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Brazil's Cuiabá- Santarém (BR-163) Highway: The Environmental Cost of Paving a Soybean Corridor through the Amazon

PHILIP M. FEARNSIDE*
Instituto Nacional de Pesquisas da Amazônia-INPA
Av. André Araújo, 2936
c.p. 478
69.011-970 Manaus-Amazonas, Brazil

* Author to whom correspondence should be addressed. *email:* pmfearn@inpa.gov.br

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ABSTRACT / Brazil's Cuiabá-Santarém (BR-163) Highway provides a valuable example of ways in which decision-making procedures for infrastructure projects in tropical forest areas need to be reformulated in order to guarantee that environmental concerns are properly weighed. BR-163, which is slated to be paved as an export corridor for soybeans via the Amazon River, traverses an area that is largely outside of Brazilian government control. A climate of generalized lawlessness and impunity prevails, and matters related to environment and to land tenure are especially unregulated. Deforestation and illegal logging accelerated in anticipation of highway paving. Paving would further speed forest loss in the area, as well as stimulate migration of land thieves (*grileiros*) to other frontiers. An argument is made that the highway should not be reconstructed and paved until after a state of law has been established and it has been independently certified that sufficient governance prevails to secure protected areas and enforce environmental legislation. A waiting period is needed after this is achieved before proceeding with the highway paving. Above all, the logical sequence of steps must be followed, whereby environmental costs are assessed, reported and weighed prior to making *de facto* decisions on implementation of infrastructure projects. Deviation from this logical sequence is a common occurrence in many parts of the world, especially in tropical areas.

KEY WORDS*:* Amazonia; Brazil; BR-163; Deforestation; Environmental Impact; Highways; Roads; Santarém-Cuiabá; Soybeans

Deforestation in Brazilian Amazonia has global impacts and is therefore a matter of wide international, as well as national, concern (Fearnside 2005a). The central role of infrastructure in driving deforestation in Brazil and in other tropical-forest countries makes understanding and improving the decision-making process for major infrastructure projects a matter of primary interest for environmental management in these countries. A concrete example of the need for strengthening the role of environment in decision-making on infrastructure projects is provided by the question of reconstructing and paving the BR-163 Highway from Cuiabá, Mato Grosso to the Amazon River port of Santarém in Pará (Fig. 1). The highway would primarily be used to transport soybeans from rapidly expanding areas of this crop in the northern part of the state of Mato Grosso (Bolzon and others 2006, Fearnside 2001). It is a high priority of the Mato Grosso state government, headed by Governor Blairo Maggi, whose Maggi Group is Brazil's largest producer of soybeans. It is also a top priority of the federal government's Ministry of National Integration, as well as the ministries of Planning, Transportation and Agriculture.

[Figure 1 here]

BR-163 has existed as a dirt road since 1973, but poor road conditions (especially in the rainy season) are a significant impediment to an influx of migrants and investment. Paving highways greatly increases their impact on deforestation in the surrounding area, as has occurred in other parts of Amazonia. The best-known example is BR-364 in Rondônia, paved in 1982 (Fearnside 1986). BR-364, which was financed by the World Bank, soon became that institution's most embarrassing project (see Fearnside 1987, Schwartzman 1986). Rampant deforestation along BR-364 led directly to creation of the Environment Department within the World Bank in May 1987 (Holden 1987).

The area in the state of Pará to be traversed by the BR-163 Highway is one of lawlessness and impunity in every respect, including the environment. This applies especially to the 646-km unpaved stretch from the Pará/Mato Grosso border to Trairão (26 km south of the junction of BR-163 and the Transamazon Highway). Paving the road would have substantial environmental impacts by further stimulating forest destruction. Governance needs to be established in the area before deforestation pressure is further increased by paving the road. Events unfolding on BR-163 are revealing of serious problems with Brazil's current environmental licensing system and indicate ways that the system might be improved. Assessment of environmental impacts must be done before *de facto* decisions are made to build infrastructure. Impacts must be weighted against benefits in order to make a rational decision. This has not been done in the case of this major Amazonian highway. The present paper examines the case of the BR-163 Highway in order to draw lessons that can be used to improve environmental assessment and decision making in Brazil and in many other parts of the world that face similar development decisions.

Environmental Impacts of Highway Paving

Deforestation along the Highway Route

The main impact of paving the BR-163 Highway at this time would be to accelerate forest destruction along its route and in various places that are physically separated from the highway but are subject to its influence. The lawless character of the area traversed by the highway means that good intentions on the part of government planners have little relevance to how deforestation, logging and fire would spread in practice.

Remaining forest near the highway would be cleared, mainly for cattle pasture. Only a small fraction of the land along the portion of the route between the Pará/Mato Grosso border and the Transamazon Highway is level enough for mechanized agriculture (Fig. 2). What level land does exist can be expected to become soybean plantations. More important than roadside deforestation is the extended reach of the highway's influence on either side. Paving leads to rapid expansion of "endogenous" side roads, and extension of logging and deforestation to substantially greater distances (Alencar and others 2004, Arima and others 2002, Laurance and others 2002). It stimulates claiming of these areas by "*grileiros*," or land thieves who illegally appropriate areas and subsequently obtain legal titles, often based on corruption and falsified documents (*e.g.*, Castro and others 2002). Clearing is the most effective means of maintaining control of these land claims on the ground and in justifying documentation for "legalizing" or "regularizing" claims in government land agencies such as INCRA (National Institute for Colonization and Agrarian Reform) and ITERPA (Land Institute of Pará). Even fines from IBAMA (Brazilian Institute for Environment and Renewable Natural Resources) for illegal clearing can be used to document a *grileiro*'s effective presence in the area, ironically leading some to want to be fined by IBAMA. Land values increase rapidly when a road is paved, thus bolstering the motivation to clear in order to protect land-tenure claims, including those intended for speculative purposes. These processes are all already occurring in expectation of the road paving, but the paving itself will further speed them. Quantifying this effect should be a top priority in assessing environmental impact.

[Figure 2 here]

Deforestation in Brazilian Amazonia has so far been largely confined to the "arc of deforestation" or "arc of fire" that extends in a crescent from the Belém-Brasília Highway in eastern Amazonia, through the forests forming the boundary between Amazonian forest and *cerrado* (central Brazilian savanna) in Mato Grosso, continuing on along the BR-364 Highway route through Rondônia to the eastern part of Acre. BR-163 will change this pattern, with the region being bisected in the middle from south to north as far as the Amazon River. This would extend the arc of deforestation, making it a "W" of deforestation instead.

