

Brazil's environmental policies for the Amazon: Lessons from the last 20 years

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I.) THE RELEVANCE OF THE PAST

“Those who cannot remember the past are condemned to repeat it.”

Nowhere is this notable statement of George Santayana (1905) more relevant, yet ignored in practice, than in the case of public policies in Brazilian Amazonia.

Many of the major infrastructure projects that shape the course of events in Amazonia today were started during Brazil’s military dictatorship (1964-1985). These include the Transamazon Highway and its associated colonization projects (Moran, 1981; Smith, 1982; Fearnside, 1986a), the BR-364 (Cuiabá-Porto Velho) Highway and its POLONOROESTE Program (Fearnside, 1987, 1989a), the BR-163 (Santarém-Cuiabá) Highway (Torres, 2005; Fearnside, 2007), the BR-319 (Manaus-Porto Velho) Highway (Fearnside and Graça, 2006), and a series of large dams such as Tucuruí, Balbina and Samuel (Fearnside 1989b 1999, 2001a, 2005a). These projects were decided by a handful of generals in Brasília, who had them built immediately either through private contractors or, as in the cases of the BR-163 and BR-319 Highways, by sending the army itself to build the infrastructure. Not only were no environmental impact studies done, but decisions were made without economic viability studies that calculate the costs and benefits purely in terms of money. Whenever examples of environmental and social impacts of these projects are brought up in discussions of current infrastructure plans, the usual government response is that Brazil is entirely different today, and that past disasters are the fault of the dictatorship and will never be repeated again due to the requirement of an environmental impact study and report (EIA-RIMA) and associated public hearings. But how much has really changed for establishing public policies in Amazonia since the dictatorship? The currently unfolding history of major projects suggests that not much has changed. Major projects that would set in motion chains of events with enormous environmental and human consequences are still decided by a handful of high officials and are announced and treated as “irreversible” before any environmental or economic viability study is done. Examples include reconstruction of the BR-319 Highway (a road that has been abandoned since 1988) and damming the Xingu River at Belo Monte.

II.) GOVERNMENT PLANS

A.) Federal Pluriannual Plans

Brazil’s federal government has been operating under a series of “pluriannual plans” such as *Brasil em Ação* (Brazil in Action) (1996 to 1999), *Avança Brasil* (Forward Brazil) (2000 to 2003) *Plano Plurianual, or “PPA”* (Pluriannual Plan) (2004 to 2007) and the *Programa de Aceleração do Crescimento*, better known as the “PAC” (Plan for the Acceleration of Growth”) (2008 to 2011). Note that the object of the current plan is “growth,” not “development,” much less “sustainable development.” The term “growth” implies simply an increase in size, whereas “development” implies an improvement, whether or not size increases. The plans have, indeed, been focused on size rather than quality, each plan being essentially a long list of highways, dams and other infrastructure projects that the government

regards as of high priority. In fact, many of the projects have remained the same through this sequence of plans, such as the BR-163 (Santarém-Cuiabá) Highway and the Belo Monte Dam.

B.) Public Policy Initiatives

Policy Plans

Public policy in Amazonia has been influenced by a wide variety of initiatives. These include projects financed by multilateral development banks such as the World Bank and the Interamerican Development Bank, including the POLONOROESTE and subsequent PLANAFLORO projects in Rondônia, the PMACI project in Acre and the PRODEAGRO project in Mato Grosso (see Fearnside, 1987). These attempted to influence policies in various ways, including ecological-economic zoning (ZEE). These multilateral development bank projects began in the 1980s, and the 1990-2009 period saw a reduction in the direct role of Bank projects for public policies. However, the World Bank, together with the Brazilian government—especially the Ministry of the Environment, was co-administrator of the PPG7 Pilot Program to Conserve the Brazilian Rainforest (1992-2008). The PPG7 sponsored a wide variety of initiatives throughout Brazilian Amazonia, and a smaller number in the Atlantic Forest region (see <http://www.mma.gov.br/ppg7/>). Projects included the “Type-A Demonstration Projects” (PDA) for financing small-scale sustainable development projects run by grassroots NGOs, support for extractive reserves (RESEX) – an activity that started before the PPG7 and continues after it, environmental management support for selected areas in Amazonian states, forestry management, *várzea* (floodplain) management, ecological-economic zoning (ZEE) by state-level agencies, demarcation of indigenous land, fire prevention and control, support for science and technology related to Amazonia, and protected area planning and creation in “ecological corridors.” These projects had varying degrees of success, the most notable contributions to the environment being demarcating indigenous lands and stimulating the formation of grassroots NGOs in order to qualify for funding PDA demonstration projects.

Payment for Environmental Services

One form of intervention with considerable potential is payment for environmental services (PES). Unfortunately, the main initiative in this area to date, the PROAMBIENTE Program under the MMA, has had little influence because the payments depend on the MMA’s budget, which is always inadequate and uncertain, leading the project to lose credibility with participating farmers when the payments are not made as promised.

Another initiative under the MMA is the Protected Areas in Amazonia (ARPA) program. This program works to achieve Brazil’s announced goal of protecting 10% of each ecosystem in the country. Reserve creation in Amazonia is central because opportunities to create new reserves are rapidly disappearing as the advancing frontier makes reserve establishment politically impractical, especially for the large areas needed to maintain Amazonian biodiversity and climate.

Forestry Management

Forestry management is an area where public policies potentially affect large areas of standing forest. In 2006, the Ministry of the Environment proposed and obtained passage of a law creating “public forests” in Amazonia that would be offered for bidding by companies for forestry management. A new agency, the Brazilian Forest Service, was created in the Ministry of the Environment to supervise these and other projects for forest management. The main rationale for creating the public forests was that it would quickly establish an official presence in areas of federal government land where use is undefined, which are the areas the greatest threat of invasion by landgrabbers (*grileiros*).

Forestry management in private properties requires approval of forest management plans by state-level environmental agencies. In the state of Amazonas in 2008 there were 2000 management plans proposed, of which only nine were approved. Most of the denied requests were based on lack of valid land title documents. By contrast, forest management in Acre is much more active.

Hydroelectric Dams

In practice, much of the environmental policy in Amazonia is not made by the Ministry of the Environment but by the ministries that build major public works such as highways and dams. The Ministry of Mines and Energy, which is responsible for hydroelectric dams, is therefore a major actor. Its subsidiary, ELETROBRÁS, is one of the few government agencies that engages in long-range planning. Unfortunately, this planning is almost entirely devoted to maximizing generating capacity to accompany an expected exponential increase in demand, which is often erroneously portrayed as “need” for electricity. Virtually never is there any questioning of what the electricity is to be used for. The exponential projections of demand are not only incorporating all of the inefficiency and waste in current energy use, but also ratify plans for a vast expansion of electro-intensive export industries, especially primary aluminum.

