

Avança Brasil: Environmental and Social Consequences of Brazil's Planned Infrastructure in Amazonia

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ABSTRACT / “Avança Brasil” (Forward Brazil) is a package of 338 projects throughout Brazil; the portion of the plan to be carried out in Brazil's Legal Amazon region totals US\$43 billion over 8 years, US\$20 billion of which would be for infrastructure causing environmental damage. Brazil's environmental impact assessment system is not yet capable of coping with the challenge presented by Avança Brasil. Generic problems with the licensing process include stimulation of a lobby in favor of construction before decisions are made on the advisability of the projects, the “dragging effect” of third parties, whereby economic activity is attracted to the infrastructure but escapes the environmental im-

pact assessment system, a tendency for consulting firms to produce favorable reports, a bureaucratic emphasis on the existence of steps without regard to the content of what is said, and the inability to take account of the chain of events unleashed when a given project is undertaken.

The environmental and social costs of forest loss are high; among them is loss of opportunities for sustainable use of the forest, including loss of environmental services such as biodiversity maintenance, water cycling, and carbon storage. The benefits of export infrastructure are meager, especially from the point of view of generating employment. Much of the transportation infrastructure is for soybeans, while the hydroelectric dams contribute to processing aluminum. The example of Avança Brasil makes clear the need to rethink how major development decisions are made and to reconsider a number of the plan's component projects.

“Avança Brasil” (Forward Brazil) is a massive program of planned infrastructure construction and other activities (Brazil, Ministério do Planejamento 1999). The portion of the plan to be located in Brazil's 5,000,000 km² Legal Amazon Region (Figure 1) totals US\$43 billion over the 2000–2007 period, of which US\$20 billion is for infrastructure with direct impacts on the environment.

The package of 338 projects throughout Brazil is organized into “development axes” (Consórcio Brasileira 2000) that are designed to stimulate economic activity in general, in addition to the activities financed directly under the program (Table 1). Much of the funding for the infrastructure and other activities is to come from private, largely foreign, capital. Avança Brasil refers to the country's 2000–2003 pluriannual plan and is the successor to the 1996–1999 plan known as “Brasil em Ação” (Brazil in Action, also called “Brazil on the Move”). In addition to Avança Brasil's 4-year period with amounts foreseen for the annual federal budget, the plan includes a longer “indicative” plan-

ning horizon to 2007, with additional projects listed. It should be emphasized that a large part of the funding for the projects is expected to come from as-yet uncommitted foreign sources, rather than the federal budget.

Avança Brasil represents a new model for Brazil's development planning and infrastructure funding. Its predecessor, the 1996–1999 Brazil in Action program, was also a break in the planning procedure, reorganizing the federal budget into a series of large projects. Project proponents were required to fit their requests into one of the overall program's areas of activity, and the financial flows and accountability would follow the management hierarchy of the pluriannual plan rather than the traditional county–state–federal government system. During the Brazil in Action program, a study of “national axes of integration and development” was commissioned, which forms the basis for the Avança Brasil program (Consórcio Brasileira 2000). This divides the country into a series of “axes” that do not correspond to any existing geographical unit, such as state boundaries, the regions of Brazil as defined by the Brazilian Institute of Geography and Statistics (IBGE), or the Legal Amazon region (on which most planning and development programs have been based in Amazonia). The new system is intended to increase integration along transport corridors such as rivers, highways

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Figure 1. Brazil's Legal Amazon Region, Pantanal, and state boundaries.

Table 1. Selected Avança Brasil infrastructure project types in the Legal Amazon region^a

Project type	Number	Length or size	Cost (US\$ million)
Highway paving	30	7,560 km	2,794
Highway segment upgrading	3		46
Agricultural road upgrading	6	1,023 km	290
Railways	4	1,625 km	1,749
Gas pipelines	2	920 km	450
Industrial waterways	2	1,057 km	55
Locks in hydroelectric dams	2		254
Hydroelectric dams	10	20.4 MW	11,942
Transmission lines	12	4,830 km	651

^aInformation from Consórcio Brasileira (2000).

and railways. It also has the effect of breaking the traditional lines of authority over the projects.

The plans for Avança Brasil were conceived and written by the Ministry of Planning and by consulting firms hired by the ministry. Once ready, the plan was presented to other ministries and to the public through a series of presentations in each state capital. These presentations gave the Ministry an opportunity to add

or modify information on the basis of inputs from the audience at the presentations; the presentations were not structured as hearings to generate lists of required alterations in the plans. The same applied to presentation of the plan to other ministries. In the case of the Ministry of the Environment, the Ministry of Planning prevailed in its claim that the country's current licensing system adequately covers any environmental im-

pacts of the projects without any additional studies or hearings. The Ministry of the Environment did secure agreement of the Ministry of Planning to undertake a review of potential overall or synergistic impacts from the suite of projects proposed for each region (as distinct from the impacts of each individual project). The study is not a precondition for initiation of any of the proposed projects, which are proceeding as planned. With the 2000–2003 pluriannual plan half over, the general review still remains in the planning stage. In 2001 the plans were broadened to include selected NGOs, especially the Institute for Environmental Research in Amazonia (IPAM).