An important aspect of BR-163 is that its route lies in a strip of drier climate than most forested areas in Amazonia. A tongue of relatively dry climate extends diagonally across the region, roughly parallel to the Tapajós River, with rainfall increasing as one moves either east (towards Belém) or west (towards Manaus) from this line (Nimer 1979, Nepstad and others 2004). Santarém and the BR-163 Highway route fall on this line. Drier climate is beneficial from the point of view of agriculture and cattle ranching, increasing profitability of converting forest to crops or pasture (Schneider and others 2000). Therefore, if transportation were improved, forest would be destroyed more quickly than it would in wetter locations. Drier climate would also facilitate fires in standing forest. Ground fires in Amazonian forests have become a major source of environmental impact over the past two decades (Cochrane 2003, Cochrane and others 1999, Nepstad and others 1998, 1999a,b, 2000, 2001). Forest flammability is greatly increased by logging, which is proceeding rapidly along BR-163. One can therefore expect much more forest to be destroyed by fire along this route.

Deforestation Spread to New Areas

The highway's effect is not restricted to the band of deforestation that expands outward from either side of the road. Influence can jump to distant locations through "teleconnections," similar to those in climatology where events (such as deforestation) in one place can affect climate somewhere else. In 2004 there was a dramatic extension of the activity of *grileiros* from BR-163 to the area of Apui, Amazonas, located over 1000 km away by road (Fig. 3). Apuí, located on the Transamazon Highway near the southeastern corner of the state of Amazonas, has long been a hotspot of deforestation in that state, mostly by ranchers and colonists who migrated from Rondônia via Humaitá. The new flow of people, and especially of investment, from the east adds to the critical situation there. According to *grileiros* on BR-163, these flows are encouraged by the mayor of Apuí, who offered 100-ha lots near the town as an inducement for larger investors to set up bases there and delimit claims in large areas of forest on public land elsewhere in the general area. The *grileiros* generally do not abandon their bases on BR-163, but instead make brief visits to Apuí and dispatch either family members or trusted assistants to establish and maintain the new claims. In December 2004 the state of Amazonas created a 3.2 million hectare mosaic of reserves, mostly state forests (for timber management) in the southeast corner of the state (Ninni 2004). The objective is to prevent the entrance of deforesters from Mato Grosso, as well as *grileiros* such as those from BR-163.

[Figure 3 here]

Another distant location that is receiving input from the highway is an area of soybean expansion in the Lower Amazonas. Soy farming in the Santarém area has been expanding for several years; now it has jumped the Amazon River and is expanding in counties such as Prainha, Monte Alegre, Alenquer and Oriximiná on the north shore of the river. Migration of investors in this sector northward from Mato Grosso is likely to be stimulated by a paved highway.

The reach of activities based along BR-163 is already spreading to substantial distances from the highway. Logging is being done at approximately 70 km from the highway, the forest on either side of the road being honeycombed with logging roads. Only four species are logged in significant quantities: cumaru (*Dipteryx* spp.), jatobá (*Hymenaea* spp.), ipê (*Tabebuia* spp.) and cedro (*Cedrela odorata*) (Maurício Torres, personal communication 2004). Mahogany (*Swietenia macrophylla*) is also logged, despite this being currently illegal. With paving of the highway, the distance from the road that is financially feasible to log will expand. The number of species that can be exploited at each distance from the highway will also increase (*e.g.*, Veríssimo and others 2002).

In February 2005 an area of 8 million hectares to the west of BR-163 was declared an "Area of Provisional Administrative Limitation" (ALAP), better known as the "interdicted area," in which other reserves would be created in the months that followed (Fig. 4). This was the first time such an interdicted area was created in Brazil. Announcement of the interdicted area apparently had some effect in discouraging *grileiros* from investing further in clearings in this area during the dry season of 2005. A new law authorizing creation of "public forests," in which forestry management concessions would be granted (including to international firms), was approved by the National Congress and signed into law in January 2006. New national forests created within the interdicted zone would be the first priority for these concessions. An area of approximately five million hectares is expected to be managed in the "BR-163 Sustainable Forestry District" created in March 2006. This is supposed to "permit creation of up to 100 thousand new direct jobs, generation of an annual production of 4 to 6 million cubic meters of logs and may generate from 200 to 800 MW of energy [from burning logging waste], without damaging the forest" (Brazil, MMA, 2006: 8). No indication is given of how such high levels of offtake will be sustained; current (highly predatory) harvest in the BR-163 area totals approximately 1.5 million cubic meters annually according to Ministry of Environment officials.

[Figure 4 here]

About half of the interdicted area has now been transformed into Areas of Environmental Protection (APAs) (Fig. 4). Despite the reassuring sound of this name, it refers to a category that carries virtually no real environmental restrictions. APAs can include cities and areas of agriculture. Most importantly, APAs recognize private property within their boundaries, meaning that the many *grileiros* who have illegal land claims in the area can carry on prolonged negotiations and appeals to legalize their claims and will gain additional legitimacy by being parties in official.

Logging is one of the most important activities to control. To control the transport of wood, in 2004 IBAMA established a checkpoint for northbound traffic at the junction of the BR-163 and the Transamazon Highway 30 km east of Itaituba (known as “Trinta”), but the checkpoint was revoved in 2006. A similar checkpoint at the southern end of the highway, for example at Serra do Cachimbo, has yet to be established, allowing the flow of illegally logged wood to the south to continue unimpeded. At both “Trinta” and Serra do Cachimbo measures are needed to prevent alternative escape routes for wood, detouring around the inspection posts. Controlling flow of wood also requires means of avoiding corruption of inspectors. Transport of illegal mahogany disguised as other species is reported to be a common practice. In addition to the challenges of controlling transport of wood, there are problems of fraudulent management projects and deforestation authorizations [*authorizações de desmate*], and of logging in indigenous areas (often with consent of local indigenous leaders).

A stimulation of migration to the area and to other areas reached via BR-163 can be expected. The example of Rondônia is relevant: even though a huge migration to Rondônia had already taken place before BR-364 was paved, the effect of the highway in opening that part of Amazonia to destruction was evident (Fearnside 1986). Importantly, it is not only poor migrants but also large investors who are attracted to the areas.

Hypothetical Governance Scenarios

Decisions such as those regarding infrastructure projects like reconstructing and paving BR-163 are made based on expectations about the future. These expectations can be based on scenarios that project observed trends into the future or that assume substantial deviations from these trends, either for better or for worse. The precautionary principle would suggest basing decisions on the least favorable of plausible outcomes, but the tendency that is apparent with respect to decisions on BR-163 has instead been to assume that there will be dramatic improvements under what are known as “governance” scenarios.

