

Railroads in the Amazon: A Key Strategy for Reducing Deforestation

Virgilio M. Viana, Mariano C. Cenamo, Mariana N. Pavan, Gabriel C. Carrero
and Matthew D. Quinlan*

The article examines the impacts of paving highway BR-319, which connects two of the largest state capitals in the Brazilian Amazon. In recent years, the construction of highways has been the biggest driver of deforestation in the region. As currently planned, BR-319 will run through the middle of the largest contiguous area of intact forest in Brazil. By 2050, the deforestation projected to result from the paving of BR-319 will release the equivalent of between 950 million to 4.9 billion tons of CO₂ into the atmosphere. The potential negative impacts of building highways in the Amazon calls into question the appropriateness of building a transport system comprised of highways in the Amazon region. The article discusses the legal framework and the political context of the planning process for BR-319. It also examines how the proposed construction of a railroad system instead of repaving BR-319 could contain deforestation, reduce greenhouse gas (GHG) emissions and promote sustainable development in the Amazon.

I. Introduction

1. Roads and Deforestation in the Brazilian Amazon

The biologically diverse Amazon rainforest is the world's largest forest, spanning nine South American countries. The Amazon biome includes an area of more than 7 million km², of which 69% (4.871.000 km²) is located in Brazil. The Legal Brazilian Amazon,¹ which includes a larger area than the biome, as it includes a portion of the savannah biome, covers roughly half of the Brazilian territory. To date, 744.000 km², or 18.6% of its orig-

inal forested area, have been destroyed,² of which 80% is located in the southern and eastern portions of the basin. This area contains a complex road network and has most of the region's paved roads. The construction of roads is the most important driver of deforestation in the Amazon.³ According to the Minister of Environment (MMA), over the last decade, approximately 75% of the deforestation in the region occurred adjacent to paved roads.⁴

The construction of most of these roads started in the 1970's, when Brazil's military dictatorship launched the National Integration Program (NIP),⁵ including the now infamous "Transamazon Highway" (BR-230), which transects the forest from west

* Virgilio M. Viana, Director General of the Amazonas Sustainable Foundation (FAS); Former State Secretary for Environment of Amazonas; Mariano C. Cenamo, Executive Secretary of the Institute for Conservation and Sustainable Development of Amazonas (IDESAM); Mariana N. Pavan, Researcher of the Climate Change Program of the Institute for Conservation and Sustainable Development of Amazonas (IDESAM); Gabriel C. Carrero, Graduate Program in Ecology, National Institute for Research in the Amazon (INPA); Matthew D. Quinlan, Collaborator researcher at the Institute for Conservation and Sustainable Development of Amazonas (IDESAM).

1 A geopolitical boundary established in 1953 by the Federal Decree-law No1806 of 1953 to orient regional planning and federal intervention.

2 National Institute for Space Research: PRODES Project. 2008 – Satellite Monitoring of the Amazon Forest. Available at: www.obt.inpe.br/prodes.

3 See, e.g., Geist/Lambin, "What drives Tropical Deforestation? A Meta-analysis of proximate and underlying Causes of Deforestation based on subnational Case Study Evidence", LUCC Report Series 4, 2001, available at <http://www.geo.ucl.ac.be/LUCC>.

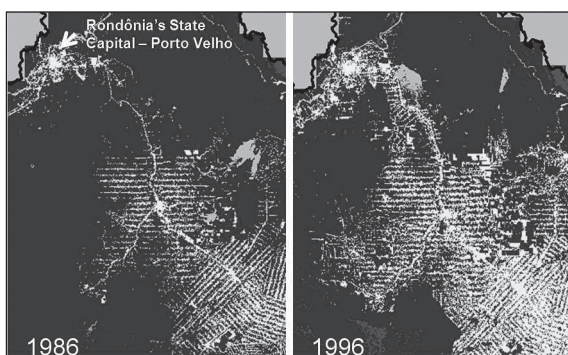
4 ISA – SocioEnvironmental Institute, available at <http://www.socioambiental.org/esp/desmatamento/site/infraestrutura>.

