel engine can run on either gasoline or ethanol (Flexible Fuel Vehicles). Ethanol usually offers consumers a cheaper option to gasoline. In the past, Brazilians became wary of relying on ethanol due supply problems and cheap oil prices.

The use of biomass fuel ethanol is an effective strategy to mitigate greenhouse gases, as it replaces oil, a more carbon-intensive fuel. While the manufacture of crop fertilizers and extraction and purification of ethanol can be highly energy intensive, this is not the case in Brazil, because much of the work is done by hand.

Nuclear

Brazil presently has two operational nuclear power plants in Angra dos Reis (Angra I and Angra II). These facilities were responsible for approximately 1.7% of the country's electric power generation in 2001. Construction had begun on Angra III, but political and economic factors have delayed its completion. The plant would generate an additional 1,300 MW of generating capacity in southeastern Brazil, a region with high population density that has been subject to energy shortages.

Outlook

Environmental conditions and developments in Brazil have both domestic and international repercussions. On an international scale, Brazil is a major player in the ongoing climate change negotiations. In 1992 Brazil hosted the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro brought together representatives of over 170 nations, 110 heads of state and 1,400 non-governmental organizations (NGO's). The primary objective of this conference in Brazil was to reconcile the link between environmental protection and development. Two noteworthy agreements reached during this conference were the Rio Declaration (or Earth Charter) and Agenda 21, a comprehensive "blueprint" for sustainable development into the 21st Century. It was also in Rio de Janeiro that the Framework Convention for Climate Change was opened for signature. Brazil ratified the Kyoto Protocol on August 23, 2002.

As a developing country, Brazil is not required to reduce its carbon emissions. However, through the Clean Development Mechanism (CDM), Brazil, like other developing countries, could benefit from foreign investment to promote the development of energy sources that would lower carbon emissions. Brazil has entered three projects, a bagasse (sugar cane waste) cogeneration project and two landfill projects, for CDM approval. The projects could receive approval by the third quarter in 2003. The greenhouse gas emission cuts generated by these projects would then count against the investor's own emissions reduction commitments at home, or could be sold into a future emissions trading market.

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