The key question is whether “governance” will contain forest loss in the BR-163 area. This has been the subject of a highly visible debate (Laurance and Fearnside 2002, Laurance and others 2001a,b, 2004, Nepstad and others 2002a,b, Silveira 2001). The effect of governance was simulated by Soares-Filho and others (2004, 2006a,b), comparing two scenarios, with and without governance. In the governance scenario, deforestation proceeds much more slowly. The question, however, is how this would be achieved in practice. How is a lawless area going to be transformed into an example of obedience to environmental regulations?

It appears highly improbable that the area can become a “corridor of sustainable development” before a change in governance occurs and the local population adjusts to living under a state of law. The key question is to what extent various public pronouncements can be taken as indicating that governance has, in fact, been established. A case in point is the mayor (*prefeito*) of Guarantã do Norte, Mato Grosso. He had declared himself the “green mayor” and announced a series of plans that led Nepstad and others (2002a) to use this case as primary evidence for predicting that governance would greatly reduce clearing along the highway. Ironically, only a

few months later, Raimunda Nonata Monteiro, head of the National Fund for the Environment (FNMA), was taken hostage by loggers in Guarantã do Norte and held until the mayor agreed not to create two proposed reserves (ISA 2003a). On 23 November 2004 the IBAMA office in Guarantã do Norte was burned down, local loggers being primary suspects (Radiobras 2004). Clearly, there is a long way to go to establishing governance, even in the one town run by a "green" mayor.

Nepstad and others (2002a) consider paving BR-163 as "inevitable." Even though it is probable that this highway will be paved under the 2003-2007 Pluriannual Plan (PPA), it is unwise to treat a high probability as synonymous with inevitability (Laurance and Fearnside 2002). Unlike a probability associated with a natural event, such as a drought, highway projects depend on human decisions, and these are subject to change. Treating the project as inevitable makes it a self-fulfilling prophesy. When to consider something as inevitable or irreversible will always be controversial. Developers will always consider things as inevitable from the moment the plan is conceived.

More deforestation has occurred in reality than in the worst scenario simulated by the Institute for Environmental Research in Amazonia-IPAM in scenarios with and without governance (Soares-Filho and others 2004). The model, which was written in 2000, used parameters derived from deforestation in the 1990s when Brazil's economic difficulties translated into slower rates of clearing at any given distance from a road. In addition, capacity of deforestation to leapfrog into previously unaffected blocks of virgin forest has proven to be even greater than that indicated by the parameters used in the model.

A quantitative assessment of the impact of paving the highway requires a comparison of scenarios with and without asphalt. Comparisons of scenarios with and without governance, while also providing important information, do not address this question. The relevant question with regard to governance is whether assumptions that constitute this scenario are realistic in the social context of BR-163 and of the capacity of Brazil's environmental agencies. A realistic scenario or set of scenarios in terms of governance must be compared against identical scenarios with and without paving.

Simulations that control for both paving and governance have recently been run using the SIMAMAZONIA model developed under the Amazon Scenarios Project (Soares-Filho and others 2006b, p. 26). These compare simulated results in 2030 and in 2050 assuming either road paving in 2008 or no road paving. The results (without governance) show an additional 29,767 km^2 of clearing by 2030 in the BR-163 area of influence as a result of paving, or an average of 1353 km^2/year over the 22 years from 2008 to 2030. The influence of paving declines over time as the area of remaining forest dwindles: average additional rate of forest loss declines by half to 653 km^2/year if analysis is extended to 2050. Decline in paving effect over time implies that in the first years after paving the difference between asphalt and no-asphalt scenarios is probably very much higher than the 1353 km^2/year 22-year average, which in itself represents a huge area (almost half the area of the Balbina Reservoir per year!). The first few years are critical, not only in terms of the amount of clearing but also in terms of the location of clearing. Continued clearing under

current lawless conditions would quickly close off opportunities for creating protected areas.

The SIMAMAZONIA simulations indicate that the governance effect in reducing deforestation by 2030 is three times greater than the paving effect is in increasing it, and the governance effect is eight times greater than the paving effect if analysis is extended to 2050 (Soares-Filho and others 2006b, p. 26). However, there is an important difference between the results for these two factors: effect of paving is modeled based on real data from observed changes in deforestation probabilities when highways have been paved in the past, whereas effect of governance is based on arbitrary illustrative assumptions, such as that protected areas will be 100% effective and that a minimum of 50% of the area of each private property will be maintained in forest (Soares-Filho and others 2006b, p. 7). Brazil's Forestry Code, which currently specifies a minimum of 80% forest cover in private properties, is widely ignored in practice (*e.g.*, Menezes 2001). The effort that would be needed to contain deforestation to conform to the governance scenario would therefore be tremendous as compared to any past deforestation-control program. Enthusiasm for potential environmental gains portrayed under governance assumptions should not obscure the fact that highway paving has a substantial and well-documented environmental cost in speeding deforestation.

Parameters used in models for simulating deforestation in both early comparisons of governance (Soares-Filho and others 2004) and in substantially improved simulations using the SIMAMAZONIA model (Soares-Filho and others 2005, 2006a,b) calculate the probability of each cell (*i.e.*, each hectare) being cleared based on "weights of evidence" that reflect such factors as proximity to a paved or an unpaved road, and proximity to previous clearings. "Weights of evidence" refers to a technique common in geological studies for modeling likely locations of mineral deposits (Bonham-Carter 1994). For deforestation studies, the technique is applied by dividing into cells (rasterizing) a pair of satellite images of a given area at two dates, and calculating the fraction of cells that undergo transitions (such as deforestation) in each distance buffer, that is, in each range of distances from a road. Statistical relations are established with predictive variables such as distance from each type of road (Soares-Filho and others 2003, 2004, 2005, 2006a,b). The amount of deforestation in the general area is calculated in a simulation without spatial representation based on economic parameters, after which deforestation is spatially allocated based on the weights of evidence.

When the weight of evidence for a given factor is positive (greater than zero), then the factor stimulates deforestation; when the value is negative then it inhibits deforestation. An examination of these parameters with Britaldo Soares-Filho, author of the model, indicated that the distance over which a road affects clearing (based on imagery from northern Mato Grosso) is 10 times greater in the case of a paved road as compared to an unpaved road. The weight of evidence is highest at the roadside, decreasing progressively as one moves away from the road, falling below a value of zero at a distance of 5 km from an unpaved road and 50 km from a paved road. This means that paving the road will increase rate of clearing in a wide swath along the highway.

The Place of Environmental Impacts in Decision Making

The recent history of BR-163 serves as a recurrent reminder of deficiencies of Brazil's present environmental-licensing system. A key problem is that environmental impact assessment and licensing procedures are subject to pressure from those interested in speedy and obstacle-free construction of the infrastructure. Only a few days after the launching of a special working group to control deforestation, Brazil's president called his ministers together to demand that they find ways to circumvent environmental and other impediments to stalled infrastructure projects throughout the country, including 10,000 km of highway projects (*Amazonas em Tempo* 2004).