After the energy shortages (*apagão*) of 2001 then-president Fernando Henrique Cardoso created the National Council for Energy Policy (CNPE). This council might have undertaken the sort of rethinking that is so sorely needed for Brazil’s energy sector, and could have taken the lead in weaning the country from the unending expansion of generating capacity to supply the world with cheap aluminum. If Brazil continues down the path of trying to supply international markets with whatever volume of electro-intensive commodities that the world wants to buy, then there is no limit to the number of hydroelectric dams and other forms of generation that the country “needs.” Unfortunately, the CNPE is almost a “ghost” agency, having rarely met since its creation.

The only time that the electrical sector has ever revealed the full extent of dam-building plans in Amazonia was in December 1987 when ELETROBRÁS released its 2010 plan (Brazil, ELETROBRÁS, 1987). The total, irrespective of the expected date of completion, was 79 dams with a combined area of 10 million hectares, or 2% of the Brazilian Legal Amazon. Following intense criticism of the plan, subsequent public releases of information have been restricted to dams planned for limited periods, such as the 2015 and 2030 plans and the ten-year “decennial”

plans. The current decennial plan covers the 2008-2017 period (Brazil, MME, 2009). It contains no discussion of what to do with the electricity generated, and furthers the impression that what is at stake are the light bulbs in people's houses rather than increasing export of aluminum.

Oil and Gas

Petrobrás is also an actor that creates structural changes through its infrastructure projects. The logic for several of the current plans is unclear. A gas pipeline from Coarí to Manaus is rapidly nearing completion, together with a smaller one from Silves to Manaus. The Coarí gas pipeline will link with the already completed Urucu-Coarí "polyduct," which transports both oil and gas. The gas deposit at Urucu is believed to be sufficient to supply Manaus for approximately 40 years. It is therefore not clear why Petrobrás has placed a priority on a gas pipeline to link Urucu with the much larger gas field at Juruá, further to the west. The EIA for the Juruá-Urucu pipeline is nearing completion. If the gas is really for Manaus, it would make much more sense to wait a few decades until the Urucu gas is nearing an end before investing in the second pipeline. The Juruá-Urucu pipeline raises the suspicion that the gas is really destined for transport via another much more controversial pipeline planned from Urucu to Porto Velho. This pipeline is ostensibly to supply gas for a thermoelectric plant in Porto Velho. However, the lack of logic for this pipeline is apparent, given that two large hydroelectric dams on the Madeira River will begin generation in 2013, making Rondônia a major exporter of electricity to Brazil's southeast region. The Urucu-PortoVelho pipeline would have much greater potential environmental impact than the other pipelines because Rondônia is overflowing with people looking for land and is the principal source of migrants to deforestation hotspots in the neighboring states of Amazonas and Acre and the northwestern portion of Mato Grosso. A pipeline from Porto Velho would open a route for invasion of the large block of intact forest in western Amazonas.

Deforestation Control

Deforestation control efforts have included an annual repression campaign by the Ministry of the Environment's Brazilian Institute for Environment and Renewable Natural Resources (IBAMA). For policy formulation, a potentially important event was the creation in 2003 of the Permanent Interministerial Working Group on Deforestation (GT-Desmatamento). However, the measures announced in the plan drafted by this interministerial working group (Brazil, GT-Desmatamento, 2004) have largely remained on paper, with no concrete action resulting from them (Greenpeace, 2005).

At present, threats to the forest have come to a head in discussions over revising or abandoning Brazil's "Forestry Code", the 1965 law (with subsequent addenda) that requires that a percentage of each private property be maintained in forest as a "legal reserve", in addition to protecting riparian areas and steep slopes (the Area of Permanent Protection, of APP). A struggle is underway between the ministries of agriculture and environment, with the Ministry of Agriculture and landholder representatives in the congress supporting reduction of the "legal reserve" requirement, which is currently 80% in Amazon forest areas. Even with the current

legislation, it is possible to avoid most of the requirements (Lima and Capobianco, 2009).

There has been a trend towards transferring increasing amounts of authority from the federal government to the state governments in environmental matters. Much of the licensing responsibility has passed to the state environmental agencies, IBAMA retaining responsibility for projects that affect more than one state. Other state-level initiatives include the “Zona Franca Verde” program in Amazonas, which includes the creation of state “sustainable development reserves” (RDS). In Acre the “Governo da Floresta” has stressed extractive reserves and forestry management. In Mato Grosso the state’s environmental licensing program over the 1999-2001 period had a discernible effect on deforestation rates (Fearnside, 2003a).

Climate Negotiations

State positions on climate negotiations have been a positive force in 2008 and 2009. Similar to the situation in the United States, where the state of California has been significantly more proactive on climate issues than the federal government, the Amazonian states have been much more active than the federal government in working to obtain international payments for maintaining Amazonian forest.

In 2008 the federal government created the Amazon Fund (*Fundo Amazônia*) to receive funds from other countries that want to help Brazil slow deforestation. The fund is administered by Brazil’s National Bank for Economic and Social Development (BNDES). BNDES will obviously be the primary voice in deciding how the money will be used, despite the fund having an advisory board that includes scientists and non-governmental organizations (NGOs). Norway has promised US\$1 billion, and contributed approximately one-fourth of this so far. Germany has promised (but not yet paid) a much more modest amount of US\$26 million. The donations do not generate any form of carbon credit that can be used to offset emissions in the countries that contribute to the fund. Brazil has been promoting the fund as the mechanism by which it would like to receive any funds intended to slow Amazonian deforestation as a means of reducing global warming. This author believes it unwise to expect this model to be the basis for financing Amazonian forest maintenance in the future because there will not be funds available for voluntary contributions outside of the crediting system of the Climate Convention once countries make serious commitments to reducing their national emissions (Fearnside, 2009a).

II.) THE EVOLVING CONTEXT OF ENVIRONMENTAL POLICY

The last 20 years have brought significant improvements for environmental policies, but, at the same time, much has either not changed or has changed less than might appear. Changes include:

1.) Creation of the Ministry of the Environment (MMA) and state-level environmental agencies (OEMAs).