5 Brazil, "PIN (Programa de Integração Nacional). Colonização da Amazônia", Brasília 1972, 32 p.

to east and gave rise to a vast network of additional highways. The government's motivation behind the plan was mainly a question of territorial control rather than economics.⁶ The emphasis given to exportation in detriment to local development accelerated the land concentration and the deforestation cycle, illegal timber exploitation and livestock and grain production.

The construction of roads provides immediate and easy access to the wealth of natural resources within the Amazon, resulting in a spatial pattern of deforestation known as the "fishbone effect". Historically, the creation of large roads in the Amazon leads to the clearing of perpendicular secondary roads and gives rise to new human settlements, thereby exponentially increasing the vectors by which deforestation can spread. The fishbone effect, which is very common in older frontiers in the Amazon, is the result of land invasions, establishment of logging operations, and livestock and agricultural production – all of which extend secondary roads.⁷ (Figure 1)

Figure 1. Satellite Data of Deforestation (in yellow) spreading out through secondary Roads from an initial main paved Road on Rondônia state, illustrating the "Fishbone Effect" over a ten year Period. (Source: Moutinho, 2007).



6 Fearnside/Graça, "BR-319: Brazil's Manaus-Porto Velho Highway and the Potential Impact of Linking the Arc of Deforestation to Central Amazonia", *Environmental Management* 2006, p. 705-716.

7 See, e.g., Arima et al, "Loggers and Forest Fragmentation: Behavioural Models of Road Building in the Brazilian Amazon", *Annals of the Association of American Geographers* 2005, p. 525-541.

8 Fundação da Indústria do Estado do Amazonas-FIEAM, "Desempenho do Pólo Industrial de Manaus", Manaus 2006, 54p.

In this context, another very important road is BR-319, which will certainly define the future patterns of deforestation in the Amazon. Originally built during the NIP, BR-319 crosses the Amazon from south to north and transects BR-230.

2. The BR-319 Highway and the Fate of Surrounding Forests

The BR-319 highway crosses 875 km of rainforest region in the central Amazon, from the south to the edge of the Amazonas River, connecting the state capitals of Amazonas (Manaus) and Rondônia (Porto-Velho). BR-319 was first built and paved in 1970, but due to a lack of maintenance and the extreme climate conditions of the Amazon, it became impassable by the end of the 1980s. As a result, unlike the Amazonian highways that remained passable, the area adjacent to BR-319 remained intact, acting as a barrier to the deforestation coming from the south of Brazil. The reconstruction and repaving of BR-319 has been planned and postponed repeatedly. Roughly, 100 km of each edge of the highway remains passable, a stretch that has since been repaved. Since BR-319 fell into disrepair, cargo has been transported by water or air.

In 2007, the National Government launched the Program for Growth Acceleration (PAC), which is a Federal Government Program comprised of a range of economical policies aimed at accelerating the development of the Brazilian economy. These policies included substantial investments in logistics and transport, the energy sector and social and urban improvements. The program also included the complete repaving of BR-319 by 2012, which would trigger major changes in the land use dynamics of the region. If repaved, the resulting frontier of deforestation would expand northward, bisecting the Amazonian forest.

The BR-319 highway runs in the middle of the world's largest section of intact tropical forest. If paved, the road will expose an immense expanse of intact forest to deforestation pressures, a process currently confined to the edges of the forest. BR-319 connects Manaus, a city of 1.6 million people and a thriving industrial centre, with the rest of Brazil. Every year, Manaus supplies the international market with over US\$ 1.5 billion worth of electronics and other manufactured goods.⁸ Because almost two-thirds of the Amazonas state's 2.4 mil-

lion residents live in Manaus, the state has an extremely low deforestation rate.

The residents of Manaus see the repaving of BR-319 as a means of exporting industrial products at lower cost to São Paulo and other major markets in south-central Brazil, and as a cheaper route for the city's inhabitants to travel outside of the region. The fact that the road will facilitate travel in both directions, leading to greatly increased migration to Manaus, is scarcely mentioned.⁹ The arguments in favour of putting the highway back into operation appear in fact to be driven more by political and social interests rather than economic or environmental concerns.