This article discusses likely consequences of these plans and identifies aspects of the decision-making process that impede its ability to avoid damaging projects. The article concludes that the environmental and social costs of many *Avança Brasil* projects are high and that Brazil's environmental decision-making process needs strengthening.

Impacts of *Avança Brasil*

The diverse array of infrastructure projects under *Avança Brasil* implies a wide range of impacts. Particularly important is the provision of access to undisturbed areas, especially by paving the BR-163 (Cuiabá-Santarém) and BR-319 (Manaus-Porto Velho) highways (Figure 2). Gas pipelines planned in the heart of the undisturbed block of forest in western Amazonia could lead to similar effects. Building of pipelines usually involves an accompanying access road, at least during the construction phase. This can lead to entry of migrants despite any number of signboards and warnings. Invasion is especially likely in the case of the Urucú-Porto Velho gas pipeline, which connects to the migration focus in Rondônia, as compared to the similar project linking Coarí to Manaus. An ominous example is provided by the Yasuni National Park in Ecuador, which was bisected by an oil pipeline, completed in 1994, and shortly thereafter invaded by squatters despite signs, barriers, and government promises that no entry would be allowed along the access road (e.g., Jochnick 1995). This is similar to the pattern in Brazil, the invasion of the Urupá Block Reserve in Rondônia serving as an example (Fearnside 2000a). An array of industrial waterways (known as “hidrovias”) and hydroelectric dams would have severe impacts on aquatic ecosystems and indigenous populations and, especially in the case of the Paraguay-Paraná (Pantanal) Waterway, on neighboring wetlands and wildlife.

Two modeling groups have recently used geographical information systems (GIS) to make projections of the impacts of *Avança Brasil* and other planned

projects in Brazilian Amazonia (Table 2). One group (Nepstad and others 2000, 2001, Carvalho and others 2001) considered only highway projects, while the other (Laurance and others 2001a, b) also considered other types of infrastructure. The first group restricted itself to deforestation, while the second group also modeled forest degradation by transfers among four classes of degradation. Both groups arrived at broadly similar conclusions, indicating massive increases in deforestation over the next two decades.

Provisions in the models do not simply extrapolate from past trends, but rather specify a buffer around each infrastructure project, representing the distance over which the project leads to transformations among the various degradation classes, including the process of deforestation. In the Laurance and others (2001a,b) model, the transformations within the buffers are modified by the existence of various categories of protected and semiprotected areas, such as national parks, national forests (for timber management), extractive reserves (for nontimber forest products), and indigenous reserves. One group (Nepstad and others 2000) based the deforestation rates within the buffers on the history of deforestation along three major highways where clearing spread rapidly, while the other group (Laurance and others 2001a,b) used observations from all existing roads in Amazonia, including those with little deforestation. Certainly, more sophisticated means of estimating the reach of this influence are needed, and parameters other than the ones used could easily prove to be correct.

The model of Laurance and others (2001a,b) made projections to 2020 indicating an additional 269,000 to 506,000 ha/yr of deforestation as a result of planned infrastructure, plus conversion of 1.53–2.37 million ha/yr of forest from the two least degraded categories (“pristine” or lightly degraded) to the two most degraded categories (moderately or heavily degraded).¹ The deforestation alone would result in increased carbon emissions of 52.2–98.2 million t C/yr. Merely as an illustration, at the US\$20/t C expected carbon price that has been used in US budget planning, the lost value of this carbon would total US\$ 1.04–1.96 billion/

¹“Pristine areas” have intact primary-forest cover but may have limited hunting, fishing, and shifting cultivation by traditional indigenous communities. “Light-impact areas” have >95% primary-forest cover but can experience illegal gold-mining, small-scale farming, hunting, hand-logging, and extraction of nontimber resources such as rubber. “Moderate-impact areas” have >85% intact primary-forest cover but contain localized forest clearings and some roads and may be affected by logging, mining, hunting, and oil and gas exploration. “Heavy-impact areas” have no or little primary-forest cover and are heavily fragmented; such areas experience edge effects, fires, and logging.