2.) Consolidation of the licensing system for infrastructure projects. The Environmental Impact Study and report (EIA-RIMA) has been required for major

projects since 1986. In the early years projects that were political priorities sometimes proceeded without any environmental report, in clear violation of the legal requirements. Examples include the North-South Railway and the Carajás pig-iron smelters (Fearnside, 1989c). Attempts to escape reporting are less frequent, but still exist. Some are successful (such as Tucuruí-II) and some not (such as the BR-319 Highway). The licensing system is a significant factor in forcing more attention to the environment, but the features of the system that limit its effectiveness have not changed since its inception: the influence of project proponents on the content of the reports due to their roles in paying for and supervising the studies, and the report's timing in the process after the political decision to build the infrastructure in question has, in fact, already been made and after contractors and others who stand to benefit financially from the project have been mobilized (see Fearnside and Barbosa, 1996).

3.) Formation of hundreds of non-governmental organizations (NGOs), both at the grassroots level and for conducting research and lobbying. These have greatly increased the level of input from civil society in formulating environmental policy.

4.) Demarcation of over 40 million hectares of indigenous areas. Although this was a requirement written into Brazil's 1988 constitution, for over a decade there was little indication that this was going to occur in practice. The demarcation significantly increases the security of indigenous peoples and reinforces their role in environmental protection and in policy debates.

5.) International conventions represent a new and potentially important influence. The most relevant conventions are the United Nations Framework Convention on Climate Change (UN-FCCC) and the Convention on Biological Diversity (CBD), both signed in 1992 at the ECO-92 "earth summit" in Rio de Janeiro. Especially the UN-FCCC, or "climate convention", may influence events through the successor to the Kyoto Protocol, which was drafted under the Convention in 1997 and will have its first commitment period conclude in 2012. The second commitment period or a successor to the Kyoto Protocol, beginning in 2013, is expected to include avoided deforestation as a mitigation measure, and could therefore potentially have a substantial influence in Brazilian Amazonia.

The above list of environmental policy developments with the potential to contribute to containing deforestation and maintaining environmental quality needs to be viewed in the context of much more powerful changes on the other side – speeding deforestation. The net effect is hardly encouraging, given that the area deforested over the 1990-2009 period totaled 304,800 km², an area larger than Spain and Portugal together (as compared to the original area of Brazil's Amazon forest, which is roughly the same as that of Western Europe). The plans and projects set in motion for roads and other infrastructure that will drive deforestation for decades in the future. The roads include major highways such as the BR-319 (Manaus-Porto Velho), which would open central and northern Amazonia to the actors and processes of the Arc of Deforestation (Fearnside and Graça, 2006, 2009).

A key part of the impact of the BR-319 is the plan for a series of side roads leading from the main highway to each of the municipal seats along the Madeira and Purus Rivers. Worse, one of the roads would cross the Purus River at Tapuã and continue to Coarí, Tefé and Juruá. This would open the large block of forest in the

western part of the state of Amazonas. The EIA for the BR-319 claims that these roads are not planned by the federal government (UFAM, 2009: Vol. 1, p. 58). However, the National Department of Transport Infrastructure (DNIT) website continues to display a map of planned roads indicating these routes (Brazil, DNIT, 2002). In October 2009 the Minister of Transportation began claiming that no side roads would be built. Unfortunately, there is little reason to believe that such a promise would be kept. The current minister of transportation will only office for a few more months, as he is expected to relinquish his post in order to run for governor of the state of Amazonas in the October 2010 elections. No institutional mechanism exists for taking on a commitment not to build specific infrastructure projects. There is a clear parallel with what NGOs refer to as the “institutional lie” with respect to the Xingu River dams planned upstream from the Belo Monte Dam (Fearnside, 2009b). The credibility of the electrical sector in this regard is very low given the history of past cases in parallel situations where promises of this type are made and later broken (see Fearnside, 2006).

Brazil’s activity in building infrastructure in other Amazonian countries has increased rapidly in recent years. Major projects built with Brazilian money (from BNDES) and Brazilian construction firms include the road known as the “Highway to the Pacific” in Brazil or the “Transoceanic Highway” in Peru. Brazil is preparing to build six dams in Peru to produce electricity for sale to Brazil: Inambari (2000 MW), Sumabeni (1074 MW), Paquitzapango (2000 MW), Uru-bamba (940 MW), Vizcatan (750 MW) and Chuquipampa (800 MW) (Dourojeanni, 2009). At least ten other such dams in the pipeline, although the total number is indeterminate. There are such two dams to be built in Bolivia, one in Ecuador and one in Guiana. Various other projects are underway, such as the Ruenabaque road in Bolivia, the Georgetown road in Guiana, and pipeline projects in Peru and Ecuador. Petrobrás exploits oil and gas in Peru (with a controversial major expansion planned in the Camesea area in the biodiversity hotspot in the Madre de Dios basin), as well as similar operations in Bolivia and Ecuador (*e.g.*, *Finer et al.*, 2008). Brazil is now finding itself in the same situation as that for which the United States was criticized for years: building environmentally destructive projects abroad that would not meet environmental standards at home. These countries have less requirements for licensing and measures to avoid environmental and social impacts than does Brazil.

B.) Who’s in Charge of Public Policy?

Public policies in Amazonia are obviously contradictory in many cases. The government attempts to control deforestation with fines at the same time that it promotes deforestation through settlement projects, agricultural financing, roadbuilding, land–tenure criteria, etc. Much of this is explained by the fact that the government is not a monolithic block, but instead is composed of many agencies with different purposes. The federal government alone is composed of 38 ministries or ministerial-level agencies, which is probably a world record. These ministries struggle with each other for budget allocations and presidential favor. The struggle for funding is continuous, rather than being confined to the budget-formulation process, because Brazil has a system of “*contingenciamento*” (placing in contingency status) that would appear very strange to anyone not familiar with the country. The budget is approved before the beginning of the fiscal year, but the funds allotted to each ministry are given out in small installments. Usually, towards the middle of the

year, the government discovers that it does not have enough money to honor the promises made in the annual budget. It therefore places some of the budget items in contingency status, meaning that they get no money until such time as sufficient tax revenues have been collected to pay for them. When money does materialize later, which is not always the case, it is often released in the final days of the fiscal year, in which case the bureaucratic procedures needed to spend the money are such that much of it must be returned to the national treasury unspent. This system means that the ministries must fight among themselves over which programs will be put in contingency status and which will go forward as planned. The Ministry of the Environment is by no means the most powerful, and therefore not only has a smaller budget but is more likely to see its funds put in contingency status.

