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BRAZIL INSTITUTE SPECIAL REPORT

# INFRASTRUCTURE INTEGRATION AND ENVIRONMENTAL PRESERVATION IN THE AMAZON

## EXECUTIVE SUMMARY

Despite decades of degradation and incursions, the Amazon is still the world's largest tropical forest. The Initiative for the Integration of the Regional Infrastructure of South America (IIRSA)—conceived at the 2000 Meeting of South American Presidents—is meant to forge links between all South American countries by creating an integrated continental economy, based on the physical integration of three strategic economic sectors: transportation, energy and telecommunications. While this visionary program is driven by the real need to promote the continent's economic development and reduce poverty, failure to consider the full environmental and social impacts of IIRSA investments—especially in the context of globalized trade and climate change—may produce irreversible environmental devastation of global consequence.

On January 16, 2008, the Brazil Institute in coordination with the Environmental Change and Security Program (ECSP) and the Latin American Program co-sponsored a half-day, three-panel seminar at the Woodrow Wilson Center that brought together various groups interested in assessing the potential impacts of infrastructure projects planned or in execution in the greatest tropical wilderness area on the planet.

The first panel discussion focused on the recent report, "A Perfect Storm in the Amazon Wilderness: Development and Conservation in the context of the Initiative for Integration of the Regional Infrastructure of South America (IIRSA)," written by biologist Timothy Killeen and published by Conservation International. Ricardo Gandour, executive editor of O Estado de S.Paulo newspaper, moderated the second panel, which discussed the impacts of deforestation, climate change and new infrastructure projects on the Amazon. The third panel, moderated by Geoff Dabelko, director of ECSP, debated the regional dimensions of infrastructure integration and its impacts on the environment.

*Written by*  
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## THE STAKES

Director of the Brazil Institute Paulo Sotero introduced the seminar, noting that the Amazonian biome—by far the most expansive, continuous forest in the world—is spread out across eight countries (Brazil, Bolivia, Peru, Ecuador, Colombia, Venezuela, Guyana, Suriname) and French Guiana, covering over 4.1 million square miles. The Amazon is home to more than 40,000 plant species, of which 30,000 are endemic and unique to the forest; 13,000 types of birds and more than 500 mammal species. While the future of the rainforest is an issue of global significance and great importance for all eight South American nations that share this enormous environmental and economic asset, with more than 65 percent of the forest within Brazil’s territorial domain, the Amazon is unmistakably Brazilian. And as owners and guardians of most of the Amazon, Sotero observed, “Brazilians are increasingly aware of the price of failing to protect and preserve it, and are therefore, ever more conscious of their responsibilities.”

These responsibilities carry with them the need to deepen the country’s as well as the world’s understanding of how human activities—ranging from infrastructure projects to global warming—will impact the Amazonian ecosystem. In organizing this conference, Sotero explained, the Brazil Institute’s purpose is to bring together the “thinkers and the doers, on both sides of the issue.” By attracting a large international audience the Institute’s aim is to advance the debate and promote discussion about public policies that balance the region’s underlying need for economic development with the equally important concern of environmental preservation.

“THE FUTURE OF THE AMAZON IS NOT ONLY CONCERN FOR ENVIRONMENTALISTS; IT HAS SERIOUS AND FAR-REACHING IMPLICATIONS FOR BRAZIL’S ECONOMY.”

Thomas Lovejoy, president of The Heinz Center for Science, Economics and the Environment and a member of the Brazil Institute Advisory Council, contextualized the discussion by reflecting on the impacts of past infrastructure projects and development activities in the Amazon. A biologist who coined the expression “biodiversity,” Lovejoy stressed that the debate at hand “is about a race to the finish line” between two opposing trends to Amazon development: the deforestation as an “unintended consequence” of infrastructure and development initiatives, and conservation that strives to promote better use of resources, avoiding their depletion as well environmental destruction. Despite significant conservation efforts<sup>1</sup>—more than 40 percent of the Amazon is registered by law as protected areas and indigenous lands—the prospect of new, large-scale infrastructure projects pose serious risks to the forest’s ecosystem. Roads serve as catalysts for environmental degradation; wherever road construction takes place, Lovejoy explained, it is followed by “spontaneous forms of colonization and deforestation.”<sup>2</sup>

1. Data produced by Brazil’s INPE indicates that from 2005 to 2007, deforestation in the Amazon declined annually from over 27,000 km<sup>2</sup> in 2004 to a low of less than 10,000 km<sup>2</sup> in 2007—a decrease of over 60 percent. Climate Scientist Carlos Nobre explained this reduction is in part a result of increased government enforcement and also a decline in Amazonian commodity prices.

