Brazilian National Plan for Native Vegetation Recovery

Brasília, 2017

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PLANAVEG

Brazilian National Plan for Native Vegetation Recovery

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Photo 2. André Nave – Bioflora Nursery, Piracicaba-SP

1 Background

The Ministries of Environment, of the Chief of Staff of the Presidency of the Republic, of Agriculture, Livestock and Food Supply, and of Education, under the use of their attributions and in view of the contents of the single paragraph, of Article 5 of Decree no. 8.972, of January 23, 2017, establish the National Plan for Native Vegetation Recovery - PLANAVEG.

Planaveg seeks to expand and stengthen public policies, financial incentives, markets, restoration technologies, best land management practices and other measures necessary for the recovery of native vegetation, principally in areas of permanent preservation (APPs) and legal reserves (RLs), but also in degraded areas with low agricultural productivity.

The preparation and implementation of a plan of this magnitude is an enormous challenge. As a result, a fundamental starting point was to become familiar with successful actions and experiences existing in Brazil and worldwide. To support this process, the Ministry of Environment (MMA), in the second half of 2013, signed a memorandum of understanding with the

World Resources Institute (WRI), to develop a strategy for large-scale restoration of native vegetation in Brazil. In this context, workshops were organized in Sao Paulo (SP), Rio de Janeiro (RJ) and Brasilia (DF) between September 24-30, 2013, to promote discussions and information sharing concerning the best practices for recovering degraded or altered areas in Brazil, involving representatives of NGOs, the private sector, governmental agencies and research and extension institutions that operate in this field. Over 45 organizations represented by a total of 70 people participated in these workshops, discussing the opportunities and challenges of preparing a national strategy for recovering native vegetation. With the objective of contributing to this theme, the World Resources Institute (WRI) and the International Union for the Conservation of Nature (IUCN), members of the Global Partnership on Forest and Landscape Restoration (GPFLR), shared historic examples and best international practices.

The purpose of these debates and examples was to identify existing barriers for the recovery of native vegetation as well as to identify factors that permit successful restoration in Brazil and in other places worldwide. The suggestions and recommendations generated during these workshops, as well as subsidies extracted in meetings, discussions and studies, provided a foundation for a preliminary draft of Planaveg,

prepared and consolidated by MMA and partners and presented in more than 20 national and international events related to this theme. In addition, the preliminary draft of Planaveg was subjected to a process of public consultation, carried out by divulging the document on MMA's website, with contributions submitted by e-mail between December 23, 2014, and August 9, 2015. Diverse suggestions and contributions were received, mainly from ordinary citizens, but also from representatives of governmental agencies and civil society organizations.

These suggestions and contributions were analyzed and most were incorporated in the current plan.

Planaveg cannot be considered in isolation of other existing public policies. It is, indeed, a necessary complement to implement different sectorial and trans-sectorial policies, such as , combating hunger and human misery, climate change, sustainable agriculture, water resources, energy, to mention only the most relevant. In fact, restoring native vegetation generates a sustainable cycle of restoring biodiversity, restoring soil, increasing agricultural productivity, generating and maintaining water resources, reducing and absorbing carbon emissions, social inclusion with generation of income and employment - which are complementary and necessary for an economy that is inclusive, robust and sustainable based on a healthy use of natural resources. For a long time, actions aimed at restoring native vegetation were not prioritized, but today these actions are increasingly recognized as urgent and necessary, to increase agricultural productivity and also to confront crises of diminishing water supply in many parts of the country, as well as to maintain springs and rivers that drive Brazil's immense hydroelectric production. As a result, it is hoped that the implementation of Planaveg will generate a series of economic, social and environmental benefits for rural landowners, the urban population, the NGO sector and the public and private sectors, with benefits for all society.

Photo 3. André Nave – Viveiro Bioflora, Piracicaba-SP

2 Executive Summary

After the revision of the Forest Code (Law no. 4,771 of September 15, 1965), the Brazilian government approved the Law for Native Vegetation Protection (Law no. 12,651 of May 25, 2012). This law reaffirmed the need for landowners to conserve, recover or compensate alterations in native vegetation within permanent preservation areas (APPs) and legal reserves (RLs), to a varying degree according to the size and geographic location of the property. Although the numbers vary, recent studies estimate the Brazil has approximately 21 million hectares in deficit of native vegetation located in APPs and LRs (Soares-Filho et al., 2014).

Under this new scenario, landowners who are in violation of Law no. 12,651/2012 will require support to meet the Law's environmental requirements. It is anticipated that the landowners' needs will vary considerably and that it will be necessary to provide support to hasten and enable them to fulfil the law. For example, some landowners should be informed about the requirements regarding recovery of native vegetation, the benefits of such recovery both in environmental terms and for society in general, as well as the possible ways to implement recovery. Other landowners will require access to seeds and seedlings that are both low in cost and high in quality.

In some cases, financing will be required for planting of seedlings, construction of fencing, and technical assistance to develop and implement recovery projects. Finally, some landowners will seek access to markets for selling products and services generated through recovery or by areas already restored.

The National Plan for Native Vegetation Recovery (PLANAVEG) was prepared to meet these demands, as well as to expand and strengthen public policies, public and private markets, best agricultural practices, and other measures that will permit the recovery of native vegetation over a minimum of 12 million hectares by 2030. The measures foreseen in the Plan will serve as a basis for achieving recovery at a larger scale, with the possibility of obtaining areas greater than those required under Law 12,651/2012.

It is important to emphasize that, despite the focus of PLANAVEG on environmental debt within APPs and LRs that require recovery, environmental compliance in various regions is not limited to recovery of these areas, since there may be remnants of native vegetation that are illegally suppressed under other sections of Law no. 12,651/2012, for example, in the case of suppression of vegetation in wetland areas that took place after the publication this law and without authorization by the of corresponding state environmental agency, or of suppression of vegetation on slopes between 25° and 45° that had not been considered of public or social interest, according to Articles 10-11, respectively. Furthermore, there may be fragments of native vegetation that have been suppressed illegally, for example under Law no. 11,428/ 2006 ("Law of the Atlantic Forest"), in which environmental compliance is not limited solely to the recovery of APPs and LRs.

PLANAVEG is based on eight strategic initiatives designed to motivate, enable and implement the recovery of native vegetation, as summarized below.

- **1. Awareness:** launch a communication movement with focus on farmers, agribusiness, urban citizens, opinion makers and decision makers, for the purpose of raising awareness about what is recovery of native vegetation, what benefits it produces and how to become involved in and support this process.
- 2. Seeds & seedlings: promote the productive chain of restoring native vegetation by increasing the capacity of nurseries and other structures for production of native species, and enabling policies to improve the quantity, quality and accessibility of seeds and seedlings of native species.
- **3. Markets:** develop markets from which landowners can generate income by selling timber, non-timber forest products, protection of springs and areas for recharging aquifers, among other services and products produced by restoring native vegetation.

- 4. **Institutions:** define the roles and responsibilities among governmental agencies, companies and civil society, and align and integrate existing and new public policies in favor of restoring native vegetation.
- **5. Financial mechanisms:** develop innovative financial mechanisms to incentivize the recovery of native vegetation, including preferential bank loans, donations, environmental compensations, fiscal exemptions and forest titles.
- **6. Rural extension:** expand the services of rural extension (public and private), with the objective of contributing to the capacity building of landowners, with emphasis on low-cost recovery methods.
- **7. Spatial planning & monitoring:** implement a national system of spatial planning and monitoring to support the process of decision making for the recovery of native vegetation.
- 8. Research & development: increase the scale and focus of investment in research, development and innovation to reduce the cost, improve the quality and increase the efficiency of recovering native vegetation, considering environmental, social and economic factors.

Three important existing programs and policies complement these eight strategic initiatives and encourage conditions to motivate, enable and implement the recovery of native vegetation. These existing efforts do not exclude new governmental decisions, but they do require continuing support and implementation so as to grow stronger in the coming years.

