

OPINION ARTICLE

# Emerging Threats and Opportunities for Large-Scale Ecological Restoration in the Atlantic Forest of Brazil

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## Abstract

Over the past 150 years, Brazil has played a pioneering role in developing environmental policies and pursuing forest conservation and ecological restoration of degraded ecosystems. In particular, the Brazilian Forest Act, first drafted in 1934, has been fundamental in reducing deforestation and engaging private land owners in forest restoration initiatives. At the time of writing (December 2010), however, a proposal for major revision of the Brazilian Forest Act is under intense debate in the National Assembly, and we are deeply concerned about the outcome. On the basis of the analysis of detailed vegetation and hydrographic maps, we estimate that the proposed changes may reduce the total amount of potential areas for restoration in the Atlantic Forest by approximately 6 million hectares. As a radically different policy model, we present the Atlantic Forest Restoration Pact (AFRP), which is a group of more

than 160 members that represents one of the most important and ambitious ecological restoration programs in the world. The AFRP aims to restore 15 million hectares of degraded lands in the Brazilian Atlantic Forest biome by 2050 and increase the current forest cover of the biome from 17% to at least 30%. We argue that not only should Brazilian lawmakers refrain from revising the existing Forest Law, but also greatly step up investments in the science, business, and practice of ecological restoration throughout the country, including the Atlantic Forest. The AFRP provides a template that could be adapted to other forest biomes in Brazil and to other megadiversity countries around the world.

**Key words:** Brazilian Forest Act, ecosystem services, environmental policy, high-diversity reforestation, large-scale restoration, natural capital, tropical forest restoration.

Over the past 150 years, Brazil has played a pioneering role in developing proactive and effective environmental policies and developing forest conservation and ecological restoration initiatives (Joly et al. 2010). Although the unacceptably high rate of deforestation in the country is well publicized, this other reality is not well-known outside Brazil (Nepstad et al. 2009). For instance, the rightly celebrated and intensively used Tijuca National Park in Rio de Janeiro arose from a forest restoration project dating from 1861. That restoration was implemented in order to protect and augment vegetation cover around natural springs and along streams then heavily degraded by coffee

plantations, and thus to ensure the provision of drinking water to the rapidly growing city of Rio de Janeiro. Furthermore, the main environmental legislative instrument in Brazil—the Forest Act, which dates from 1934—was enacted in an attempt to reconcile profitable private land use with biodiversity conservation goals and the provision of ecosystem goods and services to society at large. This legal instrument—especially its revisited versions of 1965 and 1989—has been a robust and key policy tool to ensure the provision and enhancement of ecosystem services to the public, even on private lands. In particular, compliance with the Forest Act has been decisive in determining whether or not agro-industry companies may obtain environmental certification and financial credit (Rodrigues et al. 2010, in press) and in engaging smaller landowners in various voluntary and mandatory restoration programs (Wuethrich 2007). Additionally, in 2006, Brazil established a specific legal instrument to protect its most threatened biome—the so-called Atlantic Forest (*Mata Atlântica*, in Portuguese). This Atlantic Forest Law imposes drastic—and long overdue—restrictions on any further removal or degradation of remaining natural vegetation in the biome.

The Brazilian Forest Act is vitally important in efforts to control deforestation and to conserve what is left of primary or secondary forests in human-dominated landscapes

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throughout the country, especially along the frontiers of agriculture expansion in the Amazonian and Cerrado biomes. In the Atlantic Forest, this legal instrument is nowadays essential to promote forest restoration in degraded agricultural lands. Protection of remaining forest fragments and ecological restoration are both crucial for the future of the Atlantic Forest, which is one of the hottest of the world's biodiversity hot spots (Laurance 2009; Russo 2009) and of vital importance to more than half of the Brazilian population. Less than 12% of the original vegetation cover remains in the Atlantic Forest biome, predominantly as forest fragments under 50 ha in size (Ribeiro et al. 2009). Due to the high level of habitat fragmentation, forest restoration has become an essential component of all policy strategies aiming at the reduction of local and regional species extinctions, continued provision of ecosystem services, climate change adaptation, and promotion of human well-being (Rodrigues et al. 2009a).