2. According to studies produced by INPE, from 1991 to 1997 over 90% of all deforestation in the Amazon occurred within 100 km (62.14 miles) of primary roadways. Also, in the 1970s more than 86% of deforestation in the Amazon took place within 25 km of “pioneer” lands.



## A KNOWLEDGE-BASED PLAN TO DEVELOP THE AMAZON SUSTAINABLY

A major challenge for development in the Amazon is the lack of a successful economic model in the tropics. Carlos Nobre, one of Brazil's leading climate scientists, noted to "develop the Amazon sustainably, we need to invent a new development paradigm. This new paradigm comes from the concept that we must valorize the heart of the forest: its biodiversity."

In outlining his proposal to create this new paradigm, Nobre cited the established success of both the American and Brazilian aeronautical industries. "If you want to do something that has never been done before," he said, referencing NASA's mission to land a man on the moon, "you need to have a strong knowledge-base, with dedicated centers of technology and research." This is exactly what Nobre proposes to do: bring knowledge to the Amazon by establishing a network of "Institutes of Technology for Amazonia," or ITAs. The design of the Institutes would replicate the model and structure of the prestigious Brazilian Instituto Tecnológico de Aeronáutica, which emulated the organizational structure of MIT's Department of Aeronautics and Astronautics.

### VISION

To invent a new development model by creating a network of "Institutes of Technology for Amazonia" focused on technological education and advanced research with the main objective of globalizing the development capacity of the Amazon and producing value-added goods and services.

### ORGANIZATION OF ITAs

- Faculty: 200 – 500 professors and researchers
- Students: 1,000 – 1,500 undergraduate and graduate students
- Research focus: forest and aquatic products; mineral resources; biodiversity and ecosystem services
- State-of-the art research laboratories and facilities

### TWO-TIERED APPROACH TO EXPAND R&D

- Bring 50 to 100 products based on biodiversity to global markets
- Enhance region's scientific base and entrepreneurial capacity
  - Harness appropriate technologies and full production chain
- Employ high-end technology: biotechnology, biomimicry and nanosciences
  - Draw-in international cooperation in areas of education and fundamental/applied research

\*This proposal, developed and supported by leading experts from Brazil's National Academy of Sciences, will be presented to President Luis Inácio Lula da Silva and cabinet-level ministries for review.

Lovejoy also remarked that the future of the Amazon is not only a concern for environmentalists, but also an issue with serious and far-reaching implications for the Brazilian economy. Remote sensing imagery shows the hydrological cycle generated by the Amazon (see graph on page 5) provides a significant amount of the rain south of Amazônia, in Mato Grosso, São Paulo and even northern Argentina. In addition to fueling many of Brazil's hydro-electric dams, the Amazon "rain machine" provides much of the rainfall needed for the country's successful agro-industry<sup>3</sup>, concentrated in the center and southern regions of Brazil. Understanding how environmental preservation—or conversely, environmental degradation—will impact the economies of Amazonian countries must, therefore, be a top concern for the IIRSA project. Furthermore, considering IIRSA is an initiative of continental-scale aimed at South American integration, a holistic assessment requires not only projecting the impacts of individual plans, but the effect of the interconnected web of projects as well. Lovejoy emphasized this calculation would be incomplete without considering the enormous ecological value of the Amazon.

Gustavo Fonseca, team leader of the Natural Resources Division of the Global Environment Facility and the principal instigator of the study when he was at Conservation International, reiterated the central question facing the IIRSA project.