- Sustainable agriculture intensification: increase the productivity of pastures and croplands outside of areas targeted for recovery, through programs aimed at sustainable intensification of agriculture.
- Law for native vegetation protection: implement the guidelines and instruments of Law no.

12,651/2012, including the Rural Environmental Registry (CAR) and Environmental Compliance Programs (PRAs).

• Land regularization: increase the number of rural landowners with titles and rights to restored forest resources.

The coordination of the implementation, monitoring and evaluation of Planaveg will be carried out by the National Commission for Native Vegetation Recovery - CONAVEG, established by Decree no. 8,972/2017 with representatives of government and civil society, which will revise the Plan every 4 years with a view to:

- Adjust the strategies and actions based on accomplished results, obstacles encountered, lessons learned and advances in knowledge and experience.
- Increase the Plan's efficacy through constant refinements.
- Adapt to public and private demands and opportunities that can evolve over time.
- Monitor updates associated with the implementation of the Rural Environmental Registry at a national level.

Brazil should develop and implement a series of National Plans for Native Vegetation Recovery during this century, since the success of restoring native vegetation is a long-term process that requires political, economic and social commitments throughout its implementation.

Financing for PLANAVEG can come from a number of sources, including governmental budgets, national and multilateral financial institutions, funds (such as, for example, the Global Environment Facility -GEF), bilateral governmental agreements, donations, the private sector and foundations.

It is anticipated that the implementation of PLANAVEG generates a number of economic,

social and environmental benefits for rural landowners, urban populations, NGOs and the public and private sectors, such as:

- Reduced costs for rural properties to comply with the requirements of Law no. 12,651/2012.
- Increased access of rural landowners to markets for ecosystem services and products originating from restored areas.
- Estimated generation of between 112,000 and 191.000 direct rural jobs (for example, seed collecting, running of nurseries, planting), thereby contributing to increased employment and reduction of poverty.
- Diversification of income for rural landowners through creation of new income sources, such as from timber and non-timber forest products, and from payments for environmental services (for example, water, carbon).

- Reduced risks associated with natural disasters and extreme climatic events, such as landslides and floods.
- Increased supply of drinking water for urban centers.
- Enhanced biodiversity conservation in Brazil.
- Climate change mitigation and adaptation through the absorption and capture of carbon dioxide and the reduction of emissions, due to the adoption of improved farming and forestry practices.

In short, PLANAVEG provides a positive agenda that will support landowners in a way that benefits Brazilian society as a whole. It also offers new business opportunities and reinforces the role of Brazil as a global leader among tropical nations in the conservation and recovery of ecosystems.

Photo 4. Rafael de Paiva Salomão – Carajás National Forest, Canaã dos Carajás-PA

3 Introduction

Brazil is one of the countries with the highest vegetational cover in the world: 62% of the national territory or approximately 530 million hectares (Mha) covered by native vegetation (SAE, 2013). Of this total, 40% lies in public protected areas or indigenous lands, of which 91% occurs in the Amazon region, and the remaining 60% is located in private lands or undesignated public lands (SAE, 2013).

Such an immense natural patrimony implies great opportunities for development of economic sectors such as agriculture, mining, biotechnology, ecological tourism and others. It also presents opportunities for research and development of food products, pharmaceuticals and herbal medicines. Yet it also presents the challenge of large-scale conservation efforts to protect this vast area of native vegetation, which is found in fragments of various sizes.

Given the importance of conservation and sustainable use of this immense natural patrimony, Brazil made commitments as part of international agreements, such as the Convention of Biological Diversity (CBD), the Wetlands Convention (RAMSAR) and the United Nations' Framework Convention on Climate Change (UNFCCC). All of these commitments require not only the preservation and conservation of existing natural areas, but also the recovery of degraded ecosystems.

During the 10th Conference of Parties of the CDB (COP-10), which took place in 2010 in the city of Nagoya, Japan, a group of 20 global targets were established related to the reduction of biodiversity loss, known as the Aichi Biodiversity Targets. The CDB parties agreed to collaborate in implementing the 20 targets by 2020. Among these, targets 14 and 15 seek to increase the benefits of biodiversity and ecosystem services through recovery of degraded ecosystems.

Brazil played a decisive role in defining and approving the Aichi Targetss and, now, plans to play a decisive role in their implementation. In 2013, in response to the CDB, the Brazilian Government established National Biodiversity Targets for 2020. CONABIO Resolution no. 6, made on September 6, 2013, defined the national targets and proposed principles for achieving them. The targets related to recovery of Brazilian ecosystems are:

National Target 14: By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and wellbeing, will be restored and preserved, considering the needs of women, traditional peoples and communities, indigenous peoples and local communities, and poor and vulnerable populations.

National Target 15: By 2020, ecosystems resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and recovery, including recovery of at least 15% of degraded ecosystems, prioritizing the most devastated biogeographic regions, hydrographic basins and ecoregions, thereby contributing to the climate change mitigation and adaptation to and to combating desertification.

During the 21st United Nations' Framework Convention on Climate Change (UNFCCC), which took place in 2015 in Paris, Brazil also made a voluntary commitment by 2025 to reduce its greenhouse gas emissions by 37% below the 2005 levels, with a long-term vision of preventing the increase of global temperatures below 2°C in relation to pre-industrial levels. Among the measures defined by Brazil's Nationally Determined Contribution (NDC) is the recovery and reforestation of 12 million hectares of forest for multiple uses by 2030.

In addition, in 2011 the Bonn Challenge was established, an instrument that supports various national and international commitments and that aims to restore 150 million hectares of deforested and degraded lands worldwide by 2020 and an additional 200 million hectares by 2030. The Bonn Challenge is coordinated by the German Government and the International Union for the Conservation of Nature (IUCN), with co-organization by the World

Resources Institute (WRI) and the Government of Norway. This initiative is supported by the Global Partnership on Forest and Landscape Restoration (GPFLR), the Executive Secretary of which is coordinated by IUCN.

The Brazilian government announced its voluntary contribution to the Bonn Challenge and the 20x20 Initiative¹ in December 2016 during the 13th Conference of Parties (COP) of the Convention on Biological Diversity (CBD), which took place in Cancun, Mexico. The Brazilian commitment is to restore, reforest and induce the natural regeneration of 12 million hectares of forests for multiple uses by 2030. In addition, 5 million hectares of integrated farming systems – combining croplands, pastures and forests – by 2030, and 5 million hectares of degraded pastures will be restored by 2020.

To implement these commitments, the Brazilian Government recognizes the need for urgent and permanent actions to change the current scenario of environmental degradation. Adequate land use, best land management practices and increased productivity are fundamental to assure the preservation and conservation of natural resources and sustainable development.

In recent years, Brazilian agriculture has tended systematically to increase production, primarily through constant gains in productivity. Despite reduced environmental impacts of some agricultural practices, the historic occupation of Brazilian territory has resulted, in some cases, in: areas of low productivity, increased environmental pressures, soil erosion, loss of biodiversity, environmental contamination and social imbalances. As a result, the wasting of natural resources due to inadequate land uses is a reality that must be addressed, leading to a reassessment of land settlement to avoid past errors and promote gradual readjustments in rural activities, in both environmental and agricultural terms. Law no. 12,651, of May 25, 2012, which deals with protection of native vegetation, addresses in several articles actions to be organized by the public sector and civil society for promoting the restoration of degraded or altered areas, with emphasis on Areas of Permanent Protection (APPs) and Legal Reserves (RLs), as instruments for environmental compliance of rural properties.

APPs are protected areas with specific environmental functions, where the native vegetation should be maintained or restored in case of suppression. APPs include: margins of watercourses, in proportion to their width; areas surrounding lakes, reservoirs and springs;

Law no. 12,651/2012 also requires rural landowners to maintain, as Legal Reserve, the native vegetation within a certain percentage of the property. This percentage varies according to the location of the property, ranging from 80% of properties located in forested areas of the Legal Amazon, to 35% of properties located in the Cerrado areas of the Legal Amazon, to 20% of properties located in the other regions of the country.