Given the plethora of conflicting signals, one might well wonder who is in charge of public policies for Amazonia. The Superintendency for the Development of Amazonia (SUDAM) promoted large cattle ranches from its creation in 1966 until a 1991 policy change discontinued fiscal incentives for ranching (but multiple exceptions continued: see Fearnside, 1990). Financing of environmentally destructive developments such as sawmills and pig-iron plants continued after the change. SUDAM was abolished in 2002 as the result of a corruption scandal, but was recreated as the Agency for the Development of Amazonia (ADA) in 2003. The National Institute for Colonization and Agrarian Reform (INCRA) has been a major actor in establishing settlements for small farmers. While in the 1970s INCRA was responsible for bringing colonists to settlement areas such as those on the Transamazon Highway, it has since been almost exclusively reactive, confining its role to “regularizing” land claims by illegal squatters.

In June 2007 a new ministerial-level position for “strategic affairs” was created especially for Mangabeira Unger. The new minister was charged with thinking about long-range issues, especially with regard to Amazonian development. By a presidential decision, the “Sustainable Amazonia Plan” (*Plano Amazônia Sustentável*, or PAS) was taken away from the Ministry of the Environment and transferred to the new ministry. A series of suggestions were floated, ostensibly only as a discussion exercise. Most notable was a proposal to divert water from the Amazon Basin to semi-arid Northeastern Brazil. The practical barriers to such a scheme caused it to wither, but this was not the case for another pet project with far-reaching consequences: the legalization of illegal land claims in Amazonia.

In 2009, Provisional Measure (MP) 158, widely known as the “MP for *grilagem*,” was approved by the National Congress as Law No. 11,952. The measure allows legalization of claims up to 1500 ha in area. The objective is to legalize 67 million hectares, an area half the size of the state of Pará. This is the area controlled by INCRA in Amazonia that is “still without destination” (Brazil, INCRA, 2009: *Estrutura Fundiária* p. 17). Most important, the measure creates the expectation among invaders of all sizes that future “legalizations” will also take place, and that those who invade public land today have a good chance of obtaining a legal title in the future. This is a step back in the much needed transition to eliminate land invasion as a means of obtaining land tenure in Amazonia (Fearnside, 2001b).

Shortly after his land-tenure legalization scheme was passed by the congress, Mangabeira Unger quit his post. The future of the strategic affairs ministry remains uncertain.

Various ministries and other sectors of the government have open conflicts over environmental policies. The ministers of environment and agriculture clash regularly over the issue of the Forestry Code and over whether sugar cane should be allowed to be planted in Amazonia (mostly for biofuel). Recently the executive branch has sought to limit the authority of the Public Ministry (under the Ministry of Justice) in environmental matters. The executive branch has also recently moved to restrict the actions of the Court of Accounts of the Union (TCU) in investigating expenditures for major infrastructure projects such as Amazonian highways.

The sociology of the Brazilian bureaucracy has been studied by Steven Bunker (1979), who compares it to the resolution of land conflicts between poor squatters and large landholders in the almost feudal society in the interior of Northeastern Brazil. Government agencies traditionally stand aside while these groups fight on the ground, and only after one side has won does the government step in to grant land title to the victor.

There have been recurrent calls for speaking with one voice, especially with respect to environmental policies. President Lula has often expressed his displeasure when his ministers publically express different viewpoints. However, the tendency to stifle disagreement is dangerous. Differences between environment and those building infrastructure are natural. If differences are to be settled in secret and only a unified position is made public, the environment would lose in almost every case, as the Ministry of the Environment is obviously not the most powerful ministry. The danger is best illustrated by the example of nuclear power in the United States. There the Atomic Energy Commission was created shortly after World War II to both promote and regulate nuclear energy. Literally thousands of near accidents happened outside of the public view until the Three Mile Island accident in 1979. After that incident, the functions were divided into two agencies, a separate Nuclear Regulatory Agency being responsible for safety regulation. Since then differences have been public and the record has been very much better.

D.) Making the Best of Instability

Individual policy makers, politicians and political administrators are very temporary. Each change creates both risks and opportunities. For example, the change in government in 1999 in Acre brought a sharp change to more environmental concern under the administration of Jorge Viana, as did the change of government to Eduardo Braga in Amazonas in 2002. However, swings can also go in the other direction. For the state of Amazonas, both of the leading pre-candidates for the 2010 election have histories of open hostility to environmental concerns.

This form of temporary opportunity means that it is important to be able to quickly take advantage of favorable political environments when they occur: to “run with ball when you have it.” Biologists will recognize this as an “r-selected” strategy (MacArthur and Wilson, 1967). An r-selected strategy is also indicted in situations of chaos or lack of authority—a situation that sometimes prevails in parts of Amazonia.

Rapid evolution both biological and in terms of social innovations occurs in these situations (Gundersen and Holling, 2002).

Often opportunities for environmental and social advances in Amazonia have been associated with tragic events. Examples include the El Dourado dos Carajás massacre in 1996 leading to a restarting land reform, the Chico Mendes assassination in 1988 leading to creation of extractive reserves, and the assassination of Dorothy Stang in 2005 leading to creation of a mosaic of reserve in the Terra do Meio. These measures were represent an opportunistic implementation of plans that had been drawn up in the years before these triggering events took place, but the plans had been stalled and not transformed into active projects. Being prepared to take advantage of opportunities is therefore a key part of following an r-selected strategy.

It should be remembered that the same sort of situation applies on the other side. Examples include the moves to quickly force approval of hydroelectric dams following the electricity shortages (*apagão*) of 2001, and the use made to speed approval of the Belo Monte Dam following the incident where the chief ELETRONORTE engineer for Belo Monte was cut with a machete during an indigenous demonstration against the dam in Altamira in May 2008.

E.) Science & Technology

Science and technology are essential sources of information for formulating environmental policy. Brazil has made notable progress in deforestation monitoring (Brazil, INPE, 2009a,b). However, several clear discrepancies have never been resolved (Fearnside 1993; Fearnside and Barbosa, 2004). It is also important that there be independent groups working in the same area of deforestation monitoring. The work of the Institute for Man and Environment in Amazonia (IMAZON) has been filling this role (see: <http://www.imazon.org.br/novo2008/index.php?>). Recent advances in remote sensing interpretation are expected to allow civil society to play a much greater role in the near future in assuring that ground truth matches the findings obtained by satellite, an initiative that involves both NGOs and Google (Tollefson, 2009).