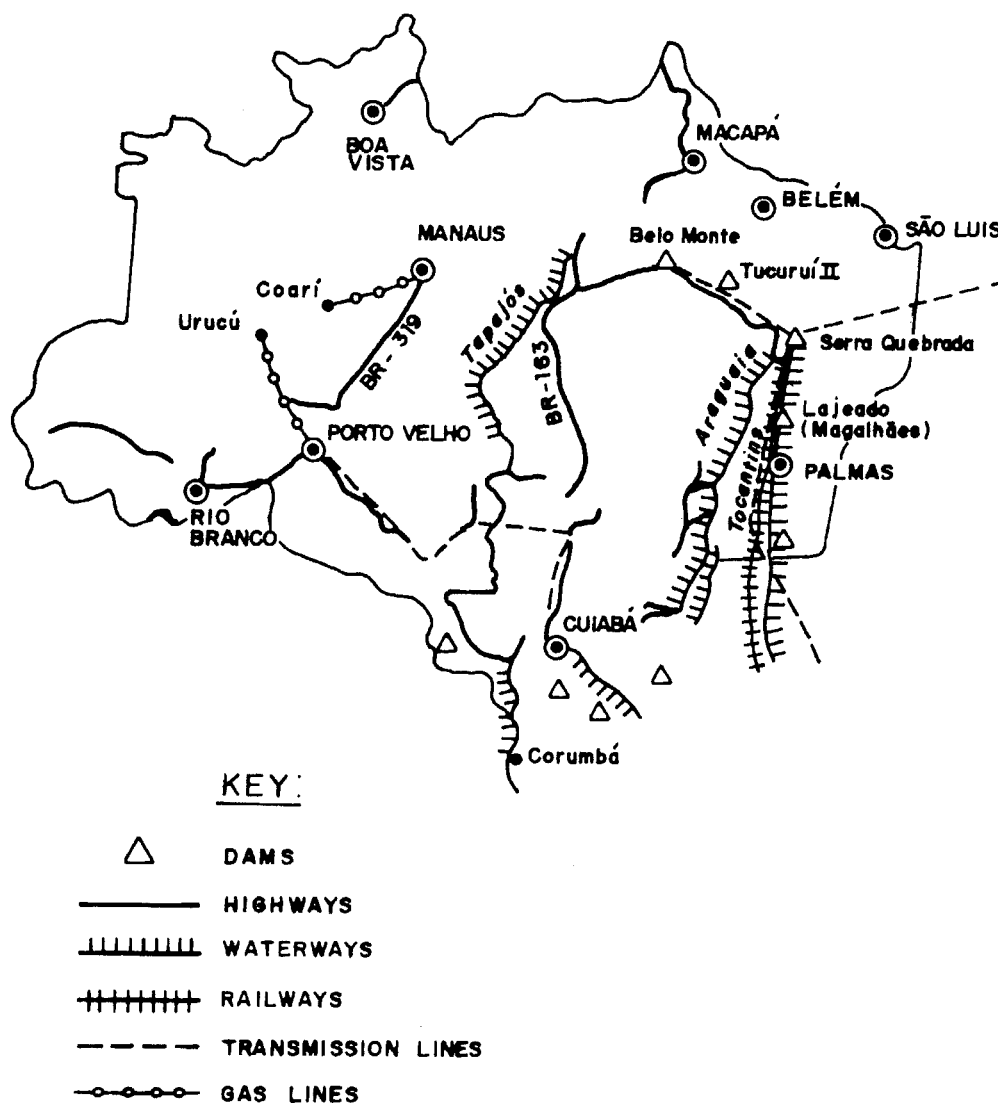


Figure 2. Major Avança Brasil projects.

yr. Nepstad and others (2000) calculated that the highway portion of the planned infrastructure would cause 120,000–270,000 km² of additional deforestation over 20–30 years (400,000–1,350,000 ha/yr), which would release 6–11 Gt C from clearing alone (200–550 million t C/yr).

Environmental Safeguards and Avança Brasil

Avança Brasil proponents emphasize the existence of federal and state environmental agencies, police, etc., giving the impression that the process of land occupation and deforestation is orderly and controlled in Amazonia (e.g., Brazil, Ministério do Planejamento 2002, Silveira 2001). This is very misleading, as much of

this activity occurs illegally (e.g., Carvalho and others 2002, Laurance and others 2001c). Enforcement of the regulations that exist on paper is a tremendous problem at the frontier. A recent report of the Secretariat of Strategic Affairs (SAE) indicated that 80% of the logging in the region takes place illegally (see Cotton and Romine 1999). Illegal deforestation, goldmining and hunting are also rampant.

Inclusion under the aegis of Avança Brasil of non-destructive projects, such as the PROBEM program for bioprospecting, does not change the effect of the infrastructure components. This infrastructure is massive, including substantial increases in the impact of the road network. The claim by Avança Brasil proponents that the plan contains “no new highways” gives the

Table 2. Comparison of modeling assumptions and results of GIS studies of infrastructure in Brazilian Amazonia

	Laurance and others (2001a,b)	Nepstad and others (2000, 2001)
Assumptions		
Width of buffer for deforestation	50 km	50 km
Width of buffer for degradation	200 km	Not considered
Impacts considered	Roads, railways, pipelines, transmission lines, waterways, dams	Roads only
Base for deforestation in buffers	All existing highways	PA-150, BR-010, BR-364
Effect of protected areas	Inhibit deforestation and degradation depending on type and distance	Not considered
Results		
Deforestation rate (10^3 ha/yr additional)	269–506	400–1350
Degradation (10^6 ha/yr additional)	1.53–2.37	Not considered
Greenhouse gas emission from additional deforestation (10^6 t C/yr)	52.2–98.2	200–550

misleading impression that the highway network funded through *Avança Brasil* would not cause deforestation. Unfortunately, the plan to pave 7500 km of highways greatly increases the accessibility of remote areas of Amazonia to ranchers, loggers, and others. The BR-163 and BR-319 Highways are especially damaging because they bisect major blocks of relatively intact forest (Figure 3).