For purposes of environmental enforcement, monitoring and planning, various measures were carried out to implement the Rural Environmental Registry (CAR) at a national level. CAR is a national electronic registry required for all rural properties, established for registering and integrating environmental data on rural properties. Another important measure envisioned in the law is the establishment of Environmental Compliance Programs (PRAs) for rural properties, to be provided by the states and the Federal District.

In addition to such command and control instruments, which are traditionally used to discourage unsustainable use of forest resources and ecosystems, this law introduces new instruments to support and encourage the restoration of degraded or altered areas in Brazil. These instruments represent a positive agenda, permitting the reconciliation of agricultural production, social protection and conservation of ecosystems.

¹ The 20x20 Initiative is a platform that seeks the restoration of 20 million hectares of productive areas in Latin America and the Caribbean. The proposal aims to restore and conserve productive soils, integrate agricultural systems, and mobilize investors to finance the Initiative's activities. The Initiative was launched by eight countries and five investment groups during the 20th COP in Lima, in December 2014. The Initiative aims to support the global restoration efforts of the Bonn Challenge.

This law authorizes the establishment of a program to provide support and incentives for environmental conservation that should include various actions, including: payments for environmental services (PES); concession of special agricultural credits and tax exemptions for producers who preserve or restore native vegetation; and lines of financing for people who embark on voluntary initiatives to restore degraded or altered areas. In addition, an Environmental Reserve Quota (CRA) was established, a nominative title referring to an area with native vegetation, which can be sold in financial markets as a form of compensation for Legal Reserves.

For small-scale producers the law provides incentives such as: fewer requirements for restoring APPs and RLs; simplified procedures for enrolling in the CAR and qualification for PRAs; as well as technical support and financial incentives for family farms. The Law no. 12,651/2012 also defines the existence of consolidated rural areas, which were occupied prior to July 22, 2008. In such areas, activities related to agriculture, forestry, ecotourism and rural tourism are allowed to continue, and special provisions are defined for the restoration of APPs and RLs.

Today in Brazil, at least 21 million hectares (Mha) of APPs and RLs are required to be restored under current legislation (SAE, 2013; Soares-Filho et al 2014).² This environmental liability is concentrated on the edges of the Amazon region, almost the entire Atlantic Forest and the southern Cerrado, where agricultural occupation is greatest (SAE, 2013; Figure 1). According to Soares-Filho et al. (2014), the biogeographical regions with the most extensive environmental debt are: Amazonia (7.2 Mha), Atlantic forest (4.8 Mha) and Cerrado (3.7 Mha). Just the liability of APPs encompasses a total area of 4.5 Mha, distributed primarily in the Cerrado (\approx 1.6 Mha), Atlantic Forest (\approx 1.4 Mha) and Amazonia (\approx 900,000 ha) (Figure 2). In terms of carbon sequestration, the restoration of this environmental liability has the potential to sequester 1 billion tons of carbon over 20 years, which corresponds to the period for restoring RLs established by Law no. 12.651/2012 (SAE, 2013).

Another source of information that illustrates the size of this liability are the preliminary data from the Rural Environmental Registry (CAR). According to the monthly bulletin of May 2016, which analyzed the results of CAR over the previous two years,³ with 77.61% of the total area potentially registrable in the country, there was a total liability of 22.27 hectares (approximately 16.81 million million hectares in RLs and 5.46 million hectares in APPs). It should be noted that these data are still tentative because they need to be validated by the states. Only after CAR is completely implemented and validated will we have a more detailed panorama.

According to SAE (2013), agriculture takes place over approximately 300 Mha in Brazil. Of this total, 68 Mha are used for farming and the rest for pastures in various degrees of occupation and productivity or degradation. According to Soares-Filho et al. (2014), of the liability of 4.5 ± 1 Mha in APPs, approximately 0.6 ± 0.35 Mha are used for croplands, equivalent to less than 1% of the total area dedicated to agriculture.

The available scientific data and projections indicate the Brazil can reduce its environmental debt without undermining its production and supply of food, fibers and energy, thereby maintaining its decadeslong trend of continual increase in productivity (Brancalion et al., 2012; Sparovek et al., 2012).

Strassburg et al. (2014a) found that the current productivity of Brazilian pastures is about one third its potential and that increasing productivity by half this potential would be sufficient to meet the demand for meat, grains, timber and biofuels until 2040 without further conversion of natural ecosystems.

² Approximate value to that already identified in the Rural Environmental Registry (CAR), according to the May 2016 bulletin.

³ Available at: http://www.florestal.gov.br/cadastro-ambiental-rural/ numeros-do-cadastro-ambiental-rural. Accessed on 22 June 2016.



Figure 1. Values in percent corresponding to areas of vegetational cover based on compliance with the Law for Native Vegetation Protection or Forest Code (Law no. 12,651/2012) using data from the National Water Agency (ANA) on micro basins up to the 12th order. Positive values indicate forest surpluses or land that may be legally deforested. Negative values indicate forest debts or land that requires restoration. Abbreviations refer to states: AC - Acre, AM - Amazonas, AP - Amapa, BA - Bahia, CE - Ceara, GO - Goias, MA - Maranhao, MG - Minas Gerais, MS - Mato Grosso do Sul, MT - Mato Grosso, PA - Para, PI - Piaui, PR - Parana, RO - Rondonia, RR - Roraima, RS - Rio Grande do Sul, SP - Sao Paulo, SC - Santa Catarina, TO - Tocantins, RN - Rio Grande do Norte, PB - Paraiba, PE - Pernambuco, AL - Alagoas, SE - Sergipe, ES - Espirito Santo, RJ- Rio de Janeiro. (Source: SAE, 2013).

As a result, the paradigm that the restoration of APPs and RLs is an impediment to the development of agriculture in Brazil needs to be broken, primarily among rural producers, since there is sufficient room for both agriculture and restoration, and agriculture only stands to benefit from the provision of various ecosystem services assured by the large-scale conservation and restoration of native vegetation (SAE, 2013). Instead of being viewed as a drain on food production, restoration of native vegetation can be seen as a way to increase food production and quality of life, as well as providing additional

economic returns to landowners (Brancalion et al., 2012).

In addition to the need to restore vegetation, it is crucial to avoid deforestation and degradation in areas containing environmental surpluses, or in other words in areas covered with native vegetation that can be transformed in the future due to legal deforestation. This is especially important in the Cerrado and Caatinga biogeographic regions, which contain most of the 99 ± 6 Mha of environmental surpluses in the country:



Figure 2. Synthesis of numbers quantifying forest surpluses or debts of Legal Reserves (RLs), and debts of Areas of Permanent Protection (APP) by biogeographic regions (Source: SAE, 2013).

40±2 Mha in the Cerrado and 26±1.5 Mha in the Caatinga (Figure 2). On the other hand, the 20±1 Mha of environmental surpluses occurring in the Amazon region should be viewed with caution, since a large part of this asset is located in undesignated areas, especially in the state of Amazonas and, as a result, capable of becoming public lands. Finally, the 4±0,3 Mha of environmental surpluses in the Atlantic Forest represent just 3% of this biome's original extent, which indicates the dimension of restoration required here (SAE, 2013).

The theoretical and practical concepts related to ecological restoration have advanced considerably in recent years and today there are many different approaches and techniques available (Rodrigues et al., 2010). Nevertheless, there is still a need for additional research, especially related to the development of a strong theoretical foundation for ecological restoration, cost savings and monitoring. In Brazil, the diversity of phytophysiognomies that occur in the major biogeographic domains requires different restoration strategies that demand detailed diagnoses to reveal the history of disturbance and soil degradation, the degree of resilience and the context within the surrounding landscape in order to plan and optimize landscape restoration (Rodrigues et al., 2009).