Research progress by institutions such as the National Institute for Research in Amazonia (INPA) and the Emilio Goeldi Museum (MPEG), and by major research projects such as the Large-Scale Atmosphere-Biosphere Experiment in Amazonia (LBA) and the Biological Dynamics of Forest Fragments Project (PDBFF). NGOs such as IMAZON and the Institute for Research and Environment in Amazonia (IPAM) provide a new and healthy source of competition with traditional government institutions in this area.

Priorities in science and technology were reviewed in a nation-wide effort that resulted in the Ministry of Science and Technology's "Green volume" in 2001 (da Silva and de Melo, 2001). High technology fields such as biomedical research, genomics and nanotechnology obviously dominate the priorities. However, for providing information relevant to Amazonian environmental policy much of what is needed from science is much more low-technology in nature, being based on observations in the field and on understanding local cultures and traditional knowledge (Fearnside, 2003b). Even for more traditional data collection in science,

much of what is needed in Amazonia remains to be done using simple tools such as spring balances and tape measures.

Not yet incorporated into policy is the value of the environmental services of the forest (such as water cycling) and the nearness of the threat posed by climate change killing the forest itself. Unfortunately, science and technology is often totally ignored in Amazonian policy making when the results are inconvenient (Fearnside, 1986b).

III.) HISTORY DOESN'T FOLLOW THE PLAN

One of the most obvious lessons of the history of public policy in Amazonia is that things often don't happen on the ground the way they are planned. The classic examples are the BR-364 (Cuiabá-Porto Velho) Highway and the Carajás Iron Project, both of which the World Bank, which funded the projects, believed would be "model" projects for environmental sustainability (Goodland, 1985). In fact, both created major impacts and, in the case of the BR-364, led directly to creation of an environment department within the World Bank. There is a strong parallel between the history of these projects and official discourse concerning the proposed reconstruction of the BR-319 (Manaus-Porto Velho) Highway (Brazil, SCS-PR, 2009).

Part of the reason for the discrepancy between plans and real developments is the large role of actors who have little reason to follow the plan, or often strong reasons for not following the plan. These include *grileiros* (large illegal landgrabbers who obtain title to public land by fraudulent means), organized landless peasant movements (*sem terras*), drug traffickers and money launderers, individual squatters (*posseiros*), and the "ruralist block" of large ranchers and agribusiness interests (*e.g.*, Fearnside, 2008a). This is especially critical for lawless areas like the Terra do Meio. This is an area the size of Switzerland that has basically been outside of the control of the Brazilian government (Greenpeace, 2001, 2003; Fearnside, 2005b). The area has been controlled by drug traffickers, *grileiros* and other illegal actors.

A current example of the gulf between plans and practice is the Sustainable BR-163 Program. This program involves 32 NGOs plus the Brazilian government in an effort to make the BR-163 Highway into a "corridor of sustainable development" The program proposes a variety of actions to favor agroforestry and other activities by small farmers in an area that has seen rapid advance of land grabbing and forest loss for low-grade cattle pastures (Alencar *et al.*, 2005; IPAM, 2005). However, MODIS satellite imagery interpreted by INPE's DETER program indicates this area as one of the main hotspots of deforestation in 2009, suggesting that deforestation activity is shifting out of the traditional Arc of Deforestation and into this supposed sustainable development area (Brazil, INPE, 2009a, p. 7). In addition, deforestation has entered the Jamanxin National Forest on the BR-163.

The case of the BR-163 Highway illustrates the danger of governance being viewed as something that can simply be taken off the shelf, and can justify any kind of infrastructure (Fearnside, 2007). One can't simply choose a "governance" scenario and expect to have history follow this more desirable course as compared to a "business-as-usual" scenario (see exchange between Nepstad *et al.*, 2002a,b and

Laurance *et al.* 2002). Simulations of the BR-163 Highway's impact indicate much less deforestation in a hypothetical governance scenario than in a business-as-usual scenario that is based on past trends (Soares-Filho *et al.*, 2006). In the case of the BR-163 Highway, what has taken place in fact is a more rapid spread of deforestation than what was expected in the business-as-usual scenarios, despite supposedly being an area of sustainable development.

The current example is the EIA for the BR-319 Highway, where one of the most unlikely scenarios imaginable is presented as the basis for the report endorsing the highway. This is one of "strong environmental governance", for which the example given is Yellowstone National Park, where the park includes roads and no one deforests (UFAM, 2009: Vol. 1, p. 185; see Fearnside and Graça, 2009).

Recently the possibility of cattle being displaced to Amazonia as a result of biofuel expansion in other parts of Brazil is based on the simple assumption that the government will be able to implant a level of governance in Amazonia that curtails any expansion of deforestation (Melillo *et al.*, 2009). This assumption is critical to a calculated benefit for climate from biofuels, with major implications for future monetary flows and land-use changes.

IV.) WHAT IS THE 'REAL' PLAN?: THE ROLE OF DECEPTION

The question of what the 'real' plan is relates to one of the recurrent tricks of the trade for infrastructure promotion: "deny, then do." Well-documented cases include the filling of the Balbina reservoir and a sequence of false promises in the case of the Tucuruí-II project (see Fearnside, 2006). Current attention in this regard is focused on the "institutionalized lie" regarding planned dams on the Xingu River upstream of Belo Monte (Nader, 2008). The question of side roads associated with the BR-319 Highway (Brazil, DNIT, 2002) also appears to fit this pattern.

Unfortunately, the EIA/RIMA is still viewed as a token exercise for bureaucratic approval of the projects, rather than as an input to decision-making. It is a bureaucratic hurdle which infrastructure promoters consider to be an obstacle and opponents view as an opportunity to delay projects on procedural grounds, but the report is not viewed as a serious discussion of the pros and cons of each project and of the development strategies of which it is a part.

V.) ENVIRONMENTAL SERVICES AS A BASIS FOR PUBLIC POLICY

Twenty years ago the idea of "environmental services" was virtually unheard of; now it is a household word (Fearnside, 2008b). There have been many gains in the science and in the policy areas related to payment for environmental services, but the consideration of environmental services still does not affect decisions such as building of destructive infrastructure. Environmental concerns need to be a central part of the decision on building the projects at all, and not just an addition of complementary measures to minimize impacts. A clear example is the inconsistency between the proposed re-opening of the BR-319 Highway and the National Policy for Climate Change (PNMC) announced in 2008 (Brazil, MMA, 2008). The highway would put in place a force for deforestation that will speed clearing and greenhouse-

gas emissions for decades, making it much more difficult to reduce deforestation as expected under the PNMC.