A key aspect of the debate on BR-163 has been an effort to suppress discussion of the possibility of not paving the highway as planned, allowing only suggestions on how to mitigate or minimize project impacts – not to evaluate whether the project should go forward in the first place. Discussion of impacts invariably begins from the assumption that paving the highway is inevitable. Hearings and other discussions are often explicit in permitting only "positive" comments, meaning that those participating must accept the assumption that the highway will be paved as a precondition for participation. Discussions are therefore limited to how to minimize negative impacts as much as possible. The interministerial working group's plan of action for prevention and control of deforestation specifies implementing "measures for prevention, ordering and mitigation of socio-environmental effects" of BR-163, making no mention of discussion of whether to pave the highway or not (Brazil, GT-Desmatamento 2004, p. 31). The most important driver of deforestation is existence of highways and other infrastructure rather than details of mitigation programs that may be promoted in conjunction with the projects.

The role of environmental non-governmental organizations (NGOs) in the meetings has become a matter of contention. In July 2004, when NGOs protested that a series of public meetings being held on the highway's impacts was simply a means of obtaining an immediate "liberation" of construction, the official response was that the NGOs had participated in previous meetings and therefore should not be complaining about the procedures outside the context of the meetings (Nunomura 2004). Needless to say, use of participation in meetings to claim agreement and to silence dissent is not the best means of charting a course towards sustainable development. Participation in meetings does not signify that NGOs endorse the infrastructure project.

It should be noted that NGOs have played an important role in pressing authorities to promise measures that would increase benefits for local populations and increase environmental protection. A "consortium" of 32 NGOs has participated in government-organized discussions. Among priorities they identified are creation and consolidation of protected areas, regularization of existing agrarian reform settlements, greater support for family agriculture with incentives for sustainable activities, and extension of infrastructure for all segments of society along the route. In order to support these programs, a sort of "sustainability toll" is proposed to be charged from trucks carrying soybeans. However, this provision has not yet been incorporated into the official plan (Convênio DNIT/IME 2005). The Institute for Environmental Research in Amazonia (IPAM), an NGO based in Belém, has played a leading role in formulating these proposals and in organizing participatory mapping and discussions along the highway (Alencar and others 2005, IPAM 2005).

An Environmental Impact Study (EIA) and a shorter Report on Environmental Impacts (RIMA) have been required in Brazil since 1986 as part the licensing process. These were prepared in 2002 for the stretch in the state of Pará as far as Rurópolis and Miritituba (on the Transamazon Highway). Studies for the stretches in Mato Grosso and from Rurópolis to Santarém have not been completed. The stretch for which the EIA and RIMA have been completed is most controversial; the other two segments are already served by better roads and paving would have less impact.

The reconstruction project was approved by IBAMA in December 2005. During the three-year period between completion of the EIA and RIMA and approval of the project the government took a number of parallel actions such as creating the "Sustainable BR-163" program and declaring the "Area of Provisional Administrative Limitation" (ALAP). However, the EIA and RIMA themselves were not rewritten to bring them up to what might be considered an acceptable standard. Use of parallel measures as a substitute for an adequate set of EIA and RIMA reports, or even for any report at all, is not a precedent without dangers (*e.g.*, Fearnside and Graça 2006). Approval called for 16 conditional measures, most important being a financial contribution to IBAMA for creating reserves as compensation for environmental impact of the highway. While these measures to be implanted simultaneously with highway construction are important, they in no way replace adequate environmental studies and reports as part of the decision-making process.

The tendency of the EIA and RIMA to emphasize benefits of the highway and minimize its negative impacts is apparent. The central fact of the BR-163 environmental study is that it does not deal with the main impact of the project, which is stimulation of deforestation and logging in a wide area influenced by improvement of transportation and migration of *grileiros* and others from BR-163 to new frontiers, such as Apuí, the Terra do Meio (to the east from Novo Progresso), and the "Transgarimpeira" area (to the west from Morães de Almeida). Highway projects have a "dragging effect" in stimulating activities such as logging and ranching, even though these are not part of the planned development (*e.g.*, Fearnside 2002). The question of spreading deforestation, titled euphemistically as "gradual replacement of forest formations by open areas," receives only three pages of the 7-volume EIA report (ECOPLAN 2002a, Vol. 4, pp. 23-25).

The EIA and RIMA list a variety of impacts, most of which are directly related to the roadbed itself. The reports also include presentation of such "impacts" as "Dynamization of the local economy," "Lowering costs of freight and of maintenance for transport of products," "Improvement of quality-of-life for the population," "Expansion of the agricultural frontier and of productive potential," and "Tapping potential for exploitation of natural resources" (ECOPLAN 2002a, Vol. 4, p. 57).

The RIMA reveals an enormous gap in its treatment of direct impacts of building the roadbed and the wider influence of the road in speeding destruction of surrounding forest. For forest removed directly by road construction, the RIMA: "removal [of vegetation] ... should be restricted as much as possible and should be done only in places where it is really necessary. In cases where removal is necessary, check to see if the animals that inhabit the site are able to move naturally to other areas, and, if not, help them in the process" (ECOPLAN 2002b, pp. 44-45).

This concern with direct impacts of the roadbed contrasts sharply with the next three paragraphs, which contain the entirety of the report's recommendations on deforestation—an impact that affects many thousands of times more forest (and wildlife) than the roadbed itself. The paragraphs on deforestation state that "With respect to deforestation ... it will be necessary ... [to take] into account the .... recommendations of EMBRAPA for alternative land-use systems that help to contain deforestation. .... IBAMA, should be made adequate to the new situation. (ECOPLAN 2002b, p. 45).

It is evident that the EIA/RIMA did not address how the highway's impact on deforestation might be controlled and instead passed off this task to another agency: IBAMA. However, IBAMA is not currently able to control the "old" situation without the paved highway. What would be done to transform IBAMA to a new status of "adequacy" is unspecified, although the RIMA's explicit endorsement of the project as a whole implies that this transformation will be automatic. The additional recommendation that following the (presumably future) advice of EMBRAPA (Brazilian Enterprise for Agriculture and Ranching Research) for land-use choices that will help "contain deforestation" is left unexplained as to what the land uses might be.

The RIMA culminates with its overall conclusion of the environmental viability of the project, especially considering that ...'the public works, in themselves, will have little direct contribution to introduction of new processes of degradation. However, the ,,,. highway will increase ... [financial] resources for a sustainable orientation of development" (ECOPLAN 2002b, p. 72).