The strategic actions presented in this plan aim to support the implementation of Law no. 12,651/2012, in particular the restoration of APPs and RLs, so as to eliminate environmental debt on rural properties and recover the productive capacity of degraded or altered areas with low suitability for agriculture. The implementation of PLANAVEG is critical for Brazil to develop a sustainability culture that can complement its prominence as a global agricultural producer, assuring access to markets, conservation of natural resources and diversification of income for rural producers through payments for environmental services. This plan also promotes the large-scale conservation and restoration of ecosystems, conserving biodiversity and environmental benefits and services.



4 Vision and Objective

4.1 Vision

The restoration of at least 12 million hectares of native vegetation in Areas of Permanent Preservation (APPs), Legal Reserves (RLs) and other lands that are degraded and with low productivity in Brazil will generate a wide range of benefits for society, including:

Compliance with the Law for Native Vegetation Protection (Law no. 12,651/2012). The restoration of native vegetation will contribute toward compliance with the law by rural producers who, by managing their properties in a more integrated way and conserving natural resources more effectively, will obtain greater access to rural credit and economic incentives, and increase their linkages with both national and international markets that increasingly demand products that fulfil sustainable criteria.

- Reduction of poverty. The restoration of native vegetation will increase and diversity the income of small- and medium-scale producers through the commercialization of timber and non-timber products and payments for environmental services.
- Job creation. Restoring native vegetation will require labor and qualified professionals to collect seeds and produce seedlings, plant and maintain restored areas, as well as sustainable management of the products originating from areas undergoing restoration.
- *Economic development.* The restoration of native vegetation will contribute to economic development by supplying sustainable natural products (e.g., timber and non-timber products) and increasing the production of environmental services (e.g., water, carbon, biodiversity).
- *Disaster prevention*. In addition, restoration will minimize the economic and social losses caused by natural disasters and extreme events such as flooding and landslides.

- *Water security.* The restoration of native vegetation around springs and other areas critical for hydrological resources will increase the supply and quality of water for consumption both by the public and companies, as well as for generation of hydroelectric energy and other multi-uses of water.
- *Climate and biodiversity.* The restoration of native vegetation will contribute to the conservation of Brazilian biodiversity and to the reduction of atmospheric concentrations of greenhouse gases. As a result, it will contribute to fulfilling national targets, to maintaining climatic equilibrium, to adaptation to climate change and to conservation of Brazil's biogeographical regions.
- *Global leadership.* The sheer scale of this National Plan and the tangible benefits that it will generate for millions of people will strengthen Brazil's global leadership in the field of sustainable development.

4.2 Objective

The objective of the National Plan for Restoring Native Vegetation is to expand and strengthen public policies, financial incentives, markets, good agricultural practices and carry out other measures required to restore native vegetation over at least 12 million hectares (Mha) by 2030. This restoration will take place primarily in APPs and RLs, but also in degraded areas with low productivity. Restoration of native vegetation such that the target during the first five years of implementation will be 534 thousand ha.⁴

⁴ Greater effort is anticipated to launch the process of large-scale restoration, which, after the initial structuring through the actions proposed by PLANAVEG, will gain momentum and attain progressive growth by 2030.

Millions of hectares



Note: "RL" = Legal Reserve "APP" = Areas of Permanent Protection. "UC" = Conservation Unit. Source: Soares-Filho et al. (2013); MMA.

Figure 3. Estimate for the minimum target of restoring native vegetation.

Seeking to fulfil this objective, the Plan contains a group of strategic initiatives aimed at motivating, facilitating and implementing the restoration of native vegetation. The plan encourages and promotes the coordination, cooperation and engagement of various sectors, including landowners, communities, governments, non-governmental organizations, companies, research institutes and academia.

Estimate of the minimum target and the evolving implementation of PLANAVEG

The target of "at least 12 million hectares" is based on an analysis of the deficit of native vegetation in relation to that required to comply with Law no. 12,651/2012 (Soares-Filho et al. 2014), as well as the estimated additional areas that can be restored for other reasons (Figure 3).

Soares-Filho et al. (2014) indicate that there is a current deficit of approximately 21 million hectares in all of Brazil's biogeographic regions.

Of this total, about 16.4 million hectares are in Legal Reserves (RLs) and the rest are in Areas of Permanent Protection (APPs). They also estimate that the maximum amount of RLs that could be "compensated" by Quotas of Environmental Reserves (CRAs) is approximately 9.2 million hectares (56% of the total deficit of RLs).

In addition, the Ministry of Environment (MMA) and the Chico Mendes Institute for Biodiversity Conservation (ICMBio) estimate that around 5 million hectares in Conservation Units (UCs) need to be restored. Thirty percent of this area has overlapping property claims. The purchase of these 1.5 million hectares could be financed by landowners with deficits in RLs, thereby compensating their debts. Accordingly, the minimum area of land that needs to be restored to eliminate the deficit is approximately 10.3 million hectares. This is the lower limit, since some landowners with potential to generate and sell CRAs may opt to not make use of this mechanism.



Figure 4. Temporal trajectory of the target of restoring native vegetation proposed by PLANAVEG.



Figure 5. Target for restoring native vegetation proposed by PLANAVEG by biogeographic region.

The same logic used to define the national target for recovery of at 12 million hectares was applied to regionalize this figure between the six biogeographic regions in Brazil (Figure 5). The values indicate that most of this area is concentrated in Amazonia and the Atlantic Forest (76%), while the rest is distributed in the Cerrado (17%), the Caatinga (4%) and the Pantanal and Pampa (5%).

It is worth noting that not all restoration of native vegetation will be carried out in compliance of Law no. 12,651/2012. Some restoration will probably be carried out to improve properties (for example, to reduce soil erosion), to diversify income (for example, timber, non-timber products, environmental services), and to promote recreation and leisure, among other reasons. The MMA estimates that these motives could result in the restoration of an additional 2.2 million hectares beyond the target of the National Plan.

In addition, the restoration of native vegetation in Brazil should accelerate once the structural conditions for large-scale restoration are in place. As a result, it is anticipated that the rate of restoration will be represented by a curve of geometric progression, with a take-off point around 50 thousand hectares – the area targeted for restoration in the first year – and the annual rate of cumulative growth around 38.73%. Thus, during the plan's first five years, approximately 534 thousand hectares of native vegetation would be restored (Figure 4).

The commitment made by Brazil at the UNFCCC COP 21, to restore and reforest 21 million hectares of forest for multiple use by 2030, includes not only actions to restore native vegetation but also reforestation for silvicultural purposes. The implementation of PLANAVEG will contribute to achieving this commitment by restoring native vegetation in APPs, RLs and areas of low agricultural potential.

The same logic used to define the national target for recovery at 12 million hectares was applied to regionalize this figure between the six biogeographic regions in Brazil (Figure 5). The values indicate that most of this area is concentrated in Amazonia and the Atlantic Forest (76%), while the rest is distributed in the Cerrado (17%), the Caatinga (4%) and the Pantanal and Pampa (5%).

Photo 6. Carlos Alberto de Mattos Scarathuzza - Bacia do Pipiripau, Brasília-DF

5 Benefits from Native Vegetation Recovery

The restoration of degraded or altered areas generates considerable environmental, economic and social benefits (see synthesis in Table 1). Many benefits initially considered to be strictly environmental - for example, reestablishing nutrient cycling, hydrological resources, climate regulation and pollination - also provide ecosystem services of great importance for the economy and for improving people's quality of life (Millennium Ecosystem Assessment, 2005). In addition, large restoration of native vegetation also has a high potential to contribute to the Brazilian economy by generating employment and income. For example, during the first 20 years restoring degraded vegetation has the potential to employ thousands of people and mobilize tens of billions of reais in investments. In addition, a wide range of companies will provide direct employment in managing and processing both forest and nonforest products.