The place of environmental services in Amazonian development depends heavily on the scale involved. This scale depends on the place of forest maintenance in mitigation under the United Nations Framework Convention on Climate Change (UNFCCC). The Brazilian foreign ministry's current opposition to carbon credit that is "fungible", or exchangeable against emissions from fossil fuels, greatly limits the scale of potential monetary flows from this source to Amazonia. Funds for voluntary payments for environmental services will be much more limited if industrialized countries take on major commitments under the formal agreement.

The interests of different countries in the climate negotiation inherently diverge. One need only put oneself in the shoes of a politician in Europe. For example, if a group of environmentalists were to go to a French politician and demand that France spend, say, 10% of its gross domestic product on fighting global warming, the reply might be that this would be fine if spent on building factories for windmills and photovoltaic panels, retooling French auto plants to produce ecological cars, etc. All of this would produce income and jobs in France. If the solution were to take this money and send it to Brazil to stop deforestation it would do nothing for the economy of France. Even if the climatic benefit were triple or more for spending money on containing Brazilian deforestation, European countries (and European-based NGOs) would oppose it. Because mitigation exclusively "at home" is much more expensive, this means that these countries would not agree to the deep cuts in emissions that would be needed to avoid impacts such as savannization Amazonian forest. Brazil has to fight for its interests, which are inherently different from those of European countries. Brazil's interests are also different from those of China and India, which have explosively expanding fossil-fuel-based economies.

This author has argued that Brazil must be the leader in promoting tropical forest maintenance for mitigation and in pressing for deep cuts in emissions worldwide (*e.g.*, Fearnside, 2009a). So far, the Brazilian Ministry of Foreign Affairs (MRE) has adopted a strategy of trying to be the "last one on the streetcar," as it would be said in Brazil. For example, only in 2009 did Brazil lend its support to a 2°C limit on temperature increase over pre-industrial levels, after over 100 countries had already endorsed this limit.

Brazil has yet to take a position on the definition of "dangerous" climate change in terms of a concentration of greenhouse gases. This limit will be negotiated as required by Article 2 of the UNFCCC, which requires that greenhouse gas concentrations not provoke "dangerous interference with the global climate system." A concentration of 400 ppmv CO₂-equivalent implies only an 80% chance of staying within a 2°C maximum increase over pre-industrial temperatures, while 350 ppmv would be the limit for 90% certainty. There may even be a need to hold warming to less than 2°C to avoid the threat to Amazon forest from drought and fire.

The fact that Brazil's National Inventory of greenhouse gas emissions (MCT, 2004) systematically underestimates emissions undercuts efforts to bring global warming under control (Fearnside, 2008c). If emissions are underestimated, then the total amount of emission that needs to be reduced in the world will be underestimated,

and the commitments made in international negotiations will be insufficient to avert grave impacts in places like Amazonia.

The key question for Brazil is its taking on targets under the climate convention, as by joining Annex I of the UNFCCC and Annex B of the Kyoto Protocol. The Ministries of Foreign Relations and Science and Technology, plus the Casa Civil, are currently pitted against the Ministry of the Environment over the question of internationally binding targets (*Amazonas em Tempo*, 2009). Will environment be defeated again?

VI.) CONCLUSIONS

Despite institutional building and great strides in the organization and capacity of civil society, we have learned surprisingly little from history in terms of environmental policy in Amazonia.

Environmental threats are increasing faster than the strengthening of environmental policies and institutions.

The Environmental Impact Study (EIA-RIMA) is still only token, but the system must be fixed rather than abandoned. The EIA-RIMA needs to be part of the decision on overall execution of the project, rather than a last-minute hurdle that can only result in adding measures to minimize the impacts when a project that is already decided upon is implemented.

Environmental services can serve as a guide to policy. The economy in Amazonia must be reoriented to be based on maintaining forest rather than destroying it. Environmental services include biodiversity maintenance, water cycling and carbon storage, but currently it is carbon that is best positioned to affect monetary flows on a scale and with a rapidity that could change the course of events in Amazonia. Brazil has a key role to play in international negotiations on this because it has both the least expensive mitigation option (avoided deforestation) and it is one of the countries with the most to lose from continued global warming, including a substantial risk of losing the Amazon forest to the impacts of drought and fire.

Brazil must have the courage to take on targets to reduce its emissions under the Climate Convention – not as a mere internal goal and statement of good intentions.

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VIII.) LITERATURE CITED

Alencar, A., L. Micol, J. Reid, M. Amend, M. Oliveira, V. Zeidemann and W.C. de Sousa. 2005. A pavimentação da BR-163 e os desafios à sustentabilidade: uma análise econômica, social e ambiental. Instituto Centro de Vida (ICV), Cuiabá,

Mato Grosso, Brazil. 25 pp.

<http://www.estacaovida.org.br/pdf/pavimentacaobr163.pdf>

- Amazonas em Tempo* [Manaus]. 2009. “Ministérios se desentendem sobre meta de desmatamento.” 3 November 2009. p. A-7.
- Brazil, DNIT, 2002. *Mapa Rodoviário Amazonas*. Escala: 1:2.250.000. Departamento Nacional de Infraestrutura de Transportes (DNIT), Ministério dos Transportes, Brasília, DF, Brazil. (Available at: <http://www.dnit.gov.br/menu/rodovias/mapas>)
- Brazil, ELETROBRÁS. 1987. *Plano 2010: Relatório Geral, Plano Nacional de Energia Elétrica 1987/2010 (Dezembro de 1987)*. Centrais Elétricas Brasileiras (ELETROBRÁS), Rio de Janeiro, RJ, Brazil. 269 pp.
- Brazil, GT-Desmatamento (Grupo Permanente de Trabalho Interministerial para a Redução dos Índices de Desmatamento da Amazônia Legal). 2004. *Plano de Ação para a Prevenção e Controle do Desmatamento da Amazônia Legal*. Presidência da República, Casa Civil, Brasília, DF, Brazil. 156 pp.
- Brazil, INCRA (Instituto Nacional de Colonização e Reforma Agrária). 2009. *Atlas da Questão Agrária Brasileira*. INCRA, Brasília, DF, Brazil. <http://www4.fct.unesp.br/nera/atlas>
- Brazil, INPE (Instituto Nacional de Pesquisas Espaciais). 2009a. Monitoramento da Cobertura Florestal da Amazônia por Satélites: Avaliação DETER-Agosto de 2009a. Instituto Nacional de Pesquisas Espaciais (INPE), São José dos Campos, SP, Brazil. 11 pp. Available at: <http://www.amazonia.org.br/arquivos/329230.pdf>
- Brazil, INPE (Instituto Nacional de Pesquisas Espaciais). 2009b. Projeto PRODES: Monitoramento da Floresta Amazônica Brasileira por Satélite. INPE, São José dos Campos, São Paulo, Brazil. Available at: <http://www.obt.inpe.br/prodes/>.
- Brazil, MCT (Ministério de Ciência e Tecnologia). 2004. *Brazil's Initial National Communication to the United Nations Framework Convention on Climate Change*. Ministry of Science and Technology (MCT), Brasília, DF, Brazil, 271 pp.
- Brazil, MME. 2009. *Plano Decenal de Expansão de Energia 2008/2017*. Ministério das Minas e Energia (MME), Brasília, DF, Brazil.
- Brazil, SCS-PR. 2009. BR-319 é modelo de rodovia sustentável na Amazônia. *Em Questão* Nº 786, Secretaria de Comunicação Social da Presidência da República (SCS-PR), Brasília, DF, Brazil 1 April 2009. http://www.brasil.gov.br/noticias/em_questao/.questao/EQ786a/
- Bunker, S.G. 1979. Power structures and exchange between government agencies in the expansion of the agricultural sector. *Studies in Comparative International Development* 14: 56-76.