It is important to understand that Brazil's environmental impact requirements (Table 3) do not assure that damaging projects will not be built. It is highly unlikely that the result would be as implied by *Avança Brasil* director José Paulo Silveira (2001), with road paving and other projects causing minimal impacts because of Brazil's current requirements of environmental impact assessments, the country's capabilities for satellite monitoring of deforestation, and the environmental crimes law (Federal Law 9605 of 12 February 1998, which specifies heavy penalties, including jail terms, for offenders). For example, in 1995 the deforestation rate suddenly jumped to 29,000 km²/yr, or double the annual rate in the preceding years (Brazil, INPE 2000), despite the current regulatory provisions being in place with the exception of the environmental crimes law. It is also important to realize the distinction between what is legally required and what happens in practice. While current licensing practices represent many hard-won victories in gradual improvement of the system, it is inaccurate to suppose that the result is freedom from worry about infrastructure projects causing environmental impacts. When specific examples of the impact study/public hearing process are examined, the inability of the system to translate environmental impacts and the concerns of affected populations into factors in decision-making is evident (e.g., Eve and others 2000, Fearnside and Barbosa 1996a). One may

hope that the challenge presented by *Avança Brasil* will result in an overhaul of Brazil's environmental licensing system and of the procedures by which major development decisions are made.

Generic Problems with the Licensing Process

Lobby Stimulated Before Decision

One problem is that powerful interest groups in favor of project construction are mobilized before the environmental impacts are assessed. Impact assessment only occurs shortly before actual construction begins. In the case of *Avança Brasil*, the program has an English-language webpage designed to attract international financing for the projects, obviously in advance of the environmental studies of each project. In April 2001, a presentation in London by finance minister Pedro Malan and other high-level Brazilian officials explained the program to potential European investors. The 338 projects in *Avança Brasil* are essentially presented as a smorgasbord from which prospective investors can pick and choose the investments that interest them. This is occurring before the country has weighed the costs and benefits of the proposed projects, especially the environmental and social impacts, and then determined that the projects are desirable. Once financing has been mobilized for a project, a lobby of parties with financial interests in project approval is automatically formed, thereby greatly increasing the probability of government approval regardless of what environmental and social impacts may be provoked.

"Dragging Effect" of Third Parties

The existence of environmental impact studies does not mean that damaging projects would not be under-

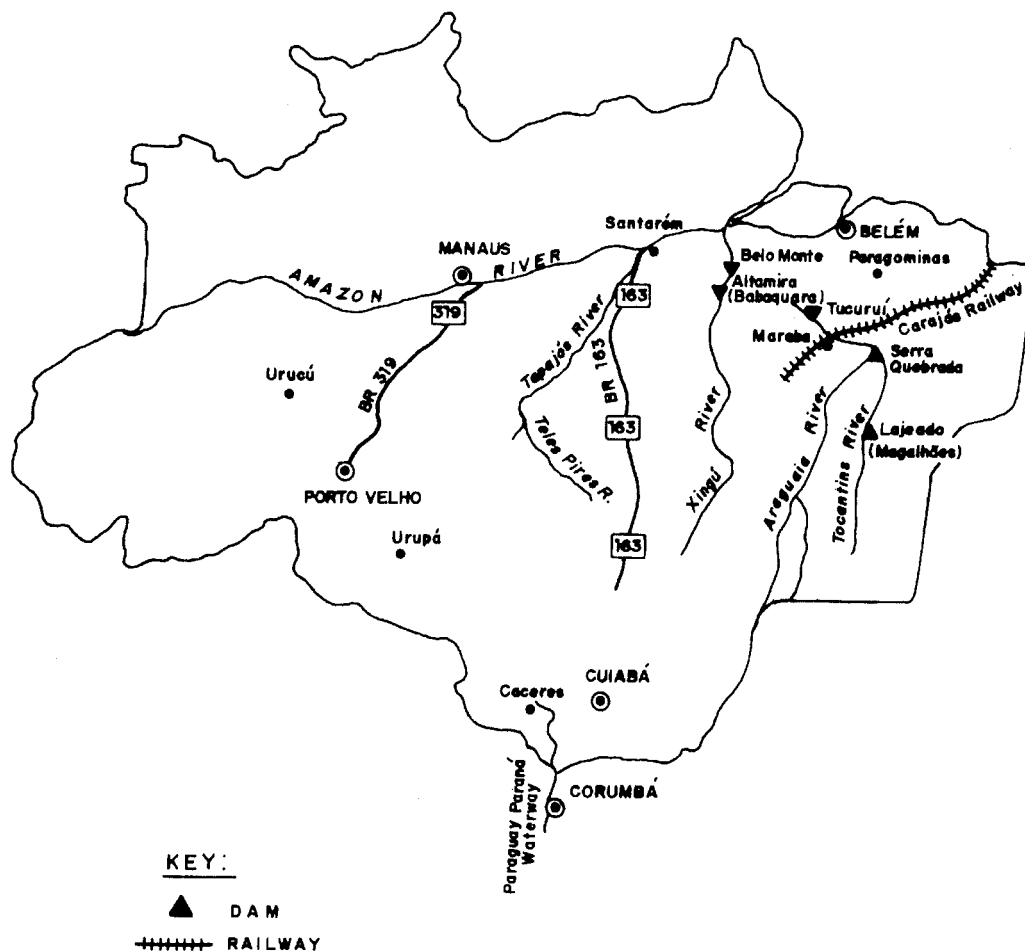


Figure 3. Locations mentioned in the text.