From left to right, Thomas Lovejoy and Gustavo Fonseca

Fonseca asked: "Can we successfully integrate the region's infrastructure without destroying all of the environmental resources of South America?" While pressure to further develop the economic potential of the Amazon will inevitably change the region, he emphasized the need to ensure that future generations are not deprived of the Amazon's enormous economic potential because of short-term development goals. To avoid this fate, he asserted, "we must recognize the future value of the ecosystem."<sup>4</sup> Natural resource depletion throughout the world will increase the scarcity of commodities and environmental assets, making the largest tropical forest a valuable national resource with major, future monetary payoffs. Current conservation efforts, argued Fonseca, are a vital strategy in the long-term effort aimed at realizing the future environmental and economic potential of the Amazon basin.<sup>5</sup>

3. According to Timothy Killeen, a 1 percent reduction in the amount of water in the Amazonian hydrological cycle—which contributes to the "river in the sky" phenomenon— would lead to a loss of approximately US\$1 billion in economic output. This US\$1 billion loss is based on the calculation that the region's agricultural "breadbasket" generates an annual value of US\$100 billion.

4. The Amazon's carbon stocks are estimated to be worth US\$2.8 trillion, if monetized in today's markets. Using the models adopted by the U.N. Framework Convention on Climate Change, it is projected that Amazonian countries could generate about US\$6.5 billion annually over 30 years if they decrease deforestation rates in their countries by 5 percent per year.

5. According to Carlos Nobre, implementing the "Triple 50" objective would have significant implications for global warming; 50 billion tons of carbon emissions can be prevented if Amazonian countries decrease deforestation rates by 50 percent by the year 2050.

# Environmental Preservation in the Amazon



Considering IIRSA is quickly becoming the operational framework through which development agencies and governments coordinate various integration initiatives, it is important leaders behind the Initiative consider the region's vulnerability to rapid change; since the period of colonization in Brazil, remarked Fonseca, the Amazonian economy has been characterized by prolonged boom-and-bust cycles. This reality presents both a challenge to leaders' development goals and an opportunity for change. If properly planned and skillfully executed, an integrationist development strategy can promote economic growth and reduce poverty by releasing the region from its reliance on natural resource extraction while still preserving the environmental integrity of forest.

## THE FUTURE OF THE AMAZON

In the report, "A Perfect Storm," Timothy Killeen seeks to study and revitalize the debate about conservation and development in order to assess objectively the

potential impacts of IIRSA-led infrastructure projects. The title of the report, Killeen explained, refers to the wide-range of inter-related phenomena—from globalization of markets and rising demand for commodities to demographic pressures and weak governance—that all converge to create a situation that has the potential to be the "perfect storm of environmental destruction." The focus of the report relates to the challenges of environmental conservation and infrastructure integration as well as the underlying need that "tropical and developing countries have to promote economic growth and social justice."

Killeen noted that while "virtually all South American societies support the conservation of the Amazon," they also "simultaneously call for increased development in the Amazon in order to provide [its] residents with a dignified life free of poverty." Although conservation and development are not mutually exclusive activities, balancing the requirements of both is a complex venture that demands

considerable political will, proper economic incentives, clear legal standards and strict regulatory enforcement. Considering this complex equation, Killeen asserted there are essentially three scenarios for the future of the Amazon: the utilitarian scenario, the utopian scenario and the “business-as-usual scenario.”

### Three Scenarios

The utilitarian scenario is based on climate-change models and projected land use patterns that interact in a way that makes the Amazon progressively drier and warmer, with tree plantations and mechanized agriculture replacing the natural forest ecosystem—the Amazon, in this view, becomes “a giant breadbasket.” Moreover, in this utilitarian perspective, the use of technological innovation and sustainable, productive systems in the Amazon enables the region to integrate successfully and build strong, prosperous intra- and inter-continental commercial links. Killeen asserted that while predictions of biodiversity loss have proven real, in this utilitarian scenario ecological collapse is avoided because of sustainable production practices and technological progress (for example, the use of better genetic crop varieties yield more returns on less land).



**“A Perfect Storm in the Amazon Wilderness: Development and Conservation in the Context of IIRSA”**

by Timothy Killeen, Conservation International



Timothy Killeen

The utopian scenario, which is similarly optimistic about the impact of human actions, depicts the “ideal future.” Killeen explained that this vision is dependent on some climate model estimates that predict relatively stable precipitation patterns (and the assumption that the worst-case global warming scenario does not materialize), in addition to concerted efforts on the part of South American nations to avoid wide-scale deforestation. In this scenario, the conservation of the Amazonian biome is principally accomplished by the creation of a market-based scheme through which individuals, communities and organizations are subsidized for their ecosystem-preserving services; agricultural production in the Amazon is balanced by the adoption and enforcement of mixed land-use practices that “maintain 80 percent of the land as forest and limit land-use change to 20 percent of total cover”; and highway infrastructure corridors are replaced by the transportation model “people by air and cargo by water.” The utopian scenario requires Brazil to lead these regional conservation efforts (and for Andean countries to follow suit) and the development of value-

added production chains that generate employment and help diversify the region's economy beyond its reliance on natural resource extraction.