- da Silva, C.G. and L.C.P. de Melo (eds). 2001. *Ciência e Tecnologia e Inovação: Desafio para a Sociedade Brasileira. Livro Verde*. Ministério da Ciência e Tecnologia (MCT) & Academia Brasileira de Ciências (ABC), Brasília, DF, Brazil. 278 pp. Available at: <http://www.mct.gov.br/conferencia/>.
- Dourojeanni, M. 2009. Hidrelétricas brasileiras na Amazônia peruana. Site OECO, 6 July 2009. <http://www.ecodebate.com.br/2009/07/06/hidreletricas-brasileiras-na-amazonia-peruana-artigo-de-marc-dourojeanni>
- Fearnside, P.M. 1986a. *Human Carrying Capacity of the Brazilian Rainforest*. Columbia University Press, New York, NY, U.S.A. 293 pp.
- Fearnside, P.M. 1986b. Settlement in Rondônia and the token role of science and technology in Brazil's Amazonian development planning. *Interciencia* 11(5): 229-236.
- Fearnside, P.M. 1987. Deforestation and international economic development projects in Brazilian Amazonia. *Conservation Biology* 1(3): 214-221.
- Fearnside, P.M. 1989a. *Ocupação Humana de Rondônia: Impactos, Limites e Planejamento*. Relatórios de Pesquisa No. 5, Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Brasília, DF, Brazil. 76 pp.
- Fearnside, P.M. 1989b. Brazil's Balbina Dam: Environment versus the legacy of the pharaohs in Amazonia. *Environmental Management* 13(4): 401-423.
- Fearnside, P.M. 1989c. The charcoal of Carajás: Pig-iron smelting threatens the forests of Brazil's Eastern Amazon Region. *Ambio* 18(2): 141-143.
- Fearnside, P.M. 1990. Environmental destruction in the Brazilian Amazon. pp. 179-225 In: D. Goodman and A. Hall (eds.) *The Future of Amazonia: Destruction or Sustainable Development?* Macmillan, London. 419 pp.
- Fearnside, P.M. 1993. Desmatamento na Amazônia: Quem tem razão nos cálculos—o INPE ou a NASA? *Ciência Hoje* 16(96): 6-8.
- Fearnside, P.M. 1999. Social impacts of Brazil's Tucuruí Dam. *Environmental Management* 24(4): 483-495.
- Fearnside, P.M. 2001a. Environmental impacts of Brazil's Tucuruí Dam: Unlearned lessons for hydroelectric development in Amazonia. *Environmental Management* 27(3): 377-396.
- Fearnside, P.M. 2001b. Land-tenure issues as factors in environmental destruction in Brazilian Amazonia: The case of southern Pará. *World Development* 29 (8): 1361-1372.

- Fearnside, P.M. 2003a. Deforestation control in Mato Grosso: A new model for slowing the loss of Brazil's Amazon forest. *Ambio* 32(5): 343-345.
- Fearnside, P.M. 2003b. Desafios estratégicos para ciência e tecnologia na Amazônia. pp. 115-124. In: *A Floresta Amazônica nas Mudanças Globais*. Instituto Nacional de Pesquisas da Amazônia-INPA, Manaus, Amazonas, Brazil. 134 pp
- Fearnside, P.M. 2005a. Brazil's Samuel Dam: Lessons for hydroelectric development policy and the environment in Amazonia. *Environmental Management* 35(1): 1-19.
- Fearnside, P.M. 2005b. Deforestation in Brazilian Amazonia: History, rates and consequences. *Conservation Biology* 19(3): 680-688.
- Fearnside, P.M. 2006. Dams in the Amazon: Belo Monte and Brazil's hydroelectric development of the Xingu River Basin. *Environmental Management* 38(1): 16-27.
- Fearnside, P.M. 2007. Brazil's Cuiabá-Santarém (BR-163) Highway: The environmental cost of paving a soybean corridor through the Amazon. *Environmental Management* 39(5): 601-614.
- Fearnside, P.M. 2008a. The roles and movements of actors in the deforestation of Brazilian Amazonia. *Ecology and Society* 13(1): 23. [online] URL: <http://www.ecologyandsociety.org/vol13/iss1/art23/>
- Fearnside, P.M. 2008b. Amazon forest maintenance as a source of environmental services. *Anais da Academia Brasileira de Ciências* 80(1): 101-114.
- Fearnside, P.M. 2008c. Quantificação do serviço ambiental do carbono nas florestas amazônicas brasileiras. *Oecologia Brasiliensis* 12(4): 743-756.
- Fearnside, P.M. 2009a. Brazil's evolving proposal to control deforestation: Amazon still at risk. *Environmental Conservation* (in press).
- Fearnside, P.M. 2009b. O Novo EIA-RIMA da Hidrelétrica de Belo Monte: Justificativas Goela Abaixo. pp. 108-117 In: Sônia Maria Simões Barbosa Magalhães Santos & Francisco del Moral Hernandez (Eds.). *Painel de Especialistas: Análise Crítica do Estudo de Impacto Ambiental do Aproveitamento Hidrelétrico de Belo Monte*. Painel de Especialistas sobre a Hidrelétrica de Belo Monte, Belém, Pará. 230 pp.
- Fearnside, P.M. and R.I. Barbosa. 1996. Political benefits as barriers to assessment of environmental costs in Brazil's Amazonian development planning: The example of the Jatapu Dam in Roraima. *Environmental Management* 20(5): 615-630.