taken. The claim that if any project that involves environmental damage, it must be reformulated or dropped (e.g., Brazilian Embassy, London 2001) does not fit with experience. One of the problems is that Brazil's environmental impact reporting requirements only cover direct impacts, such as laying down a road-bed. It is essential to understand that the major impact of infrastructure projects, which is caused by economic activities attracted to and facilitated by the projects, completely escapes Brazil's environmental impact statement (EIA/RIMA) review process. The impacts of activities carried out by third parties, such as ranching and logging that accelerate when access is provided, are not covered. Ironically, descriptions of project benefits often extol the economic returns of these activities, which *Avança Brasil* planners call the "dragging effect," but the same does not apply to their impacts (Fearnside 2001a). In the case of the Madeira River Waterway, José Paulo Silveira (public statement, 1998), then director of the Brazil in Action pluriannual plan, estimated that

the "dragging effect" attracted US\$3 in additional economic activities for each dollar invested in the waterway.

The BR-163 (Santarém-Cuiabá) highway provides a dramatic example of the dragging effect. This highway opens access to vast areas of relatively intact forest that is particularly susceptible to degradation through fire due to the strong dry season in the area (Carvalho and others 2001, Nepstad and others 2000). Paving the BR-163 is a top priority under *Avança Brasil*, and sawmills are already migrating to the area (Schneider and others 2000, p. 19).

Avança Brasil proponents often suggest that the program's infrastructure in Amazonia will have minimal environmental impacts because it will employ "environmentally friendly technology" with federal and state environmental impact assessment report requirements and because the *Avança Brasil* program includes a selection of "environmental projects" in addition to the infrastructure construction (e.g., Brazilian Embassy,

Table 3. Brazil's environmental licensing system

Legal basis	National Council of the Environment (CONAMA) resolution 001 of 23 January 1986
Reports required for major projects	EIA (environmental impact study); RIMA (report on impacts on the environment)
Report preparation	A "multidisciplinary team" that is "not directly or indirectly dependent on the project proponent" (normally a consultancy firm)
Payment for reports	Project proponent
Public access	RIMA: publicly available at the state environmental agency (OEMA) in the state where the project is located EIA: differing interpretations; in practice the report is usually not available
Report approval	Council of the Environment (<i>Conselho do Meio Ambiente</i>) ^a if project is wholly located in a single state; Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA) if the project spans more than one state. Operating license issued by OEMA.
Alternatives considered	EIA and RIMA must consider "alternatives." This is interpreted by NGOs to mean alternatives to achieve the project's social objectives, whereas project proponents interpret this to mean alternative means of exploiting the resource in question. ^b Judicial interpretation is pending.
Public consultation	Required for presentation of the RIMA in a location (or locations) "accessible to interested parties." ^c Hearings are organized by the OEMA with participation of the Public Ministry.
Judicial participation	The Public Ministry (<i>Ministério Público</i>) ^d is an independent branch of the judiciary that has considerable autonomy in initiating inquiries, soliciting information and deciding cases (see Eve and others 2000). Requests by the Public Ministry for addition of information to the RIMA, usually at the time of the public hearings, are an important hurdle in the approval process.

^aThe "Council of the Environment" in each state is appointed by the state government. These councils are often dominated by local business interests that are favorable to infrastructure projects (see Carvalho and others 2002).

^bFor example, alternatives to the Urucú-Porto Velho gas pipeline are interpreted by NGOs to include other forms of electricity supply for Rondônia (hydroelectric dams, transmission lines, other gas sources, etc.), whereas the pipeline proponent claims that alternatives are restricted to means of transporting gas from Urucú (i.e., pipelines versus barges).

^cCONAMA resolution 009 of 3 December 1987.

^dAuthorized by Law No 7347 of 24 July 1985 (Law of Diffuse Interests) and by Brazil's 1988 constitution.

London 2001). Unfortunately, none of this alters the basic nature of *Avança Brasil* and the scenarios for the future of Amazonia, such as those presented in Nepstad and others (2000) and Laurance and others (2001a,b).