The third, and unfortunately the “most likely future scenario,” assumes that business will carry on “as usual.” In this scenario individuals are motivated by short-term economic interests, governments are unable to enforce regulations or control development in the Amazon, and international organizations and their member states fail to create a market mechanism that pays for ecosystem services. The underlying logic of this scenario is not altogether different from that of the utilitarian scenario. The key differences, Killeen noted, is how individuals and governments respond to structural challenges: the same international commodity demand, growing demographic pressures and poverty reduction needs presented in the utilitarian scenario are, in this case, not supported by cohesive integration policies, strong capital inflows, stable land tenure, and technological innovation. The results are devastating. The impetus for an integrated transcontinental transportation system “induces governments to open up more areas for settlement,” which directly and indirectly lead to “massive levels of species extinctions” on local, regional and global scales. Moreover, not only are important agricultural regions such as Brazil, Argentina and Paraguay, negatively impacted by dramatic changes in the Amazon's hydrologic cycle, but rural communities suffer from the region's economic stagnation and volatility in international commodity prices.

### Avoiding the End of the Amazon

Considering these three scenarios of the impact of human activity on the Amazon, Killeen concluded that the two most serious threats to conservation are climate change and deforestation. In his view—if properly planned and effectively executed—IIRSA can be a force for conservation, rather than a force for deforestation. In order to “avoid the end of

## “CAN WE SUCCESSFULLY INTEGRATE THE REGION'S INFRASTRUCTURE WITHOUT DESTROYING ALL OF THE ENVIRONMENTAL RESOURCES OF SOUTH AMERICA?”

the Amazon,” Killeen proposed a series of policy recommendations that would improve IIRSA, making it a “model for development throughout the region and the rest of the world.”

His policy recommendations included traditional and non-traditional approaches to environmental conservation. His traditional policy recommendations included initiatives such as sustainable forest management and the establishment of national systems of protected areas alongside indigenous reserves. As a result of the ineffectiveness of most traditional conservation approaches, Killeen highlighted five feasible and compelling, non-traditional proposals: monetizing carbon credits, providing social services in exchange for ecosystem services, reforming land tenure systems and changing the development paradigm.

### Policy Alternatives

“Saving the Amazon,” Killeen remarked, “will require resources.” Creating revenue by monetizing carbon credits is a viable, market-based alternative to current economic activities that deforest natural areas. Through “carbon markets and voluntary mechanisms,” Killeen remarked, resources for conservation efforts can be raised while still respecting the territorial sovereignty of “individual

## “SAVING THE AMAZON WILL REQUIRE RESOURCES; CARBON CREDITS ARE A VIABLE, MARKET-BASED ALTERNATIVE TO CURRENT ECONOMIC ACTIVITIES THAT DEFOREST NATURAL AREAS.”

nations to manage their own resources”—a point of great contention for developing countries.

The contention regarding the issue of sovereignty makes it such that individual nations require additional incentives to abide by an ecosystem services agreement, or as Killeen explained, a “quid pro quo” exchange. In this exchange, extra-regional states and international organizations will beseech Brazil and the Andean countries, with portions of the Amazon in their territory, to preserve the rainforest in order to help mitigate the international security threat posed by global warming. In order for these South American countries to engage in an international agreement, Killeen recommended that Europe and North America shift their domestic agricultural subsidies to forest conservation.<sup>6</sup> This would not only benefit Europe and North America by unlocking world trade talks and opening markets for industrial goods and services in leading emerging countries like Brazil, but also would have the indirect effect of protecting European and American farmers from increased competition because of limited agricultural expansion into the Amazon.

Providing a fair exchange for local populations—using direct economic subsidies to link forest preservation with the provision of social services—will enable a crucial constituency to support broader conservation efforts. Compensating communities that protect the Amazon and limit deforestation with the provision of health and education services only will be successful, Killeen maintained, if national and state governments engage local municipalities directly and monitor the program’s efficacy.