However, "new processes of degradation" are not necessary for the paving project to have a massive environmental impact. Extending the reach of "old" processes such as deforestation, logging and fire, is more than sufficient. Unfortunately, the paved highway will not only result in more funding for a "sustainable orientation of development" (assuming the unspecified source of funding materializes), but will also add to the forces of destruction.

Tremendous pressure built up to approve the EIA and RIMA and get on with paving the highway immediately. This is an example of what must be avoided, namely transformation of development projects into irreversible juggernauts by means of a high-level political decision, after which all environmental studies and mitigatory measures become mere formalities.

Alternate Policies and Paths

The need for governance is obvious. The question of importance is whether this should be a precondition for paving, or whether (as implicitly assumed in the EIA and RIMA, for example) this will come automatically as a result of asphalt. Unfortunately, governance does not come automatically, and even when it does the gap in time is crucial in allowing irreversible deforestation fronts to spread out from the highway. Once again, Rondônia provides a reminder. In the POLONOROESTE project that accompanied paving BR-364 in Rondônia, paving was supposed to occur simultaneously with measures such as creation of protected areas and demarcation of

indigenous land (Goodland 1985, IBRD 1981). The paving itself went forward quickly (even with financial advances from construction firms), while mitigation measures lagged years behind. Invasion and clearing of much of the area to be protected was already a *fait accompli* by the time these activities were undertaken (Fearnside 1989, Fearnside and Ferreira 1985).

The effort to contain lawlessness must extend beyond the immediate vicinity of BR-163. An effective program must be implanted to contain migration of the lawless frontier to more distant locations in the region. One is struck by the frequency of comments by *grileiros* and other actors in the region that imply that they have a God-given right to take over any unoccupied land and subsequently get the government to legalize their claim. The attitude that forested land is there for the taking is something that can change relatively quickly, but not without a turning point. The historical parallel with occupation of North America is evident, the "closing of the frontier" in 1890 being the turning point there (Turner 1893). BR-163 is an opportunity to close the frontier in Amazonia, rather than waiting until the last tree is cut on some more distant frontier.

If one considers the future on a scale of decades, paving the road is virtually assured. The question at hand is whether it should be paved now, or whether it should be delayed until after current plans to bring the region under the rule of law have had time to take effect. A key question is whether governance can only be had with asphalt. I would suggest that governance can be had without asphalt, providing that the government is willing to invest in a serious effort to bring the rule of law to the region. Only after governance has been established in fact should the floodgates be opened by paving the highway. There should be a waiting period before paving the highway, and the period should be established counting from the date when the area is independently certified as being under control (*i.e.*, with governance). Some respite has been afforded by the government's difficulty in providing funding for the project. In February 2006 the government's estimate of project cost doubled to approximately US$500 million, meaning that a substantial contribution would be needed from the federal budget in addition to what was expected from soy interests and from firms that had planned to fund construction in return for the right to charge tolls (Amigos da Terra-Amazônia Brasileira 2006). Multilateral development bank financing is not expected. Soy firms are currently unwilling to commit funds due to falling global soy prices and to falling value of the US dollar against the Brazilian real over the 2002-2006 period (the exchange rate fell by almost half from R$3.96/US$ in October 2002 to approximately R$2.2/US$ in 2006), thus making agricultural exports less profitable). Delays due to economic fluctuations are temporary and essentially random events—they cannot substitute for a decision-making process that allows needed measures to be taken before commitment to a construction timetable and consequent increase in the force of deforestation drivers.

Among measures needed is a way of neutralizing efforts of local officials to promote illegal activities. Examples are easy to find. For example, a bulldozer belonging to the municipal government of Trairão was apprehended by IBAMA making illegal logging roads in the Itaituba FLONA [National Forest]. Implantation of effective governance is not only needed along the BR-163 itself, but also in areas to which BR-163 effects are spreading, including Apuí and the Terra do Meio. Before opening the floodgates there needs to be an accelerated program for creation of

protected areas and “sustainable-use” areas such as FLONAs. No land can be left without a specific designated use, as this inevitably leads to its being appropriated by *grileiros*.

The area has also produced an important setback in efforts to protect both indigenous peoples and forested areas. This is reduction of the Baú indigenous reserve in 2003 by 317,000 ha in order to appease ranchers and *grileiros* from BR-163 who had invaded a portion of the reserve (ISA 2003b). This precedent has serious implications, since the expectation that attempts to invade indigenous areas and conservation units will ultimately be unsuccessful is the greatest protection that these areas have.

Gaining control of the BR-163 area will require clamping down on numerous illegal operations, including illegal airstrips, *garimpos* (gold mines, often in indigenous areas), and mahogany logging. This will require a permanent presence of armed police, in addition to staff from IBAMA. IBAMA has a base in Itaituba from which a series of control operations was launched during the 2004 dry season using helicopters. The young and dedicated staff at the post made exemplary progress despite threats and hostility from logging interests in the town. In November 2004 heightened threats against the IBAMA staff in Itaituba led the agency’s headquarters in Brasília to have a helicopter sent to evacuate the employees from their barbed-wire enclosed compound. The staff refused the evacuation offer in order to make clear to the loggers that they would not be intimidated. Patrolling an area the size of BR-163 will require several additional bases of the same caliber as the one maintained at Itaituba over the 2003=2005 period. An attempt to establish such a base in Novo Progresso in 2004 was unsuccessful because the new staff assigned there fled in the face of threats; a base wa establishd in 2006, but the Itaituba base was downgraded at the same time. Even a simple checkpoint at Serra do Cachimbo has not yet been established to inspect timber trucks headed south. In other words, although the history of the IBAMA base in Itaituba over the 2003-2005 period is encouraging as an example of what must be done to establish the rule of law on BR-163, the situation shows the tremendous gulf that exists between talking about these problems and actually doing something to change them.

Different viewpoints exist as to the extent to which governance, or certain subsets of the measures that might be included under that rubric, should be in place before highway paving goes forward. Clearly there are powerful forces that want immediate paving no matter what. However, the history of past highway projects where road construction and mitigatory measures were supposed to proceed simultaneously provides ample justification for rejecting any suggestion that such a plan should be adopted here (Fearnside 2006).

Another view is that of the International Advisory Group (IAG) of the G7 Pilot Program to Conserve the Brazilian Rainforest (PPG7). The IAG wrote in its 21st report: “The IAG suggests an alternative that would permit a relatively rapid start of the [paving] project, but would be tied to an essential stipulation, which is prior solution of the land-tenure issue” (IAG 2004). The operative words here are “prior solution,” meaning that the problem must be solved first, not merely be the subject of an official announcement, a plan or a committee. It is essential that the government hold firm on not legalizing illegal *faits accomplis* through “land-tenure regularization”

(*regularização fundiária*). Virtually nothing happened to deal with the land-tenure situation until August 2006 when a joint campaign by INCRA and the Federal Police began to "regularize" small-farmer claims in part of the interdicted area.