Tendency for Favorable Reports

Consulting firms tend to prepare reports favorable to approval of the projects, since the firms are contracted by project proponents that have heavy financial stakes in securing approval (e.g., Fearnside and Barbosa 1996b). The environmental impact study (EIA) and report on impact on the environment (RIMA) are paid for by the project proponent, who thereby has influence in choosing the personnel who are hired, setting near-impossible deadlines that assure that only cursory attention is given to problems and that the proponent reviews a series of preliminary drafts of the

reports (with opportunities to "suggest" deletions and other changes) prior to their being submitted to government authorities. Frequently the contracts stipulate that the last installment of the consulting firm's payment is only made after the government environmental authorities have approved the report, thereby virtually guaranteeing that the report will be drafted to emphasize the proposed project's positive aspects.

An example is provided by the Araguaia-Tocantins Waterway, a top priority under *Avança Brasil*. In this case, when statements regarding heavy impacts on indigenous populations along the route were included in the report, the outcome was to alter the report rather than to drop the project (Carvalho 1999, Switkes 1999). The waterway was temporarily embargoed by judicial order (Silveira 1999), but the company later obtained another order allowing continuation of the project.

The Teles-Pires–Tapajós Waterway has also been the subject of a scandal involving its environmental impact studies, which, in this case, were divided into two separate studies, one above and one below the Mundurucú indigenous area that is bisected by the waterway (Novaes 1998). The project has been barred since 1997 by a judicial order, but it continues to appear in the smorgasbord of potential *Avança Brasil* investments presented to prospective investors (e.g., *Consórcio Brasileira* 2000).

Emphasis on the Existence of Steps

More common than scandals such as those surrounding the Tocantins-Araguaia and Teles-Pires–Tapajós Waterways is the more subtle effect of the licensing system requiring only that each step in the process be completed (report submission, public hearing, etc.), with little regard, in practice, to the content of the information. In effect, the consultants writing the reports and the witnesses at the hearings can say whatever they like, even pointing out major impacts, and the project approval process simply moves ahead based on the fact that the reports have been duly submitted and the population has been “consulted” (Eve and others 2000, Fearnside and Barbosa 1996a).

Unleashing Chains of Events

One of the inherent problems of the current environmental impact assessment system in Brazil is that only one proposed project is considered at a time, without regard to the other projects that may be set in motion by implementing the first one. The classic example is provided by the Belo Monte/Altamira Dams (see Fearnside 1999a). These planned dams will undoubtedly be one of the great environmental controversies in Amazonia over the next decade.

The impacts of hydroelectric dams are severe in many ways that go beyond land-use transformations (World Commission on Dams 2000). Little evidence exists that a fundamental change in project selection has occurred, since the most damaging project of all is now scheduled for completion in 2013, beyond the time horizon of *Avança Brasil*. This is the 6000-km² Altamira Dam, formerly called Babaquara (Brazil, Eletrobrás 1998). The planned Belo Monte Dam (known as “Kararaô” prior to 1992), a top priority under *Avança Brasil*, is closely linked to this much more damaging project, which would regulate the flow of the Xingu River to compensate for the small reservoir at the Belo Monte Dam (Santos and de Andrade 1990, Fearnside 2001b).

In 1989, an Amerindian woman threatened Antônio Muniz (director of Eletronorte, the electrical power

authority in Amazonia) with a machete as part of a protest against the six dams that were then planned in the Xingu/Iriri Basin, especially the Babaquara Dam. In the succeeding years, government authorities stated many times that Babaquara would not be built, but now it has reappeared under a new name (the Altamira Dam) in the current plan for hydroelectric expansion (Brazil, Eletrobrás 1998, p. 148).

The reappearance of plans for the Babaquara Dam is indicative of a basic problem: the lack of a legal mechanism by which the government can make irrevocable commitments not to build specific projects that are known to be damaging. When projects are judged to be politically unpromising due to criticisms of their expected impacts, they can simply lie dormant for decades, only to reemerge at a more politically favorable moment. Such projects are known as “vampire projects.”

Another example is provided by the Paraguay-Paraná waterway, or “Pantanal Hidrovia.” The Brazilian government announced in March 1998 that it was dropping plans for the Paraguay-Paraná Waterway (e.g., Associated Press 1998). Now, the Mourinhos barge port, 80 km from Cáceres at the upper end of the Curumbá-Cáceres stretch of the Paraguay River, is a top priority of the Mato Grosso state government and the subject of a judicial battle (International Rivers Network and *Coalição Rios Vivos* 2001). If a license is granted to operate the port, the traffic of soybean-laden barges on the upper Paraguay River will provide the rationale for future dredging and straightening of the river. This would increase the water flow in the river, lowering the water table in the Pantanal and causing impacts to one of the greatest wildlife assemblages in Brazil and in the world (Hamilton 1999).

Locks in the Luis Carlos Magalhães (Lajeado) Dam provide another example of the danger of a piecemeal approval process. Construction of the locks, an *Avança Brasil* project, would have no conceivable purpose were the rest of the Tocantins River not made navigable by carrying out the Araguaia-Tocantins Waterway project as a whole, at least as far as the Carajás railhead at Marabá. However, project proponents are engaged in a legal battle to have construction start now with approval as an isolated project by the state of Tocantins, before a decision is reached on the waterway as a whole. A judicial restraining order halted the project briefly in 2001, but has since been lifted.