II. Railroads as Transport in Brazil

Railway transport came to Brazil in 1854.¹⁰ Cheaper and more efficient for long distances, two critical aspects for a country that spans an entire continent, railroads must have seemed a promising transport system. However, the first Brazilian railroad was a disaster, as it was neither economically viable nor functional. Subsequently, in 1866, the big coffee farmers of southeastern Brazil started to build railroads to transport their coffee to the coast. These railroads, which met with good results, stimulated the building of other railroads.

The Brazilian railroads flourished during the 1930s and 1940s, with high levels of goods and passenger transportation. In the 1950s, the Brazilian government took over management and maintenance of the country's railroads, but proved unable to keep up the quality of service the railroad provided. Infrastructure development started to focus on improving air and road transportation. The growing political influence of automobile manufacturers, combined with the growth of country's road network, made the street the most common mode for transport for both cargo and people in Brazil. In a country of continental dimensions, the reliance on highways, which cannot compete in costs against railways at any distance above 500km or more, is highly inefficient.¹¹

The Brazilian goods transportation matrix is composed of railroads (24%), waterways (14%), and highways (62%). The volume of goods transported by highways in 2001 was 485,625 TKU,¹² while only 164,809 TKU went by railroad.¹³ Highways carry 96% of Brazil's passenger traffic.¹⁴ The scarci-

ty of railroads reflects the lack of adequate, long-term planning, and the failure to maintain consistent policies from one administration to the next. As a result, Brazil's railroads are typically comprised of tracks of limited length with low connectivity, low productivity and insufficient investment.

Comparing the country's rail system with other geographically large countries, one can see that Brazil underutilizes railroad transport. For example, in the United States, trains move 40% of goods transported, while highways transport approximately 25%¹⁵. The U.S. has a rail system of 194,731 km, covering 9,158,960 km² of territory. In Brazil, the situation is reversed, with highway transportation comprising 60%, and railroads only 20%, of the goods moved. Brazil has only 29,000 km of track serving an area of over 8,456,510 km².¹⁶ Despite research showing that rail transportation can be up to 30% cheaper than roads, and significantly faster, Brazil's roads still dominate Brazil's transportation matrix.¹⁷

The railroad system has been under private management since 1996, when the National Association of Rail Transportation-ANTF received a concession for 28,000 km of railroads. Since then, large investments have been made in infrastructure improvements, increasing the rate of transportation by 50% and the productivity by 69%, while decreasing the incidents of serious accidents by 81%.¹⁸ However,

9 Fearnside/Graça, *supra*, note 11.

10 Fruet, "150 Years of Highways", Terra Magazine 2005, available at <http://www2.uol.com.br/caminhosdaterra/reportagens/index.shtml>.

11 Freitas/Miranda/Marques et al, "Operador de Transporte Multimodal", Seminary of the Faculty of Baixada Santista, Santos 2004, arch 2006, available at <http://www.logisticabs.com.br>.

12 TKU is defined as the quantity of tons transported, multiplied by the number of kilometers travelled.

13 Peixoto, "Comparative Table between the different Modalities of Goods", in Freitas/Portugal (eds), *Estudos de Transporte e Logística na Amazônia*. Manaus 2006, p.89-108.

14 BNDES: Infra-Structure and Development. National Forum, May 2005. BNDES – Banco Nacional de Desenvolvimento Econômico e Social, available at www.bndes.gov.br.

15 Available at www.dot.gov.

16 COPPEAD, CNT, 2001 apud Technical Presentation – Rodrigo Vilaça, ANTF.

17 Cascão/Pinto/Cascão, "Pre-Project of Economic, Financial, Social and Environmental Feasibility of the Implantation of the Railroad between Manaus and Careiro da Várzea in the State of Amazonas", Technical Report, Manaus-Brasília 2008, 119p.

18 Vilaça, "Technical Presentation on the Debate: Railroad x BR-319: an Important and Urgent Debate", Manaus 2008.

more investment in improvements and incentives to use rail investment is still required. A railroad system could be an excellent alternative for Brazil's transportation infrastructure development, and especially for connecting new regions such as the Amazon.