In sum, for the long-term conservation of the Atlantic Forest biome, ecological restoration efforts are essential and urgent and can be justified and incentivized as a means of compliance with the Forest Act (Rodrigues et al. 2010, in press) and, in some States, with specific regulations regarding forest restoration techniques (Brancalion et al. 2010). For instance, in the state of São Paulo, a resolution establishing norms for the practice of ecological restoration of tropical forests was created in 2001 to optimize the effectiveness and quality of restoration efforts in both large and small landholdings. This legislation is unprecedented in the world and continues to evolve thanks to ongoing debate among legislators, landowners, and scientists (Aronson 2010; Brancalion et al. 2010; Durigan et al. 2010).

Indeed, compliance with the Forest Act has been an important tactic of Brazilian non-governmental organizations (NGOs) and government agencies attempting to simultaneously address the need for forest fragment conservation and restoration in private lands, and private landowners' legitimate commercial interests. However, this favorable scenario may change dramatically in the near future, as a proposal for major revision of the Forest Act is now under debate, headed by some key rural politicians and the Brazilian Agribusiness Confederation. Some of the key proposed changes are (1) reduction of the width—from 30 to 15 m—of the areas currently slated for the protection of riparian forests along streams <5 m wide; (2) decrease of the amount of legal reserves (set-asides); and (3) removal of the legal protection of all natural vegetation on mountain tops. These changes could result in the worst environmental setback in half a century, with prospects of extinction for more than 100,000 species (Metzger et al. 2010), and dramatic reductions in the provision and quality of already diminished ecosystem services (Michalski et al. 2010). Several other potential threats have been identified by scientists and can be reviewed in a special issue of the Brazilian journal *Biota Neotropica* (<http://www.biotaneotropica.org.br/v10n4/pt/item?article>). The proposal has been approved by a Commission and submitted to the Brazilian Congress for validation. It is important to mention that the political situation in Brazil at the time of writing is not conducive to serious discussions of highly controversial

issues like this one because elections for president, state governors, and congress took place in October and November of this year and the country is now in a transitional phase of governments.

Although the above-mentioned political situation is likely to be quite transient, as happens in every country, some important political groups are not. One example, here in Brazil, is traditional rural politicians. These highly conservative politicians have always had strong influence on the decisions taken by the National Congress because they constitute a supra-partisan and very well-organized group that represents the economically important agribusiness sector in the country. If the proposed changes in the Brazilian Forest Act are not approved—and it seems unlikely that they will not—this theme will return again and again in debate, as the falsely perceived dichotomy between agriculture and conservation is far from being overcome or resolved in the current political landscape. Moreover, another key aspect that has a strong influence on the level of engagement and commitment by landowners, obliged by law to restore critical areas for ecosystem services production, is the perception that the law can always be modified to accommodate specific interests by those sectors.

All Brazilian biomes will be negatively affected if the proposal is approved, but in different ways. For example, both the Amazon and Cerrado biomes, which still have 85 and 50% of pre-European conquest vegetation cover, respectively, will succumb to higher rates of deforestation. In the case of the Atlantic Forest, which already has highly modified and fragmented landscapes, the major impact will be the reduction of the scope and effectiveness of existing and planned forest restoration initiatives. Therefore, the approval of this proposal would also represent an important obstacle for emerging strategies to reconcile economic development with biodiversity conservation and provision of ecosystem services in the country.

### Scaling Up Restoration Initiatives: The Atlantic Forest Restoration Pact

In 2009, a group of NGOs, private companies, governments, and research institutions launched one of the most important and ambitious ecological restoration programs in the world, the so-called Atlantic Forest Restoration Pact—AFRP (<http://www.pactomataatlantica.org.br/index.aspx?lang=en>).