Opportunity Costs of Forest Loss

Deforestation inevitably leads to loss of opportunity for sustainable use of standing forest, including tapping

the value of environmental services (Fearnside 1997). Environmental services include biodiversity (Fearnside 1999b), water cycling (Fearnside 2000b), and avoided emissions of greenhouse gases. Carbon storage is the environmental service that is nearest to yielding substantial monetary returns, even despite the March 2001 withdrawal of the United States from negotiations over the Kyoto Protocol and the July 2001 Bonn Agreement ruling out credit for avoided deforestation in the Clean Development Mechanism (CDM), defined in Article 12 of the Protocol, in the first commitment period (2008–2012).

Use of avoided deforestation in the CDM after 2012 would require definition of several critical points. The same applies to possible use of similar crediting outside of the Kyoto Protocol. How baselines would be defined remains an open question, with important implications both for the amount of credit obtainable and for the potential for perverse incentives (Watson and others 2000; Hardner and others 2000). Important among these considerations are requirements regarding certainty (Fearnside 2000c), permanence (the time over which carbon would be kept out of the atmosphere) (Fearnside and others 2000), and various forms of leakage (effects of the project, such as displaced population or deforestation activity, outside of the project's physical or conceptual boundaries, often leading to negation of the intended mitigation results) (Brown and others 2000, Fearnside 1999c).

In the Brazilian context, if only historical deforestation rates are allowed as a baseline then credit would be given to (figuratively) “fence off” remnants of remaining forest in parts of Brazil that had already experienced heavy deforestation by 1990, whereas avoiding the future opening of currently untouched areas would not gain credit. The example of *Avança Brasil* illustrates why it is worthwhile to find ways to make crediting for avoided deforestation apply to new frontiers as well. What makes *Avança Brasil* so damaging to the environment, including its role as a source of carbon emissions, is precisely that it opens vast new “virgin” areas to deforestation, logging, and fire. The likely price of not devising regulations that give credit for avoiding these impacts would be the transformation of the computer-generated scenarios into reality. Clearly the stakes are high.

It is worth noting that the CDM is not the only means by which Brazil might obtain credit for avoiding deforestation under the Kyoto Protocol. Were Brazil to join Annex B of the Kyoto Protocol (the list of countries that agree to national caps on greenhouse gas emissions), Article 3.7 of the protocol guarantees that the country's massive emissions from deforestation in 1990

(Fearnside 2000d) would be included in Brazil's assigned amount (the amount of greenhouse gases that a country can emit annually without penalty), and that any reduction in future emissions below 1990 levels could be used for emissions trading under Article 17 (Fearnside 2001d). Unlike the CDM of Article 12, the eligibility of forests for these credits does not require further negotiation. The *Avança Brasil* plans imply a substantial opportunity cost by rendering such reductions unviable.

Benefits of Export Infrastructure

A basic question to be answered with respect to export infrastructure, as for any planned project, is “Are the benefits worth the cost?” Unfortunately, the benefits of export infrastructure are meager, especially in terms of social benefits for Brazil. Public investments in infrastructure projects, as well as private investment in the activities they serve, represent tremendous opportunity costs, since many other kinds of development would result in greater local benefits from the limited financial resources. For example, the BR-163 Highway, which is to be paved for the benefit of soybean exporters in Mato Grosso, contrasts with the BR-230 (Transamazon) Highway from Marabá to Itaituba, which serves an area already occupied by small farmers.

Aluminum processing, which is a major beneficiary of planned hydroelectric dam construction, provides another extreme example. Albrás, which uses power from the grid supplied by Tucuruí and other dams, consumes more electricity than the city of Belém but employs only 1200 people, while Alumar in São Luis employs 750 (see Fearnside 1999a). In 2000, 33% of Albrás was purchased by Norwegian companies, and a plan was announced to double production capacity.

The Serra Quebrada Dam, to be built on the Tocantins River by international aluminum companies (Alcoa and Billiton) is part of *Avança Brasil*'s plan to turn this river into a staircase of dams. In this case, the reservoir would displace an estimated 14,000 people and flood part of two indigenous reserves, as well as affecting flooded forests (Themag 2000).

If power is to be used for aluminum, then there is virtually no limit to the amount of generating capacity “needed.” Brazil would be wise to first establish its policies on what electricity is to be used for before deciding on new hydroelectric construction projects. A primary criterion for evaluating electricity uses should be the number of jobs created per unit of electricity consumed. In the case of aluminum for export, the two major smelters supplied by the Tucuruí Dam consume 6 MWh of electricity annually for each of the 1950 jobs

created as direct employment. Considering only the proportional cost of constructing the Tucuruí Dam, these jobs cost US\$2.7 million each (Fearnside 1999a). If decisions are based on social benefits in Brazil, I find it unlikely that power would be supplied to producing aluminum for export.