Furthermore, within the context of family agriculture, the establishment of agroforestry systems as a way of restoring Legal Reserves (Law no. 12,651 /2012, art. 66, § 3°) offers huge potential for contributing to food security, nutrition, income, health, shelter, social cohesion, energy resources

and environmental sustainability. The employment of agroforestry practices and techniques for establishing plantations of trees in conjunction with food crops provides a number of advantages for environmental restoration initiatives:

- Reduction of costs involved in preparing the land and maintaining plantations, since caring for the crops also benefits the trees;
- Use of the residual nutrients applied to the crops by the growing trees;
- Shading of slow-growing tree seedlings in the initial stages of their establishment;
- Income derived from agricultural crops, diminishing dependence on external financing to cover the costs of establishing and maintaining areas under restoration;
- The presence of native or exotic fruit trees in agroforestry systems serves as an attraction for seed dispersing animals originating from surrounding forests, thereby contributing to spontaneous regeneration and increasing the diversity of plants in the areas under restoration.

Area	Benefits	Comments
Economic	Establishment of the productive chain of restoration	 Commercial plantations of native species increase the supply of timber and non-timber products. Inclusion of species with potential uses for food and medicine in the plantations. Payments for Environmental Services (PES). Potential of ecotourism and activities of leisure and recreation.
	Avoided losses	 Restoration of vegetation on slopes reduces the risks of landslides and silting of rivers that can increase the risks of flooding in riparian zones. Restoration of native vegetation can reduce the frequency and intensity of flooding.
	Employment generation	• Large-scale restoration can generate approximately 112-191 thousand direct jobs every year, especially in rural areas, involving seed collecting, production of seedlings, establishment

Table 1. Potential benefits of restoring native vegetation in Brazil.

Area	Benefits	Comments
Social	Reduction of poverty and social inequality	 The restoration of degraded areas should generate and increase and/or diversification of production by small- and medium-scale farmers (e.g., wood, latex, fruits, seeds, etc.). Restoration of native vegetation should induce the professionalization of activities such as seed collecting, production of seedlings, establishment of plantations, among others, consolidating new fields of action and opportunities for professional qualification involving thousands of people, thereby contributing to the securit
	Identity and social inclusion	 Restoration can encourage the reconnection of people with the land, by recovering cultural identity and the perception of value associated with the local environment. The engagement of people in restoration, the cultural recovery of traditional practices and customs, the redirecting of aspirations among local communities, and the construction of new regional
	Food security	The use of agroforestry systems and the restoration of pastures, especially on small-scale properties, can contribute to increased food production and food security.The use of fruiting species (fruits, nuts, etc.) on lands under restoration can contribute to increased food supply in surrounding communities and increased income through the sale of fruits.
Environmental	Soils	 The presence of litter contributes to the protection of soils, increases the quantity of soil organic matter and improves nutrient cycling. Restoration of vegetation, primarily on slopes and on sites adjacent to rivers, reduces soil erosion and loss. Restoration of vegetation contributes to the increase and maintenance of fertility and av.
	Biodiversity	 Expanded vegetational cover contributes to increased biodiversity, both at the local level and at the landscape scale. Restoration reduces habitat fragmentation, increases genetic flux and assures the maintenance of populations of species threated with extinction through increased connectivity of biological corridors. Restoring fragments of vegetation through enrichment planting and natural regeneration increases species diversity.
	Climate change	 Restoration increases the sequestration and stock of carbon and reduces emissions of greenhouse gases. Restoration of native vegetation contributes to increased biodiversity, which, in turn, increases ecosystem resilience and stability in relation to climate change.
	Water	 Restoration of vegetation contributes to increased water supplies, primarily in urban centers. The restoration of slopes and river edges reduces the loss of the soil surface due to erosion, increasing infiltration and the supply of water tables while reducing the silting of water resources.

5.1 Economic Benefits

5.1.1 Creation of a new "green economy" based on the restoration of native vegetation

The implementation of projects to achieve the National Plan's objective can potentially generate millions of direct and indirect jobs. The economic activities associated with restoring native vegetation – which include seed collection, production of seedlings, establishment and maintenance of plantations, and monitoring of projects – provide unique opportunities to generate green jobs, increase income and improve people's quality of life. A publication on the Pact to Restore the Atlantic Forest estimated that for each 1,000 hectares under restoration, 200 direct and indirect jobs are created (Calmon et al., 2011).

According to 2, to achieve the plan's target, 112-191 thousand jobs per year could be generated, depending on the scenario and restoration system used, and this only considers jobs directly involving the implantation and maintenance of restored lands. If one also considers indirect employment and activities involving the processing of products derived from restored sites, it becomes evident that the restoration of degraded or altered areas can generate jobs on the same scale as those associated with important agricultural crops (Strassburg et al., 2014b) The economic potential of restoring vegetation is even greater, as models indicate that it can generate return rates that are greater than certain agricultural activities (e.g., low productivity cattle pastures) or standard investments such as savings accounts (Brancalion et al., 2012; Strassburg et al., 2014b). According to Brancalion et al. (2012), in anthropogenically modified landscapes located in developing countries, the restoration of native vegetation should not only assist in the recovery of degraded or altered ecosystems but also provide economic compensation to landowners. Restoration for economic ends can be implemented, for example, in low productivity pastures, which provide an average economic return of US\$100 per hectare per year. Wood production in restored areas can generate greater returns. Yet such production has an critical limitation: the time required to obtain economic returns. This limitation can be overcome, for example, through three approaches: using mixed plantations (combining slow- and fast-growing species), beginning wood production within about 10 years; developing several income streams (e.g., from non-timber forest products and payments for environmental services) as a strategy to generate more constant returns to the landowner; and obtaining long-term credit at attractive rates.

Table 2. Number of jobs directly generated through adoption of different scenarios, each one predicting specific proportions of the various systems of vegetation restoration. The restoration systems "total planting," "high enrichment and high density" and "low enrichment and low density" include planting of seedlings at a 3x2 m spacing and maintenance of the area. The calculation of jobs was carried out considering the target of recovering 12 million hectares. Values calculated according to the premises of the Pact for the Restoration of the Atlantic Forest.

Systems of Vegetation Restoration						
	Total planting (1,666 seedlings per hectare)	High enrichment and high density (800 seedlings per hectare)	Low enrichment and low density	Natural regeneration (with fencing)	Natural regeneration (abandoned pasture)	
Scenario 1	50%	15%	15%	10%	10%	190,696
Scenario 2	40%	15%	15%	15%	15%	164,554
Scenario 3	30%	15%	15%	20%	20%	138,412
Scenario 4	20%	15%	15%	25%	25%	112,270

On the other hand, it is important to consider the peculiarities of other biogeographic regions, such as, for example, the Pampa, which has been used sustainably over centuries for extensive cattle ranching, in which grazing does not suppress the native savanna vegetation but only partially consumes it. This interaction permits restoration of degraded Legal Reserves (RLs) and Areas of Permanent Preservation (APPs) in which grazing is an important tool. This factor can provide an added incentive for rural producers to embark on restoring the native vegetation.

5.1.2 Avoided costs and risks

At the same time, it is important to note that environmental degradation causes enormous harm to the country. In addition to depriving society of the benefits derived from ecosystem services (see section 5.3), it generates considerable economic losses and poses mortal risks to local populations (Brasil, 2011). For example, we can cite the disaster that occurred in the highlands of Rio de Janeiro state during 2011 due to flooding and landslides. The economic costs of this disaster, just within the municipality of Teresopolis, totaled over R\$45 million, as shown in an economic analysis of the disaster in comparison with sound management of APPs (Table 3). This value is much greater than the costs of implanting sound management of Areas of Permanent Protection, associated with the relocation of settlements, urbanization and restoration of degraded or altered sites, and the risk of deaths is greatly reduced. According to a report by the Ministry of Environment (MMA), 92% of landslides occur in areas that have undergone some form of ecosystem alteration (MMA, 2011). Consequently, without adopting measures of territorial planning along with restoring Areas of Permanent Protection (APPs) and Legal Reserves (RLs), the risks associated with new extreme events will remain.