This unique program with more than 160 members has as its mission to restore 15 million hectares of degraded lands in the Brazilian Atlantic Forest by 2050 (Fig. 1) and to help protect, in a sustainable fashion, the remaining forest fragments. This will be achieved by promoting: (1) biodiversity conservation; (2) job generation and income opportunities through the restoration supply chain; (3) provision of key ecosystem services to millions of people and businesses; and (4) establishing serious incentives for landowners to comply with the Forest Act. Ecological restoration efforts are focused on reestablishing high-diversity tropical forests through different methods and incorporating possibilities of exploiting

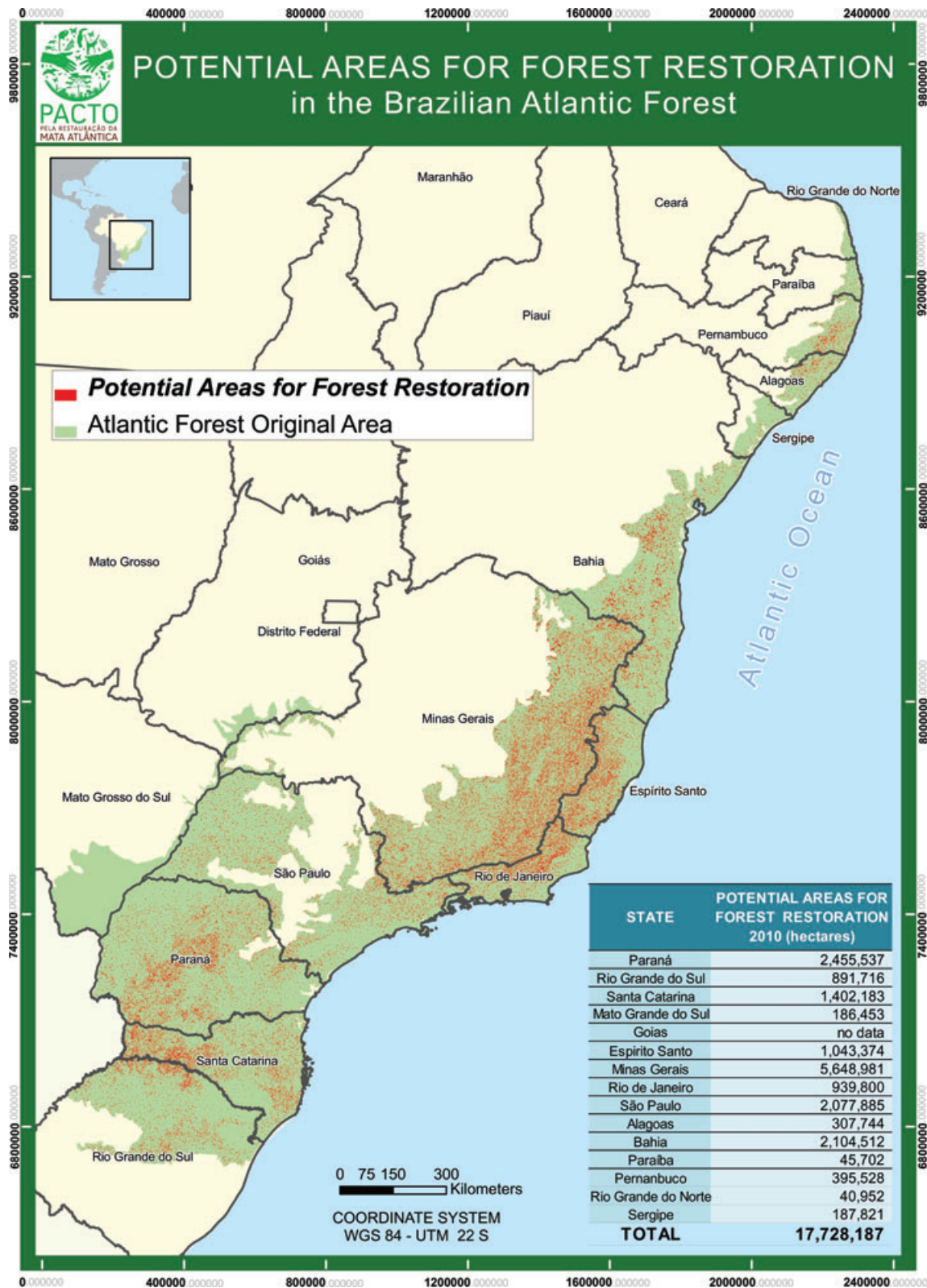


Figure 1. Portions of private lands that are protected by the Brazilian Forest Act or represent marginal areas for agriculture (>15° of slope incline) that have been identified (red dots) by the AFRP as suitable for forest restoration efforts without competing with profitable agriculture and cattle ranching.