III. Railroad as an Alternative for BR-319

An analysis between the impacts and benefits of repaving highway BR-319 with the alternative of building a railroad provides strong arguments in favour of the railroad. The additional investment costs associated with building a railroad instead of a highway are less than the costs of controlling the deforestation that would result from paving BR-319. A key environmental advantage of railroads over highways is that they allow greater control of access to the adjacent land by limiting the construction of new secondary roads ramification (i.e., block the fishbone effect). In large intact areas of forests, opening a highway means giving immediate access to these areas, resulting in deforestation and the associated greenhouse gas emissions and loss of biodiversity.

Given the contributions of the transport sector to greenhouse gas emissions, railroads are preferable to highways from a climate change perspective. A single train engine can move large numbers of containers, while a truck can only transport three containers. This means that trains can avoid significant amounts of CO₂ emissions, while also improving the efficiency and reducing the costs of transporting cargo. By also halting the "fishbone effect" of deforestation associated with highways, railroads can help fight two of the major sources GHG emissions: those released by deforestation and those produced by the transport sector.

¹⁹ Cascão/Pinto/Cascão, *supra*, note 22.

²⁰ As a comparison of costs: Initial investment to build a railroad – US\$1.15 billion, while the one for re-paving the highway is around US\$447 million. The division of the railroad costs is: Permanent tracks – US\$750 million, locomotives and wagons – US\$303 million, and other investments – US\$104 million.

²¹ Soares-Filho/Nepstad/Curran et al, "Modeling Conservation in the Amazon Basin", *Nature* 2006, p.520-523.

²² Fearnside/Graça/Keizer et al, National Institute for Research in the Amazon (INPA), Coordination of Research in Ecology. Human Carrying Capacity in Agro-Ecosystem Laboratory, Manaus, Amazonas, Brazil.

Previous studies¹⁹ have shown that, even though the initial investment to build a railroad can be larger than that required to build a highway,²⁰ railroads require less investment once the cost of maintenance is incorporated. Therefore, railroads are a better investment from a financial return perspective.

Unfortunately, the change of paradigms and adoption of a new development model is a long and hard fight. Brazil does not have a transport policy that promotes the building of railroads, so their construction depends on private sector investment. Unfortunately, such financing is not always available. Since Brazil's existing railroads were built by different companies at different periods of times using different standards (e.g. track gauge size), it is impossible for a train to cross the entire country. Those tracks that are not under private management also require upgrading, as does the associated infrastructure. Many train stations, which were typically built a long time ago, are currently abandoned.

Railroads face significant, but not insurmountable, challenges. The creation of a new policy for a sustainable development model that emphasizes the conservation of the Amazon's forests and the efficient transport of goods and people over long distances could serve as a guide for Brazil national transport model.