5.1.3 Environmental services

Environmental services are defined as benefits generated by ecosystem for society that contribute directly and indirectly to human wellbeing (Millennium Ecosystem Assessment, 2005). A large part of environmental services has their actual value incorporated in the economy, because they are used as essential inputs in diverse sectors such as agriculture, sanitation, industries producing beverages and energy generation. Table 4 shows that the value of environmental services generated by tropical forests is far greater than the costs of restoration. As a result, the restoration of native vegetation can contribute to a significant increase in the provision of services, especially in the case of highly disturbed ecosystems.

Table 3. Costs of the 2011 disaster and the costs of sound management of Areas of Permanent Protection (APPs) in two neighborhoods in the municipality of Teresopolis, Rio de Janeiro state (MMA, 2011).

Areas of Permanent Protection (APPs) – River edge	Campo Grande*	(R\$/ thousand)	Bonsucesso*	(R\$/ thousand)
	Lower	Higher	Lower	Higher
Total structural, non-structural and emergency costs	14,840	42,747	4,160	10,635
Externalities (mortality and morbidly)	112,288	382,574	14,523	49,483
Total cost of the disaster	127,129	425,321	18,684	60,173
Costs of relocating and urbanizing settlements; Opportunity cost of agriculture	7,659	21,126	6,033	17,043
Cost of restoration	39	77	148	286
Total cost for sound management of APPs	7,699	21,203	7,180	19,355
Avoided costs = Costs of the disaster – Costs of good management	119,430	404,118	17,966	40,818

* Neighborhoods in the municipality of Teresopolis, Rio de Janeiro state. Social benefits

5.2 Social benefits

5.2.1 Reduction of poverty and inequality

As shown in Table 2, restoring degraded or altered areas holds great potential for generating jobs and income. As estimate 90% of jobs go to rural inhabitants with low income and professional training, especially for collecting seeds of native species, producing seedlings, establishing and maintaining plantations, and monitoring restoration projects. As a result, restoration initiatives can reduce poverty and inequality by generating green jobs and strengthening the rural economy.

5.2.2 Identity and social inclusion

The engagement of rural and traditional communities in initiatives to restore vegetation depends on the identification of individuals with projects ready to be implemented. Considering that ecosystem degradation over the past centuries has been due, in large part, to human activities (Ellis et al., 2010), society's involvement in the restoration of degraded ecosystems has been recognized as fundamental for the success of such initiatives (Wortley et al., 2013). The professionalization of seed collection, seedling production and plantation establishment, among other activities, has led to the creation of new fields of action and opportunities for professional training, for community engagement and for social inclusion involving thousands of people.

5.2.3 Food Security

Reconciling food production with economic, social and environmental sustainability is one of today's greatest challenges. The restoration of native vegetation, associated with the establishment of agroforestry systems that are managed in an integrated fashion, permits the optimization of land use and results in social and environmental benefits such as food production and the maintenance of wild varieties of species and conservation of soils, water resources and native vegetation. In this context, the use of fruit species in plantations established for the restoration of degraded sites can contribute directly to the income diversification and food security of families in rural communities, in addition to attracting wild fauna and in general supporting life on rural properties.

Table 4. Estimated costs and benefits of projects for restoring vegetation in different ecosystems of Teresopolis, Rio de Janeiro (MMA, 2011).

Ecosystem	Restoration cost US\$/ha	Annual benefit derived from restoration (US\$/ha)	Net present value benefits in 40 years (US\$/ha)	Rate of return(%)	Benefits/ Costs
Coral reef	542,500	129,200	1,166,000	7%	2.8
Mangrove	2,880	4,290	86,900	40%	26.4
Lakes/Rivers	4,000	3,800	69, 700	27%	15.5
Swamp/Flooded Forest	33,000	14,200	171,300	12%	5.4
Tropical Forest	3,450	7,000	148,700	50%	37.3
Savanna	990	1,571	32,180	42%	28.4

Costs were based on analysis of case studies; benefits were calculate using the approach of transferring benefit, the time horizon calculated for benefits was 40 years; discount rate=1%; all the estimates were based on analyses that are being developed by TEEB (The Economics of Ecosystems & Biodiversity) ad adopted 40 years as the period for calculating benefits and a 1% discount rate. Source: TEEB (2009) TEEB Climate Issues Update. September 2009.

5.3 Environmental Benefits

5.3.1 Biodiversity conservation

Habitat loss is considered the greatest threat to biodiversity (Secretariat of the Convention on Biological Diversity, 2010). Specifically, in the case of Brazil, this threat is even greater in the Atlantic Forest due to the higher loss of original forest cover and the reduced size of the remaining forest remnants (Ribeiro et al., 2009). In this sense, restoration of the debt in forest cover can be considered one of the greatest contributions to biodiversity conservation, since it permits the reestablishment of ecological processes and the connection of forest fragments through ecological corridors. Several restoration initiatives in Brazil have shown the capacity of such projects to contribute to increased biodiversity, whether through active restoration (plantations of native species Rodrigues et al., 2011) or passive restoration (natural regeneration, Cheung et al., 2010).

5.3.2 Climate change mitigation and adaptation

According to the International Panel on Climate Change (IPCC), half of the planet's carbon in terrestrial ecosystems resides in forests (IPCC, 2007). However, the loss of both forest and non-forest vegetation cover and the substitution of these ecosystems by pastures or cropland has caused high rates of carbon emissions (Asner et al., 2005; Lal, 2008). In this way, the large-scale restoration of native vegetation offers a great opportunity for carbon sequestration in degraded or altered sites with low carbon stocks and reduced emissions. A study carried out by Montagnini et al. (2011) in Brazil showed that 16-year old plantations of native species contain carbon stocks higher than 60 Mg/ha. Another important finding of this study was that plantations with higher numbers of species contain higher carbon stocks compared with monocultures. Consequently, considering the carbon sequestration potential of tree plantation, large-scale restoration initiatives can provide considerable gains in carbon stocks in the different biogeographic regions of Brazil.

5.3.3 Improvement in the quality and quantity of water

The environmental service generated by conserving and restoring natural ecosystems that is currently most studied, recognized and valued undoubtedly is related to water. A study carried out in 105 of the world's most populated cities showed a clear relation between forests and the water quality of basin that supply these cities (Dudley & Stolton, 2003; Stolton & Dudley, 2007). Forest cover plays a critical role in preventing flooding (Bradshaw et al., 2007). As a result, initiatives to restore native vegetation should contribute to increased provision of environmental services related to water and will thereby provide enormous benefits to Brazilian society as a whole, especially during extreme climatic events and water scarcity that have occurred in the country.



6 Success factors in the restoration of native vegetation

6.1 Experiences worldwide

Some examples worldwide suggest that large-scale restoration of degraded or altered areas is possible and viable from economic, social and environmental perspectives. Costa Rica is an example that is wellknown and recognized for its success. Between 1943 and 1987, the country's forest cover was reduced from 77% to just 23% (GOCR, 2011). Nevertheless, through a series of conservation and restoration initiatives, the country's forest cover increased to 52% by 2010 (GOCR, 2011), producing environmental, economic and social benefits. Less known is the case of South Korea, which restored its forests following the Korean War. Between 1953 and 2007, the country's forest cover increased from 35% to 64%, even as the population doubled and the economy grew 300 times (Bae et al, 2012; KFS 2010).

Similar cases took place in other countries and regions. In the eastern United States, for example, about 12 million hectares of forests were restored between 1910 and 1960 (USDA Forest Service, n.d.; Hanson et al., 2010). The increase of forest cover in Puerto Rico jumped from 6% of the island's territory (around 1940) to about 40% in 2000 (Chazdon, 2008; Zimmerman et al., 2007). In southern Niger, farmers restored 5 million hectares with agroforestry systems (Tappan, 2007; WRR, 2008; Tougiani et al., 2009). Likewise, China (Tang et al., 2013; Lu et al., 2012), India (Banco Mundial, 2011)Panama (Dale et al., 2010; Ibáñez 2002), Sweden (Holmberg, 2005) and Tanzania (Barrow, 2005; Barrow & Mlenge, 2004) had similar successes with large-scale restoration of native vegetation.