native timber and nontimber products in areas that are undergoing restoration, especially in economically marginal agricultural areas (Rodrigues et al. 2010, in press). Thus, the vision is in fact one of the restoring natural capital, at landscape, watershed, and biome-scales, as discussed by Aronson et al. (2007).

The current members of the AFRP include 96 NGOs, 34 government institutions, 25 private companies, and 7 research institutions. The program intends to mobilize and invest up to US\$77 billion over the next four decades to reach at least 30% of the preexisting, that is, pre-European conquest, forest cover, and ameliorate the well-being and livelihoods of millions of people and businesses. Through the restoration of 15 million hectares of degraded lands, the Pact has the potential to generate more than 3 million direct and indirect local jobs through seed collection and processing, seedling production, planting, and maintenance, not to mention ongoing monitoring and evaluation, and basic and applied research. Moreover, it is expected that the 15 million hectares of restored forests will remove approximately 200 million tons of CO<sub>2</sub> per year and store more than 2 billion tons of CO<sub>2</sub> by 2050. Given that recent research has shown that standing tropical forests represent 34% of global CO<sub>2</sub> sequestration (Beer et al. 2010) and that ecological restoration of such forest helps store more CO<sub>2</sub> than monoculture or mixed-species tree plantations (Kanowski & Catterall 2010), the AFRP may significantly contribute to help Brazil reach its voluntary commitment to reduce carbon emissions projected to 2020, if no effort was accomplished, by 36.1–38.9%, as established by the National Climate Change Policy on December 2009.

The AFRP is governed by a Coordinating Board composed of 20 members representing the four categories of stakeholders (private companies, research institutions, governments, and NGOs) and is governed by an Executive Secretariat. To support and address the needs and objectives of the Pact and its members, five working groups composed of representatives of the organizations were created. These are (1) Technical and Scientific; (2) Information and Knowledge; (3) Communication and Marketing; (4) Public Policy; and (5) Fundraising.

During the development and construction of the AFRP, some key documents were produced as the basis for implementing large-scale restoration actions in the Atlantic Forest biome. These include: a book on Reference Concepts and Actions of Forest Restoration produced in Portuguese, and now in translation to English. This book describes the techniques and underlying concepts and motivations for ongoing work in restoring high-diversity tropical forests in the Atlantic Forest of Brazil, building on 30 years of scientific research (Rodrigues et al. 2009b). We have also produced a Map of Potential Areas for Restoration in the Atlantic Forest, an effort that identified more than 17 million hectares of potential areas for restoration in the Atlantic Forest (Fig. 1).

All AFRP restoration initiatives are registered and available at the AFRP's Web site (<http://www.pactomataatlantica.org.br/index.aspx?lang=en>). This online database includes key information such as project coordinates, total area being restored,

restoration methodologies and techniques applied, partners and investors, total cost, monitoring standards, number of jobs created, and so on. This information will be used to promote dissemination and exchange of experiences, develop capacity-building programs to improve and leverage existing efforts, attract investors and supporters to enhance the quality and scale of the restoration efforts, and—last but not least—promote ongoing research, project development, and growth.