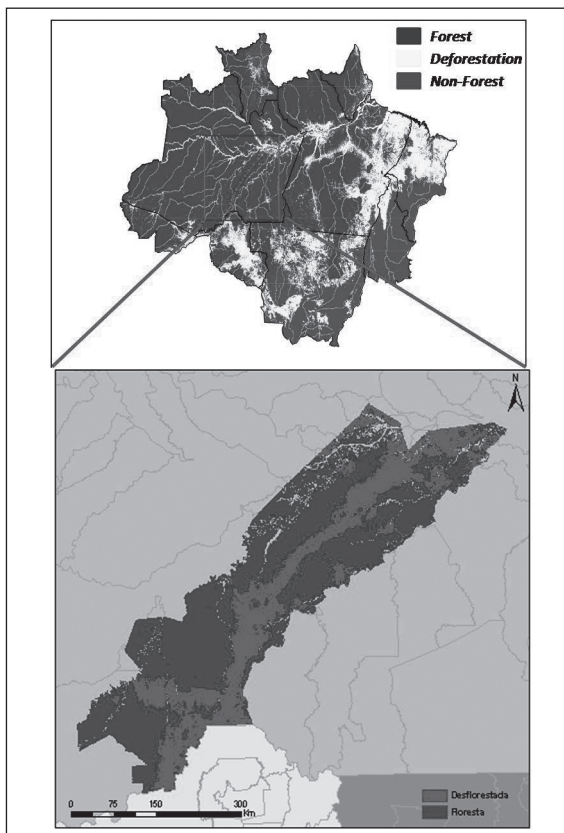
IV. Projected Scenarios

Some scientist groups have started to study the impacts of the repaving of BR-319 on the Amazon forests. A simulation using the SimAmazonia I model projects deforestation for the whole basin up to 2050.²¹ The model's main assumptions were road paving schedules, historical rates of deforestation and an index of anthropogenic pressure to stratify the Amazon into 47 sub-regions. The simulation also presented data for the State of Amazonas using the repaving the BR-319 as a "business as usual" scenario, under which an area of 39 million hectares would be deforested, releasing up to 4.9 billion tons of CO₂eq into the atmosphere by 2050. These numbers include all the human activities following from the paving of BR-319, these proximate and underlying causes driving the deforestation include market accessibility, socio-economic and political changes and population dynamics.

Fearnside and colleagues²² projected the deforestation and CO₂eq net emissions for the repaved

section of BR-319²³ using the same modelling software with some improvements and more detailed local land use and socio-economic datasets. Under a “business as usual” scenario, 5.1 million hectares would be deforested by 2050 (Figure 2), emitting 950 million tons of CO₂eq, which represents more than twice the total GHG emissions of France in 2005. This amount is a net emission account that considers the carbon sequestered by the vegetation replacing the lost forest.

Figure 2. Brazilian Legal Amazon and Deforestation in 2006 (source: INPE 2006); and the BAU Scenario of Deforestation on 2050 (Source: Fearnside et al., unpublished).



The projection made by Fearnside et al. only considers the 15 million hectare area around the highway depicted in figure 2 above. The projections do not account for the deforestation and emissions that would occur elsewhere in the basin due to the increased population migration that would result from the repaving of BR-319.

These studies show that, even under very optimistic scenarios, the repaving of BR-319 would have disastrous impacts on the region and global climate.

V. Legal Framework

In Brazil, there are federal roads crossing state boundaries and state roads within state boundaries. The control and management of each type of road represents some sort of challenge in terms of land use dynamics and land tenure, resulting in conflicts and overlap of federal, state and municipal jurisdiction. In an effort to gain control over infrastructure and agrarian development in Amazon in 1971, the Brazilian Government adopted a “decree-law”²⁴ granting the federal government control over all the land within 100 km of any planned highway. In 1987 another “decree-law” stipulated²⁵ that any land within 100 km of a highway that was not already allocated to a specific purpose (such as for rural settlements) would be considered “unclaimed land” and therefore be placed under state control. Since a considerable portion of the land alongside BR-319 had no clear definition, the government would have the effective tenure and rights to manage such areas. Experience shows that the anticipation of the government claim to the land is likely to lead to an accelerated land grab and illegal logging activities. To minimise such expected increased deforestation, the federal government declared the area of BR-319 an “Area of Provisional Administrative Limitation” in January 2006. These 15 million hectares encompass almost all the land between the Madeira and Purus Rivers. An inter-ministerial commission is in charge of taking special measures associated with the paving of BR-319, such as conducting studies for the creation of protected areas and specific allocations of land.

Because the paving of BR-319 would have significant environmental impacts, it must undergo an Environmental Licensing Process, as stipulated by

23 Fearnside/Graça/Keizer et al, “Deforestation and Carbon Emissions projected for Southern Amazonas, Brazil: A Summary of Modeling Results for Deforestation and Emissions in the Municipality of Apuí and in the Area of the Manaus-Porto Velho (BR-319) Highway over the 2007-2050 Period”, Technical Report 2008, Manaus, 21p.

24 “Decree-law” No. 1164/1971.

25 “Decree-law” No. 2375/1987.

the Federal Constitution.²⁶ Furthermore, the resolution of 1986²⁷ mandates that environmental impact studies under the Environmental Licensing Process must consider alternative development scenarios. However, the Federal government never considered other alternative modes of transport, such as railroads or waterways. The ineffectiveness of Brazilian environmental legislation is exemplified by the “decree-law”²⁸ that creates the National Council for Integration of Transport Politics-CONIT, which has never been implemented and would be useful in improving the intermodal transport system²⁹ in the context of the Amazon.