Killeen observed, “the insecurity of land tenure is a major driver of deforestation and conflict” in the Amazon. Reforming the land tenure system to produce long-overdue changes could reverse the current titling process that “reward land tenants who deforest lands and castigate those who do not.” The primary objective of altering this paradigm would involve maintaining a forest matrix that follows the 80:20 (forest:cultivated land) rule delineated in the Brazilian Forest Code. To ensure the effectiveness of these production system reforms require both government regulation (and enforcement) as well as market-based economic incentives.

In proposing to change the “development paradigm” of the Amazon, Killeen outlined his policy recommendation that sets out the groundwork for future, sustainable conservation efforts. In order to create a production system that is less vulnerable to the fluctuations of international commodity markets, Amazonian commodities must be transformed into manufactured goods and services. To further diversify the region’s economy, Killeen suggested establishing technology-based industries in cities throughout the Amazon (following the model of the Manaus Free Trade Zone<sup>7</sup>).

6. According to the “A Perfect Storm” report, subsidies in Europe and North America fluctuate between US\$50 to US\$75 billion annually. The proposed payments for carbon sequestration services mentioned above represent only 1 percent of this total.

7. Manaus Free Trade Zone and Western Amazon Region has as its goal to introduce and disseminate the business and investment opportunities in the Manaus Industrial Sector and in the States of Acre, Amazonas, Rondônia, Roraima and in the Macapá Free Trade Area -Santana, in the State of Amapá, an area of influence of the Manaus Free Trade Zone model. ([http://www.suframa.gov.br/publicacoes/site\\_suframa/english/index.htm](http://www.suframa.gov.br/publicacoes/site_suframa/english/index.htm))

# Environmental Preservation in the Amazon



Mauro Marcondes

## Explaining IIRSA

Mauro Marcondes, IIRSA coordinator at the Inter-American Development Bank, rounded out the first panel with a discussion on the “myths and reality about IIRSA.” He noted that IIRSA is neither a mechanism to finance “mega-infrastructure” projects, nor a process for the privatization of public assets, nor an agency that defines any of its member countries’ political agendas. Rather, IIRSA is a forum for regional dialogue of twelve South American countries that is built on consensus, with each government responsible for the activities and projects undertaken through the Initiative. Moreover,

IIRSA is dedicated to defining mechanisms to tackle gaps on regulation; developing tools and methodologies with the aim of efficient project implementation as well as a broad territorial planning scope to include processes such as logistic chains and productive integration. Marcondes also laid out IIRSA’s strategic vision for the “Amazon Hub,” which includes sustainable and certified forest management; development of bio-industry and bio-commerce; export of new Amazonian products through sustainable practices; and the provision of environmental services. He concluded that the main purpose behind the Initiative is to help countries “gradually construct a new vision for the planning and implementation of regional infrastructure networks.”

## DEFORESTATION, CLIMATE CHANGE AND THE FATE OF THE AMAZON

Carlos Nobre, director of the Center for Climate Studies and Weather Forecasting and senior scientist at Brazil’s National Institute for Space Research (INPE), warned that human civilization has entered the Anthropocene<sup>8</sup> geological period without truly understanding its complex relationship with nature. “Earth is composed of myriad ecosystems,” he noted, “and all have drastically different responses to human pressures.” In order to deepen our understanding of endangered critical “hot-spot” systems that are at risk throughout the world, Nobre asserted, we must have a more profound understanding of the interplay between the impacts of droughts, fires<sup>9</sup>, deforestation and global warming.

8. In a February 2008 article published in *GSA Today*, Jan Zalasiewicz et al. explain that the term Anthropocene is used to identify a new epoch. The authors elaborate by noting that “since the start of the Industrial Revolution, Earth has endured changes sufficient to leave a global stratigraphic signature distinct from that of the Holocene or of previous Pleistocene interglacial phases, encompassing novel biotic, sedimentary, and geochemical change.” (<http://www.gsjournals.org/perserv/?request=get-document&doi=10.1130%2FGSAT01802A.1>)

9. Fires pose a significant threat to deforestation in the Amazon. According to remote-sensing fire data obtained by INPE, lack of precipitation and proximity to main roads are major drivers for fire activity in the region. This may further accelerate deforestation, as new roads and increased global warming (which may lead to a drier regional climate) exacerbate the threat of fires.