- Fearnside, P.M. and R.I. Barbosa. 2004. Accelerating deforestation in Brazilian Amazonia: Towards answering open questions. *Environmental Conservation* 31(1): 7-10.
- Fearnside, P.M. and P.M.L.A. Graça. 2006. BR-319: Brazil's Manaus-Porto Velho Highway and the potential impact of linking the arc of deforestation to central Amazonia. *Environmental Management* 38(5): 705-716.
- Fearnside, P.M. and P.M.L.A. Graça. 2009. O EIA-RIMA da Rodovia BR-319: Decisão Crítica sobre a Abertura do Coração da Amazônia ao Desmatamento. <http://colunas.globoamazonia.com/blogdaamazonia/2009/06/05/pesquisadores-do-inpa-analisam-eia-rima-da-br-319/>; <http://www.globoamazonia.com/Amazonia/2009/BR319.pdf>
- Finer, M., C.N. Jenkins, S.L. Pimm, B. Keane and C. Ross. 2008. Oil and Gas Projects in the Western Amazon: Threats to Wilderness, Biodiversity, and Indigenous Peoples. *PLoS ONE* 3(8): e2932. doi:10.1371/journal.pone.0002932
- Goodland, R.J.A. 1985. Brazil's environmental progress in Amazonian development. pp. 5-35 In: J. Hemming (ed.) *Change in the Amazon Basin: Man's Impact on Forests and Rivers*. Manchester University Press, Manchester, UK. 222 pp.
- Greenpeace. 2001. Terra do Meio: Lar para onças, paraíso para foras da lei. Viva Amazônia 2001, Greenpeace, Manaus, Amazonas, Brazil. 2 pp. Available at: http://www.greenpeace.org.br/amazonia/pdf/briefing_terradomeio.pdf
- Greenpeace. 2003. *State of Conflict: An Investigation into the Landgrabbers, Loggers and Lawless Frontiers in Pará State, Amazon*. Greenpeace International, Amsterdam, The Netherlands. 53 pp. Available at: <http://www.greenpeace.org/international/press/reports/state-of-conflict>
- Greenpeace. 2005. *Faltou Ação ao Plano de Ação: Relatório sobre as Ações de Governo para Combater o Desmatamento na Amazônia no Período março de 2004 a maio de 2005*. Greenpeace, Manaus, Amazonas, Brazil. 29 pp. Available at: http://www.greenpeace.org.br/amazonia/pdf/Fata_acao_web3.pdf
- Gunderson, L.H. and C.S. Holling, 2002 *Panarchy Synopsis: Understanding Transformations in Human and Natural Systems*. Island Press, Washington, DC, U.S.A. 508 pp.
- IPAM (Instituto de Pesquisas Ambientais da Amazônia). 2005. Os caminhos da Cuiabá-Santarém: Oportunidade para o desenvolvimento regional sustentável. IPAM, Belém, Pará, Brazil. Available at: http://www.ipam.org.br/programas/cenarios/br163/planejamento.php?session_id=7447fabd6c6d356cf7cedf0280584e16
- Laurance, W.F. and P.M. Fearnside. 2002. Issues in Amazonian development. *Science* 295: 1643.

- Lima, A. and J.P.R. Capobianco. 2009. Alcance territorial da legislação ambiental e a consolidação do uso agropecuário de terras no Brasil. Instituto de Pesquisas Ambientais da Amazônia (IPAM), Belém, Pará, Brazil: 5 pp. Available at: <http://www.climaedesmatamento.org.br/uploads/livros/18135df03aa6143c3b22eeeb101a42fa2678374e.pdf>.
- MacArthur, R.H. and E.O. Wilson. 1967. *The Theory of Island Biogeography*. Monographs in Population Biology 1. Princeton University Press, Princeton, New Jersey, U.S.A. 203 pp.
- Melillo, J.M., J.M. Reilly, D.W. Kicklighter, A.C. Gurgel, T.W. Cronin, S. Paltsev, B.S. Felzer, X. Wang, A.P. Sokolov and C.A. Schlosser. 2009. Indirect emissions from biofuels: How important? *Science* Published online 22 October 2009 [DOI: 10.1126/science.1180251]
- Moran, E.F. 1981. *Developing the Amazon: The Social and Ecological Consequences of Government-Directed Colonization along Brazil's Transamazon Highway*. Indiana University Press, Bloomington, Indiana, U.S.A. 292 pp.
- Nader, V. 2008. Mentira institucionalizada justifica Hidrelétrica de Belo Monte. *Correio Cidadania*, 17 June 2008. <http://www.correiocidadania.com.br/content/view/1955/>
- Nepstad, D.C., D. McGrath, A. Alencar, A. C. Barros, G. Carvalho, M. Santilli and M. del C. Vera Diaz. 2002a. Frontier governance in Amazonia. *Science* 295: 629.
- Nepstad, D.C., D. McGrath, A. Alencar, A. C. Barros, G. Carvalho, M. Santilli and M. del C. Vera Diaz. 2002b. Response. *Science* 295: 1643-1644.
- Santayana, G. 1905. *Reason in Common Sense*. Vol.1, In: *The Life of Reason: The Phases of Human Progress*. Dover Publications, Inc., New York, NY, U.S.A., 5 vols,
- Smith, N.J.H. 1982. *Rainforest Corridors: The Transamazon Colonization Scheme*, University of California Press, Berkeley, California, U.S.A. 248 pp.
- Soares-Filho, B.S., D.C. Nepstad, L.M. Curran, G.C. Cerqueira, R.A Garcia, C.A. Ramos, E., Voll, A. McDonald, P. Lefebvre and P. Schlesinger. 2006. Modelling conservation in the Amazon Basin. *Nature* 440: 520-523.
- Tollefson, J. 2009. Counting carbon in the Amazon. *Nature* 461: 1048-1052.
- Torres, M. (ed.). 2005. *Amazônia revelada: Os descaminhos ao longo da BR-163*. Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Brasília, DF, Brazil. 496 pp.
- UFAM. 2009. *Estudo de Impacto Ambiental – EIA: Obras de reconstrução/pavimentação da rodovia BR-319/AM, no segmento entre os km*

250,0 e km 655,7. Universidade Federal do Amazonas (UFAM), Manaus, Amazonas, Brazil. 6 Vols. + Annexes.