In Brazil historic actions of restoration took place in several areas, of which one of the most emblematic involved the Tijuca National Park, since it is the earliest recorded case and is related to the threat of losing the water supply for the city of Rio de Janeiro during the 19th century. The National Plan for Restoration of Native Vegetation naturally considered lessons learned and experiences from these and other cases over the past 150 years, from both other countries and Brazil, involving restoration (Rodrigues, 2009; Garret et al, 2013). Such examples reveal some common trends that are relevant to the development of a national plan focused on restoration of native vegetation. In the first place, countries and their citizens frequently aim to achieve a wide range of benefits by restoring native vegetation. Historically, the benefits most sought have included protection of springs and the recharge areas of aquifers, reduction of soil erosion and degradation, employment generation, increase in wood supply, increase in areas for recreation, conservation and climate change mitigation.

Second, the desired benefits frequently change over time, reflecting changing priorities of governments and citizen. Third, a number of factors, when present, increase the probability that restoration of native vegetation will be successful.

Experiences shows that there are a number of factors that, when present – whether naturally or because people took measures to assure their presence – increase the probability that the restoration of native vegetation will succeed. These success factors can be grouped under 3 axes in the process of restoring native vegetation, depending on the objectives and stage of the initiative:

- **1. Motivating** the factors required to inspire and motivate decision makers, landowners and/or citizens to restore degraded sites.
- **2. Enabling** the factors required to create conditions (ecological, market, political, social and/or institutional) necessary to favor the restoration of native vegetation.
- **3. Implementing** the factors required to permit the implementation of restoration in a sustainable fashion, with resources, training, monitoring, etc.

These "success factors" that are key for the restoration of native vegetation are summarized in Table 5. The greater the number of success factors present, the greater the chances that restoration will

be successful. Nevertheless, not all success factors need to be present and no one factor is sufficient for the success of restoration.

Axis	Aspect	Key success factor	Definition
	a. Benefits	Restoration actions generate social and environmental benefits	Restoration of vegetation furnishes a wide range of benefits for landowners (reduction in soil erosion, supply of timber and non-timber products), communities (recreation) and the public in general(biodiversity conservation, clean water).
		Restoration is economically viable	Landowners view restoration of native vegetation as a cost.
	h Sansibility	The benefits of restoration are widely divulged	Despite the efforts of NGOs and academic institutions to demons- trate the benefits associated with restoration, these benefits were still not sufficiently quantified and disseminated to landowners and the population in general.
	D. Sensibility	Opportunities for restoration are identified	The mapping, quantification and prioritization of areas targeted for restoration are more advanced in the Atlantic Forest, while they occur in some parts of Amazonia and are less advanced in the other biogeographic regions.
	c. Crisis events	Crisis events are transformed into opportunities	Government and civil society have still not become sensitized about the occasional risks of natural disasters (e.g., flooding and landslides) to justify the need for restoring native vegetation and for building policies and public support for this.
1. Motivating	d. Legal mechanisms	Legislation exists that requires the restoration of native vegetation	The Law for Native Vegetation Protection (Law 12,651/2012) and the Atlantic Forest Law (Law 11,428/2006) requires that landowners restore their environmental debt.
		The legislation that requires the restoration of native vegetation is understood and obeyed	Many landowners do not understand the law and thus do not know exactly what requirements related to restoration of vegetation should be fulfilled.
	e. Culture	A cultural connection with native vegetation exists	Brazil has the greatest quantity of vegetation in the tropics and a strong biodiversity conservation ethic, celebrating, for example, Tree Day. Many traditional populations in Amazonia, for example, have strong cultural ties with forests. Nevertheless, there lacks a general recognition that restoration of native vegetation can provide a foundation for economic development and human wellbeing.
		National recognition desired	The Brazilian government is a recognized leader in issues related to biodiversity conservation, sustainable management and restoration of vegetation. Evidence for this includes the country's commitments to the forest-related terms of the UNFCCC, REDD + and the Aichi Targets 5, 11 and 15 of the CDB. At the same time, several states and municipalities seek national recognition for their environmental commitments (frequently for economic motives, such as the end of sanctions imposed due to the lack of compliance with laws such as 12,651/2012).
2. Enabling		Soil, water and climate conditions are adequate for restoration of native vegetation	Despite local variations, climatic conditions are relatively favorable for restoring vegetation. In some locations, soil degradation can impede restoration.
	a. Ecological conditions	Plants and animals that can impede recuperation and fire are absent	In most eligible sites for restoration there occur invasive species such as grasses (Urochloa spp., Eragrostis plana), trees (Pinus spp.), released and uncontrolled cattle, and fire. All of these factors impede the restoration of native vegetation.
		Ready availability of propagules, seeds and seedlings	Although advances exist in some states, in many areas eligible for restoration there lack basic structures for furnishing seeds and/or seedlings of native species.

Table 5.	Main success	factors f	for restoration	of native	vegetation	grouped into 3 ax	ses.
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Axis	Aspect	Key success factor	Definition
	b. Market conditions	Competing demands for areas suitable for restoration (for production of food, biofuels, fibers, etc.) are declining	Demand for production of food (from ranching or farming), biofuel and fiber in areas eligible for restoration is still not in decline, although policies have recently been implemented aimed at intensifying agricultural production and freeing up areas for restoration.
		Existence of a consolidated markets for products originating from restored areas	Although markets exist for some non-timber foresr products (e.g., honey and palm heart), these markets are incipient and conditions to sell many sources of wood from restored areas are restricted or poorly developed.
		Legal ownership of land and natural resources is assured	Clarity and security of land ownership are tenuous in Brazil and vary by biogeographic area. Despite this obstacle, there now exists sufficient areas with secure land tenure to permit the start of large- scale restoration.
	a Dublia action	The policies involving restoration are aligned	Policies that affect restoration of vegetation are often confusing, and there is overlap or lack of coherence between states and between federal agencies, increasing the risk of initiatives by landowners to restore their properties.
	conditions	Existing laws prohibit and/or restrict the suppression of native vegetation	Law 12,651 and other regional laws (for example, the Atlantic Forest Law) and local laws restrict the cutting and suppression of native vegetation.
		Existing laws that prohibit and/or restrict the suppression of native vegetation are applied	The imposition of legal restrictions on the suppression of native vegetation, such as converting forests and savannas for grazing, cropping or silviculture, varies according to biogeographic region.
	d. Social conditions	Local communities are engaged and empowered to participate in decisions about restoration projects and actions	Most technical knowledge about restoring native vegetation has been generated by non-governmental organizations, universities and research centers. In some cases, landowners have been involved in restoration efforts and pilot projects, but in other locations their participation has been less.
		The local population benefits from restoration	Landowners who are required to comply with the environmental requirements of Law 12,651 frequently do not perceive the benefits associated with restoring ecosystems and only carry out these actions to regularize their property with the law.
	e. Institutional conditions	Responsibilities for restoring native vegetation are clear and defined	Rules and responsibilities related to restoration of native vegetation are still not completely defined among governmental agencies (federal, state and municipal), civil society and the private sector.
		Integration occurs between different governmental agencies	Coordination between federal, state and municipal agencies is growing, yet the policies affecting restoration of native vegetation remain confusing and conflicting between governmental agencies, creating difficulties for restoration initiatives and affecting small-scale landowners and the private sector.
3. Implementing	a. Leaders	Participation of local and national leaders	In some biogeographic regions there are good cases of restoration of native vegetation initiatives by both individuals and organizations (e.g., (PACTO in the Atlantic Forest), while in other regions such initiatives are still scarce.
-FB		Existence of long-term political commitments	Commitments to restore ecosystems exist and are increasing, in part due to the need to comply with the requirements of Law 12,651.