This author would go a bit further and wait for other aspects of governance, in addition to dealing with the land-tenure situation, before paving the highway. After all, the costs of paving the road now that might be avoided by paving it later include many additional impacts, such as invasion of indigenous land, invasion of the Terra do Meio, invasion of land west of BR-163 from Moraes de Almeida via the Transgarimpeira road, invasion of the new Riozinho de Anfrísio extractive reserve, as well as FLONAs and other areas, and the foreclosing of opportunities to establish additional protected areas. Even though on the long term (on a scale of decades) existence of a paved road is logical to expect, the environmental cost of paving the road in the next few years is too high, and instead the road should be delayed until after the area has been brought under the rule of law and a track record of governance has been established.

Conclusions

Reconstruction and paving of the BR-163 Highway in Brazil's state of Pará at this time would cause severe impacts in stimulating deforestation both along the highway route and at other locations to which actors (including *grileiros* or land thieves) move from the BR-163 area. The current state of lawlessness must be brought to an end along the unpaved section of the road in the state of Pará as a prior condition for paving; no plan or committee can substitute for achieving a condition of governance in practice. The logical sequence of steps must be respected in order to reach rational decisions on infrastructure projects. Parallel activities are not substitutes for a proper environmental impact assessment and report. Environmental impact assessment must include analysis of impacts of economic activities and migration flows stimulated by the infrastructure rather than a narrow focus on roadbed preparation. Decision making should use scenarios based on known relationships (such as those relating road paving to deforestation) rather than on assumptions about future changes in behavior of actors under governance scenarios. Instead, governance must be established first as preconditions for project approval and execution.

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FIGURE LEGENDS

Figure 1 – Brazil with the BR-163 (Santarém-Cuiabá) Highway.

Figure 2 – The BR-163 (Santarém-Cuiabá) Highway stretch from Guarantã do Norte to Santarém.

Figure 3 – The area of influence of BR-163 in Pará, including the Transamazon Highway as far west as Apuí, and the Terra do Meio bounded by the Xingu River at São Félix do Xingu. 1=Amaná National Forest; 2=Amazonia National Park; 3=Itaituba National Forest; 4=Tapajós National Forest; 5=Administratively interdicted areas; 6=Altamira National Forest; 7=Riozinho do Anfrísio Extractive Reserve, 8=Kararaô Indigenous Area; 9= Xingu National Forest; 10=Terra do Meio Ecological Station; 11=Serra do Pardo National Park; 12=Trincheira Bacajá Indigenous Area; 13=Kaiapó Indigenous Area; 14=Mekrangnoti Indigenous Area; 15=Baú Indigenous Area; 16=Cachimbo Military Base; 17=Munduruku Indigenous Area.

Figure 4 – Current proposal for allocation of land in the 8-million hectare “Area of Provisional Administrative Limitation” (ALAP) on the BR-163 Highway.

Fig. 1

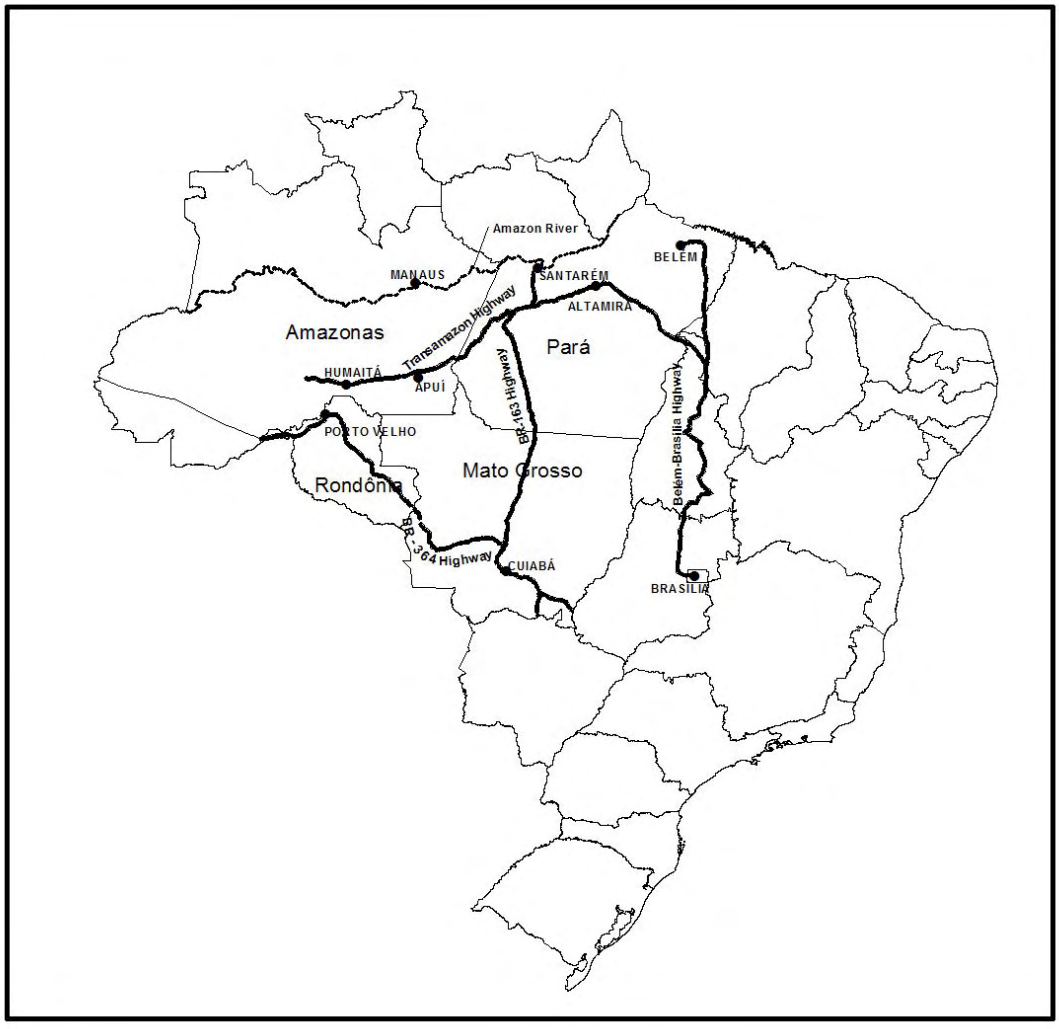
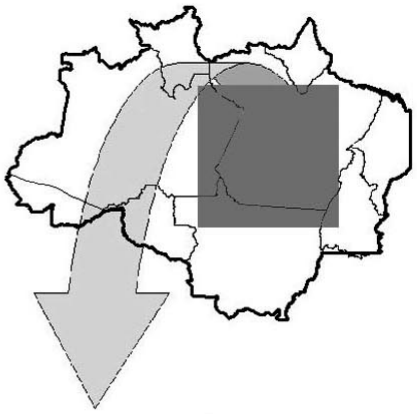