The notion that projects such as highways and waterways will improve the plight of the Amazonian poor is quite farfetched. These projects are primarily designed for transporting commodities such as soybeans, which are grown by wealthy agribusiness operations and generate little employment (Fearnside 2001a). For example, in Maranhão an average of 167 ha of soybeans are needed to create one job according to a survey by EMBRAPA, the Brazilian Enterprise for Agriculture and Ranching Research (Carvalho 1999). Soybeans are often being produced in former savannas and are transported on highways, waterways, and railways through the forest areas. In the forest areas themselves cattle ranching is the major land use that quickly dominates the landscape in areas that have been opened to transportation. Ranching benefits a wealthy elite and provides minimal employment (Fearnside 2001c). In the case of logging, the employment generated is likely to be temporary because most logging in Amazonia today is unsustainable (Cotton and Romine 1999).

Much of the infrastructure is justified by export of soybeans, a crop with minimal social benefits (Fearnside 2001a). Constructing a massive infrastructure network to support soybean growing is difficult to imagine as coming under the rubric of “sustainable development.”

Improving the Environmental Licensing System

Avança Brasil offers multiple lessons for improvement of Brazil’s environmental licensing system. Strengthening the system requires not only that reports be unbiased and complete, but also that they enter the decision-making process before the real decisions on infrastructure priorities have already been made. The Avança Brasil plan elevates a list of construction projects to national priorities before potential impacts have been identified and the plans have been discussed by society (or even by government ministries other than the Ministry of Planning). The role of environmental licensing is inherently small when it is done as a formality just before actual construction begins—that is, after projects have been announced, funds raised, bids solicited, and construction contracts signed.

The studies themselves could be improved in various ways. Broadening them to include the “dragging effect” of economic activity stimulated by the infrastructure is

essential. It is impressive that no estimates of the deforestation impact of the proposed infrastructure were generated either as a part of the planning process for Avança Brasil or as a part of the environmental impact assessment process for the individual projects. The two available studies (Nepstad and others 2000, Laurance and others 2001a) were produced independent of these processes and after Avança Brasil was underway.

Studies are needed that assess the impact of interrelated sets of projects, as in river basin development, before individual projects are approved. The Xingu Dams illustrate the danger of unleashing chains of events that are much more damaging than the initial projects. For each project, a full suite of alternatives needs to be analyzed—broadly interpreted to include other forms of addressing the social objectives of the projects. The debate over the Urucu-Porto Velho gas pipeline, mentioned earlier, makes this clear.

Guaranteeing the objectivity of impact studies will require addressing the proponent-pays arrangement that is specified in the regulations governing the system (CONAMA resolution 001 of 23 January 1986). Replacing this with public funding would not be viable, as funds would not be available in practice in adequate amounts and with sufficient speed and efficiency to make the system work. A better solution would be for proponents to be required to contribute money to a fund that would be administered independently under government oversight; the fund would then contract out the studies without involvement of the proponent. This would remove the biases inherent in the proponent’s current right to select consulting firms and the subsequent influence enjoyed by proponents over contracting within firms, establishment of impossible deadlines and other limitations that prevent an adequate evaluation of impacts, and review of report drafts by the proponent prior to submission to authorities. Public participation could be increased by better choice of locations and times of hearings, and by efforts to facilitate the availability of relevant project documentation. This should always include public availability of the full environmental impact study (EIA), not just the shorter report on impact on the environment (RIMA). Availability should include release of the full documents through the internet, as opposed to the current form of “access” that is restricted to the opportunity to consult bound volumes in the library of the state environmental agency.

Judicial procedures are an important part of the licensing process. An important need is creation of a mechanism by which commitments can be made not to implement certain projects that are identified as especially damaging. In the absence of such a mechanism,

major problems that may be identified in studies of interlinked projects, such as river-basin development plans, would have little potential effect other than possible denial of licensing for the initial project in each project set.

Involvement of the Public Ministry is an important safeguard in assuring the inclusion of relevant consideration in the reports and adherence to the procedures that have been specified for the licensing system (see Table 3). This provides the main means by which alternative written documentation can be included in the decision process. However, this kind of judicial involvement is not a substitute for a licensing system that works on its own. Efforts must be made to strengthen the licensing system, while maintaining the safeguard provided by the judiciary.

Conclusions

The challenge presented by *Avança Brasil* makes clear the need to further strengthen Brazil's environmental impact assessment system, which is not yet capable of coping with many of the types of impacts expected from the plan. These include the "dragging effect" of infrastructure projects on economic activities that lead to deforestation and other impacts, and the chains of events set in motion by interlinked projects such as strings of hydroelectric dams. The timing of environmental impact studies needs to be changed in order to provide input to the planning process, rather than merely legitimizing projects after major decisions have already been made. A full suite of alternatives should be evaluated for each proposed project and, particularly in the cases of developments for export of soybeans and aluminum, wider discussion of the social objectives of the projects is needed. Various changes could increase the independence and the transparency of the licensing process, which is currently heavily influenced by the project proponents that pay for the environmental studies. The major impacts implicit in the *Avança Brasil* program make clear both the need to rethink how major development decisions are reached and the need to reconsider the advisability of carrying out a number of the program's component projects.

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