Since 2002, state level policy-making has been moving in a different direction. The State Government of Amazonas has created policies and programs aimed to halt deforestation, promote forest conservation, and support sustainable use of forest resources. Among several political advances towards environmental conservation, the State Government launched the “State Policy for Climate Change” law in June 2007.³⁰ This law is a voluntary commitment by the State to reduce its greenhouse gas emissions from the transport sector. The state is promoting a debate regarding the other alternatives for a regional transport system.

In 2007, the State Government initiated a public debate about alternatives to reach a consensus regarding the economic viability of BR-319 as well as to learn how to lessen the social and environmental impacts of the project. In October 2007, a debate titled “BR-319 Re-Building vs. Railroad: An urgent and necessary socio-environmental debate” was held in Manaus. In March 2008, the State Government of Amazonas and the Institute for Conservation and Sustainable Development of

Amazonas (IDESAM) organised a broader debate on the same theme. An impressive number of participants attended the event. Attendees included representatives from federal ministries, the private sector such as industry and transport, NGOs, academia, and civil society organizations. Among the main outcomes of the discussion was the recognition that those highways are the major driver of deforestation in the Amazon. There was a notable division among the political positions of the attendees. Some participants did not want to consider the environmental damage associated with BR-319, believing that economic development was the most important consideration. Other participants preferred the railway option, which may promote environmental conservation, reduce negative social impacts, and provide a less expensive terrestrial route for transporting cargo transport in the Amazon.

In May 2008, the city of Manaus hosted the IIIrd State Conference for the Environment. The debate about BR-319 was on the top of the conference agenda. An alliance of NGOs, social movements and indigenous organisations³¹ formed to promote a discussion about the environmental problems associated with the highway. The result of this discussion was that various groups put forth proposals at the National Conference for the Environment held in April 2008. These proposals included halting the paving of highways in the Amazon that had a potential to generate extensive deforestation and GHG emissions as predicted in the Program for Growth Acceleration (PAC). Second, the proposal prioritised finding viable transportation alternatives for the Amazon, alternatives with less environmental, social and economic impacts, such as railroads and waterways. Other State Conferences presented similar proposals. The result was that these proposals were approved with minor changes. There is still concern that such proposals are very weak in the face of political interests behind the decision-making process for infrastructure development in Brazil.

VI. Present Status

The Government of the State of Amazonas commissioned a pre-feasibility study³² that demonstrated the technical viability of the railroad and identified the associated economic and environ-

26 Article 225 of the Federal Constitution of 1988. and Federal Law No. 6938/1981.

27 National Council for the Environment (CONAMA), Resolution No. 01/1986.

28 “Decree-law No. 10.233/2001.

29 State Policy for Climate Change No.3.135/2007

30 State Policy for Climate Change No.3.135 of 2007

31 The alliance was formed by the following institutions: Center for Human Rights (CDH) of Manaus’ Archdiocese, IDESAM – Institute for Conservation and Sustainable Development of Amazonas, the Pastoral Land Commission (CPT), National Rubber Tappers Council (CNS), Confederacy of Indigenous Organizations and People of Amazonas (COIAM), State Foundation for Indigenous People (FEPI) and the Union of Indigenous People of Manaus (UPIM)

32 Cascão/Pinto/Cascão, *supra*, note 22.

mental benefits. Although there is still a need for additional information and more detailed studies, the study shows that the railroad proposal merits serious consideration. After the first public debate, the group hired to develop an environmental impact study of BR-319 added railroad transport as an alternative scenario. Nevertheless, such addition does not indicate that the government will conduct a serious cost-benefit analysis. Rather, the addition of the railway alternative to the study seems to be simply a response to the political pressure from civil society organisations and the State Government, challenging the rationale of paving the highway.

In March 2008, the Government of Peru approved the construction of the “Rey Brazil-Peru Railroad”. The Rey Railroad will cross Peru from the Pacific Ocean to Brazil frontier near to the capital of the State of Rondônia. The Brazilian and Peruvian governments are negotiating the construction of a section of highway in advance of the repaving of BR-319, which would eventually connect the Rey Railroad to the railroad system in south central Brazil. These developments give rise to the possibility that the railroad proposed for Amazonas State could link Manaus to the Latin American market and the Pacific. This would be especially important for the transport of commodities such as soybean, minerals and manufactured goods. The efficiency gained with a railroad system would likely diminish the pressure on the forest by reducing the building of secondary roads and the associated deforestation.