However, as mentioned above, this huge mobilization effort of the AFRP to restore 30% of the Brazilian Atlantic Forest, at very modest per hectare cost, may be hampered or blocked altogether, because part of our strategic plan is based on the voluntary compliance of landowners with the Brazilian Forest Act. If this legal instrument is radically revised, lowering the levels of required compliance, the power of the AFRP to restore forest ecosystems in the biome will be reduced and the remaining fragments and plant and animal components of the Atlantic Forest—many of which are endemics—will be even more highly at risk than at present. As mentioned, the proposed changes in the Forest Act are expected to reduce areas along both sides of the streams and rivers, in which the maintenance and protection of native vegetation are mandatory. On the basis of the analysis of detailed vegetation maps (SOS Mata Atlântica/Instituto Nacional de Pesquisas Espaciais 2008) and high-resolution hydrographic maps from 11 Brazilian states in the Atlantic Forest biome (Pacto pela Restauração da Mata Atlântica 2009), these changes could reduce the total amount of potential areas for restoration in the Atlantic Forest by approximately 6 million hectares. This estimation is based on the identification of the current deficit of native vegetation in permanent preservation areas along rivers and streams and the projected deficit of native vegetation if permanent preservation areas along each side of water course are reduced from 30 to 15 m, as proposed.

Nearly 60% of the Brazilian population—that is, over 120 million people—live in the Atlantic Forest biome and depend on it in large part for much of their drinking water. This in turn means that the reduction of the protection of critical areas for water production and purification, such as the riparian forests, especially within the predominantly agricultural landscapes of this biome, may have extremely serious consequences for the provision of water and energy for the rapidly growing Brazilian population and its equally rapidly developing economy. Moreover, the capacity of the Atlantic Forest to provide critical ecosystem services to millions of people, to generate jobs for local people and communities, and to enhance sustainable agricultural production will be impaired by the proposed changes to the Forest Act. On the basis of information from previous restoration projects carried out in the Atlantic Forest, the AFRP estimates that for every 1,000 ha of areas being restored, 200 direct and indirect jobs are created through seed collection, seedling production, planting, and maintenance. Thus, if the proposed reduction of the permanent protected areas is approved, we may lose the opportunity to create more than 1 million new local jobs during the next 40 years.

## Lessons and the Way Forward

Over the recent years, the Brazilian Forest Act has been fundamental in reducing deforestation, engaging private land owners in forest restoration initiatives, and positioning Brazil as a pioneer among nations seeking to reconcile economic production and growth, on the one hand, and biodiversity and natural ecosystem conservation, on the other. In addition to maintaining or improving—rather than disabling—this very important and innovative legal instrument, large-scale initiatives such as the AFRP are needed to reconcile biodiversity conservation and economic development objectives and for the nation to successfully comply with international agreements on climate change mitigation and biodiversity protection. Moreover, the proposed changes may block or hamper the creation of thousands of local jobs, as well as the much-needed increase in income of traditional forest communities. It will also reduce proactive efforts to provide more drinking water to millions of people and businesses and also to significantly increase the vulnerability of millions of people to extreme and increasingly unpredictable weather events and trends. There is no doubt that Brazil was ahead of its time when the original Forest Act was drafted, more than 70 years ago. Now is the right time to strengthen the Brazilian Forest Act through joint efforts and innovative solutions and incentives that help farmers and landowners comply with the Forest Act without negatively impacting their business or ownership interests.

### Implications for Practice

- Environmental legislation defining priority areas for biodiversity conservation and ecosystem services generation is essential to stimulate restoration efforts in private lands.
- Ecological restoration is a key element for the persistence of biodiversity and improvement of ecosystem goods and services in human-dominated landscapes such as those of the Brazilian Atlantic Forest biome, which makes it a priority strategy in terms of environmental, social, and economic development policies.
- The proposed changes in the Brazilian Forest Act may result in a deep environment set-back in all biomes of the country, including major reduction of potential areas for forest restoration in the Brazilian Atlantic Forest.
- Large-scale programs of ecological restoration, such as the Atlantic Forest Restoration Pact in Brazil, are promising strategies for mitigating and adapting to climate change, generating millions of jobs and income to local rural communities, producing key ecosystem services for the well-being of people and businesses, and mainstreaming and up-scaling restoration efforts in megadiversity countries of the world, and elsewhere.

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