Amazon River
MANAUS
SANTARÉM
BELÉM
ALTAMIRA
Amazonas
Transamazon Highway
Pará
HUMAITÁ
APUÍ
BR-163 Highway
Belém-Brasília Highway
PORTO VELHO
Mato Grosso
Rondônia
BR-364 Highway
CUIABÁ
BRASÍLIA

Fig. 2



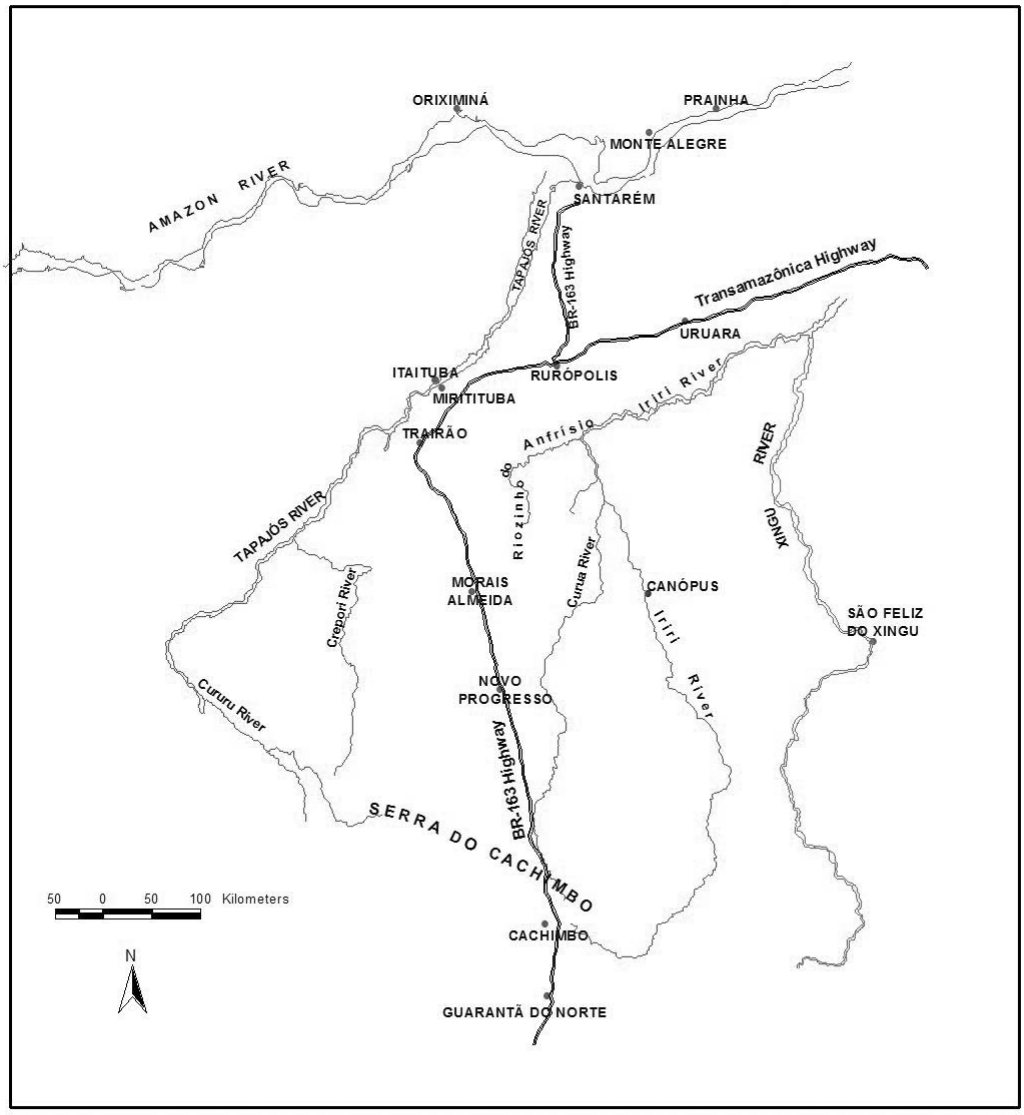
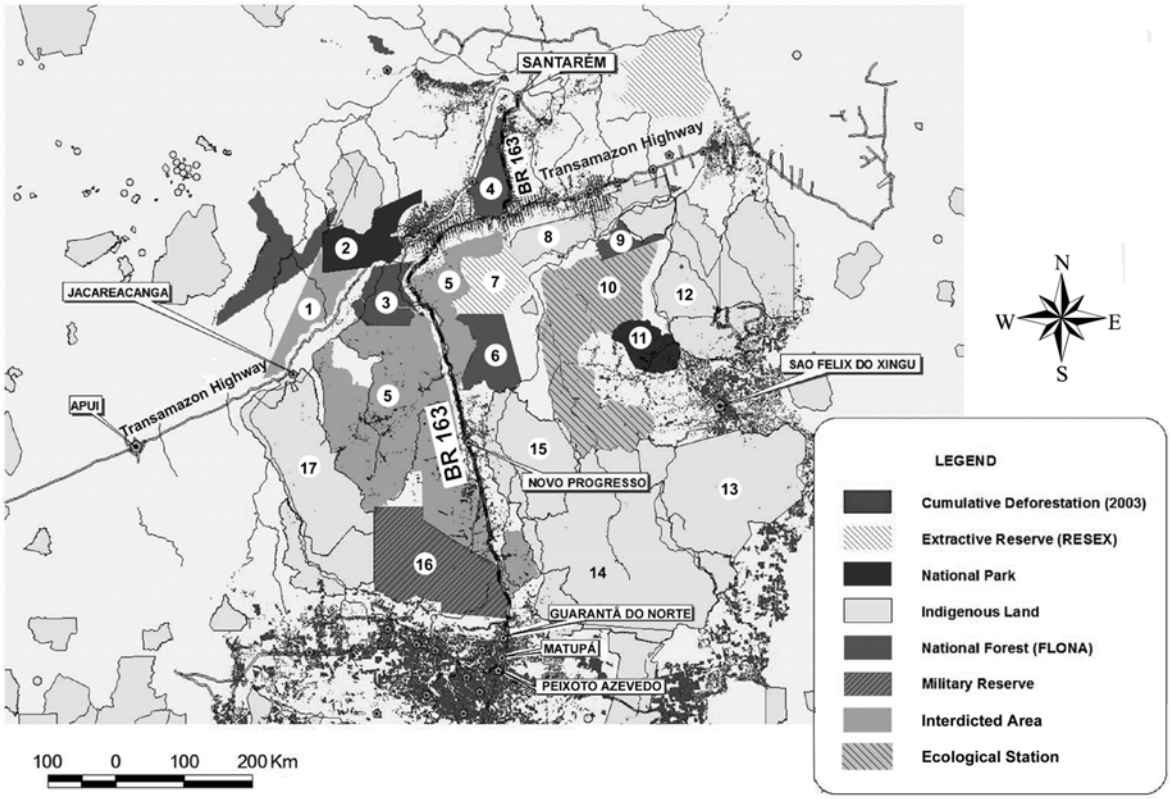