Plans and programs of the Ministries of Agriculture, Infrastructure and Development have always tended to differ from defer (i.e., creating conflicts or tradeoffs in land use and land cover change) with the Ministry of the Environment, without considering the measures necessary to protect the Amazon rainforest. Federal environmental agencies have limited political support and resources to counterbalance illegal timber exploitation, expansion of cattle and soybean production, and land speculation.

The political support for pushing forward the paving of BR-319 often relies on the argument that a railroad would be ineffective in the extreme climatic conditions for the Amazon. Furthermore, the building of the highway has the political support of well-established economic interests that argue that the paving of BR-319 would generate jobs and eco-

nomie growth related to road building, ground transportation and land occupation.

VII. Railroads and the Carbon Trade Market

One of the strongest arguments against the railroad for Manaus-Porto Velho is that it will cost more than paving the BR-319 highway. The initial cost for the construction of the railroad would be around US\$ 1.15 billion.³³ The estimated cost for the reconstruction of BR-319 is US\$ 450 million, less than half that of the railroad.

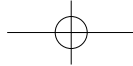
The Federal Ministry of Transportation has already stated that would only cover the costs for the BR-319, but not those of a railroad despite the fact that the long-term maintenance costs of a railroad are much less, as are the environmental impacts resulting from its construction. From this perspective, the railroad solution can only be made to move forward by addressing the difference in construction costs.

The solution to the funding gap is to implement an innovative, multi-sector, nationwide project to reduce emissions from deforestation, with a simple change on the decision-making process. The rationale is simple. If the Brazilian government builds the road, deforestation will occur as predicted by the business as usual scenario in the model for land use change.

Preliminary consultations with carbon market participants indicate that there is significant interest among buyers of carbon-offset credits for the credits a railroad would provide. Conservatively, the construction of the railroad instead of BR-319 would prevent 60% of the 950 million tCO₂ that the paving of B-319 would release due to deforestation in the business as usual scenario in the Fearnside et al. model. Using this estimate, the railroad would generate 570 million tCO₂ in carbon credits by 2050. Considering an average price for VERs negotiated on the Voluntary Carbon Standards (VCS)³⁴, which are around US\$ 6.00 per ton (early 2008), the railroad project could generate US\$ 3.4 billion in revenues, more than three times the cost of the railroad. The revenues generated

33 Cascão/Pinto/Cascão, *supra*, note 22.

34 Available at www.v-c-s.org.



building a railroad in place of BR-319 would allow for an increase in the governmental presence in the region as well as efforts to promote the sustainable development of the populations living in the area.

VIII. Conclusion

It is time to consider innovative approaches for curbing deforestation, ones that attend to the needs of the people living the isolated region of the Amazon. We cannot repeat the mistakes of the past, not only in terms of climate change mitigation, but also in terms of forest conservation. We need to create models that link social development with environmental protection. This is the only solution that will result in the sustainable development of the world's tropical regions.

There is an increasing demand in the global economy for projects and programs that reduce emissions of greenhouse gases, as demonstrated by the CDM and voluntary carbon markets. It is necessary to channel this demand in support of efforts that

promote real changes in the decision-making process of the developing countries, so that these nations adopt less carbon intensive models for their future development.

This article seeks to show that carbon markets can play a role in influencing the political decisions of developing countries. Carbon markets can generate multiple local benefits as well as reduce deforestation and promote forest conservation and improvement. Innovative efforts, such as the railroad option for BR-319, can provide for development and economic growth as well as protect the global climate and environment.

Carbon markets can play a significant role to influence the political decisions of developing countries, generating multiple local benefits such as reducing deforestation, promoting forest conservation, protecting the global climate and environment, and supporting economic development. Building a railway instead of repaving BR-319 could provide a historic landmark by linking carbon markets with the sustainable development of the Amazon.