ORIXIMINÁ
PRAINHA
MONTE ALEGRE
AMAZON RIVER
SANTARÉM
TAPAJÓS RIVER
BR-163 Highway
Transamazônica Highway
URUARA
ITAITUBA
RURÓPOLIS
MIRITITUBA
Iriri River
TRAIRÃO
Anfrísio
Rio Zinho
TAPAJÓS RIVER
XINGU RIVER
Cregori River
MORAIS ALMEIDA
Curua River
CANÓPUS
SÃO FELIZ DO XINGU
Cururu River
NOVO PROGRESSO
Iriri River
BR-163 Highway
SERRA DO CACHIMBO
50 0 50 100 Kilometers
N
CACHIMBO
GUARANTÃ DO NORTE

Fig. 3


SANTARÉM
BR 163
Transamazon Highway
JACAREACANGA
APUI
Transamazon Highway
BR 163
NOVO PROGRESSO
SAO FELIX DO XINGU
GUARANTÃ DO NORTE
MATUPÁ
PEIXOTO AZEVEDO
1
2
3
4
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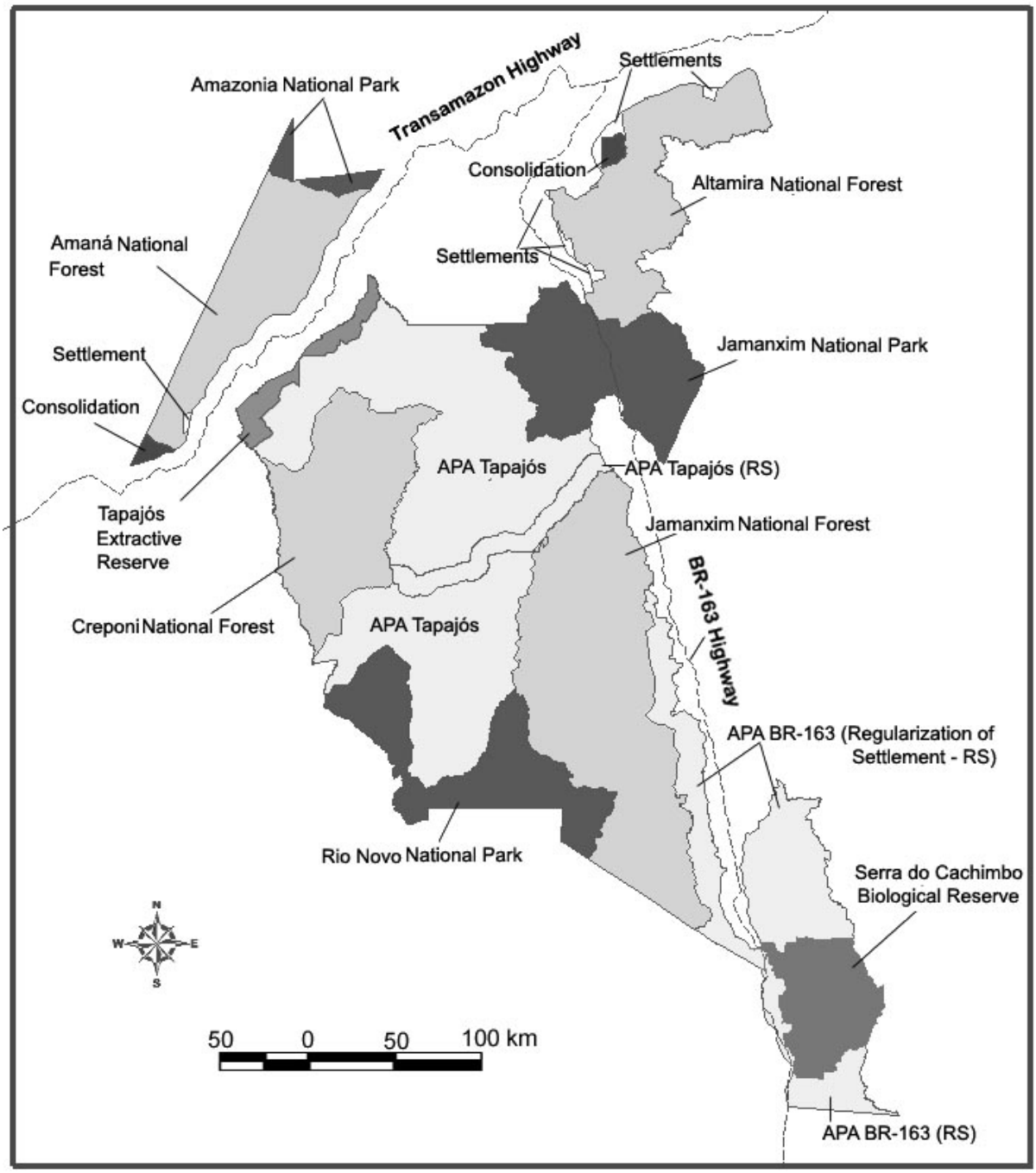
W
E
S
LEGEND
Cumulative Deforestation (2003)
Extractive Reserve (RESEX)
National Park
Indigenous Land
National Forest (FLONA)
Military Reserve
Interdicted Area
Ecological Station
100 0 100 200 Km

Fig. 4


Transamazon Highway
Amazonia National Park
Settlements
Consolidation
Altamira National Forest
Amaná National Forest
Settlements
Jamanxim National Park
Settlement
Consolidation
APA Tapajós
APA Tapajós (RS)
Tapajós Extractive Reserve
Jamanxim National Forest
BR-163 Highway
Creponi National Forest
APA Tapajós
APA BR-163 (Regularization of Settlement - RS)
Rio Novo National Park
Serra do Cachimbo Biological Reserve
N
W
E
S
50 0 50 100 km
APA BR-163 (RS)