Axis	Aspect	Key success factor	Definition
	b. Knowledge	Existence of knowledge about restoration of native vegetation	Numerous institutions and companies are carrying out high-quality research on techniques and methods for ecological restoration. Yet, for Brazil to achieve restoration at a scale of millions of hectares, further research is required on a series of issues (e.g., cost reduction, removal of invasive species, commercial valuation of native tree and non-arboreal species), as well as research on restoration of non- forested biogeographic regions.
		Transfer of knowledge between peers and through technical assistance and rural extension	Numerous institutions and companies offer technical training to participants in different segments of the restoration process (e.g., seed collectors, tree planters and landowners. Yet this is still insufficient to address the sheer scale of restoration planned for Brazil, due to the size of the areas that require training, technical assistance and rural extension.
	c. Techniques and methodologies	The techniques and methodologies are sound and adapted to changing conditions (e.g., climate change)	Brazil has experience and technical capacity to prepare projects to restore native vegetation at large scale, e.g., with regional native species and restoration techniques and methods based on the best technical approaches available. Yet this is not the case in all biogeographic regions and, furthermore, the main initiatives still are not considering the impacts of climate change on native species.
	d. Financial incentives	The techniques and methodologies are sound and adapted to changing conditions (e.g., climate change)	Even if economic incentives existed for restoring native vegetation (e.g., funds, loans with low or subsidized interest, payments for environmental services), these would be insufficient in quantity and duration to compensate for existing economic activities that compete with restoration.
		Access to financial incentives and other financial resources is facilitated	Eligible landowners and institutions that provide technical assistance (.e., non-governmental organizations, private companies) frequently confront obstacles to gain access to financial resources and incentives for restoring vegetation, including lack of knowledge about the existence of these resources, bureaucracy and complex requirements for submitting projects, difficulty in demonstrating the economic returns obtained from restoring native vegetation (required for loans), among others.
	e. Results monitoring system	Existence of an effective monitoring and evaluation system	While a globally recognized system exists for monitoring the suppression and degradation of native vegetation in Brazil (PRODES and DETER in Amazonia), there still does not exist a system for monitoring the progress and impact of restoring vegetation (hectares restored and benefits generated) that operates is a consistent way throughout Brazil.
		Successful cases of restoration are divulged	Although some examples of successful projects and initiatives involving restoration have been recognized and disseminated, these could have been more widely communicated and divulged to encourage replication and political support for restoration.

6.2 Evaluation of success factors in Brazil

To analyze the degree to which the main success factors for restoration of vegetation are already present in Brazil, a preliminary evaluation was carried out of how active these success factors are in Brazil's five biogeographic zones: Amazonia, Caatinga, Cerrado, Atlantic Forest and Pampa.

Table A, which is found in the Annex, presents the results of this qualitative evaluation, which was based on contributions originating from a series of workshops, interviews with professionals in the field and representatives from non-governmental organizations that coordinate or execute projects for restoring vegetation *in loco*, companies from the private sector and governmental agencies, as well as studies available in the literature (Pastorok et al. 1997; Leitão & Ahern, 2002; Linkov et al., 2006; Doren et al., 2009; Orsia et al., 2011; Jalilova et al., 2012; Le et al. 2012; Trivedi et al., 2013; Melo et al., 2013; Newton et al., 2013; Pataki et al., 2013; Whately & Campanili, 2003; PMV, 2013).

This evaluation showed that the presence of these key success factors varies by biogeographic region and that some of the main success factors are already present, others are partially present and still others are absent. To contribute to the success of this initiative, the National Plan for Restoration of Vegetation focused on those factors that were found to be absent or only partially present.

6.3 Complementary public policies

A critical condition for the success of PLANAVEG is that various existing programs and policies are implemented, including three of special importance: a) increase in the sustainability of production and productivity of pastures and farmlands as a result of the ABC Program and other related programs in regions outside the areas destined for restoration; b) implementation of Law no. 12,651/2012 such as the Rural Environmental Registry (CAR), the Environmental Compliance Programs (PRAs) and the Quotas of Environmental Reserves (CRAs); and c) assured land titles for restored areas. These existing efforts require continuity, strengthening and increased scale and scope. • Sustainable agriculture intensification: increase in the productivity of pastures and farmlands in regions outside the areas to be restored under the ABC Program and other programs supporting intensification of agriculture using sustainable parameters

It is critical that there occurs development and strengthening of sustainable practices on farmlands and ranches with high and medium agricultural suitability. Various practices can help to increase agricultural production and productivity in a sustainable way on existing farmlands and pastures. These practices include the improvement of pasture management (e.g., rotational or rational), irrigation of croplands-pastures-forests, genetic enhancement, irrigation, direct planting, minimal cropping, integrated soil and water management, etc. Brazil already has several policies and programs aimed at increasing agricultural productivity, such as the Sectoral Mitigation Plan and the Adaption to Climatic Change to Consolidate a Low Carbon Economy in Agriculture, or the "ABC Plan". Among other actions, this Plan aims to restore 15 million hectares of degraded pastures so as to increase the productivity of ranching or make viable the increase ("land sparing") of other agricultural crops.

The successful implementation of these and other policies and programs aimed at sustainable intensification of agriculture is essential for the National Plan for Recovery of Native Vegetation to achieve its objectives and target. When combined with other policies that prevent the conversion of new natural areas, the increase in the sustainability of agricultural productivity can contribute to reducing the pressure on new areas of natural vegetation. Furthermore, the increased productivity can free up areas with low agricultural suitability for restoration of native vegetation and in this way contribute to fulfilling the guidelines of the Law for Native Vegetation Protection (Law no. 12,651/2012).

Finally, the sustainable increase in productivity will reinforce Brazil in its global leadership role in meeting increasing food demand worldwide on a sustainable basis and, at the same time, promote initiatives for restoration of ecosystems. • Law for Native Vegetation Protection: Implement Law no. 12,651/2012. It is critical to give continuity to the provisions of the Law for Native Vegetation Protection (Law no 12,651/2012) in terms of eliminating environmental debt and avoiding deforestation and conversion of natural areas beyond permitted levels.

Two aspects of Law no. 12,651/2012 can enable Brazil to carry out large-scale restoration and at the same time expand activities in the agricultural sector. In the first place, the Law determines the limits and percen- tages of areas in APPs and RLs on rural properties that should be maintained with native vegetation cover. This guideline has a critical impact on the conservation of biodiversity and ecosystem services in Brazil and will contribute to securing sources of propagules, seeds and seedlings of native species for the restoration of ecosystems. Secondly, the Law establishes that landowners can restore or compensate vegetation deficits in APPs and RLs (except small-scale landowners, in the case of restoring RLs deforested before July 22, 2008). This measure is one of the main motivations for the development and implementation of the Plan for Restoration of Native Vegetation.

Fulfilling and monitoring these measures will provide an encouraging effect on the Law for NativeVegetation Protection (12,651/2012) and will guarantee that the economic benefits of increasing agricultural productivity will not lead to new conversions of native vegetation or impede its restoration. Important short-term steps to encourage the fulfilment of Law no. 12,651/2012 include the adhesion of landowners to the Rural Environmental Registry (CAR) in the states and the definition of models and guidelines for the Environmental Compliance Programs (PRAs) and the Project for Recomposing Degraded and Altered Areas (PRADAS). The implementation of these legal instruments is coordinated by the MMA's Brazilian Forest Service. Linking these instruments with the implementation of Planaveg is directly evident in the strategic initiatives of this document (see item 7.2.2, activity 3; item 7.2.3, activities 2 and 3; item 7.3.3, activity 6.3).

• Land regularization: increase the number of rural properties with legal titles. Increasing the number of landowners with titles and assure legal ownership over the land and its natural resources originating from restored lands is a critical condition for motivating landowners to invest in the restoration of native vegetation and seek access to incentives and credit to finance restoration. Past examples show that it is unlikely that producers will invest in the restoration of their rural properties if they do not have clear land title, as well as clear rights over the benefits generated by restoring vegetation. By the same token, it is difficult for landowners who do not possess titles to access lines of credit or other sources of resources necessary to finance the restoration of native vegetation.

In Brazil, the scenario regarding guaranteed land ownership varies according to biogeographic region. In the Atlantic Forest, for example, most areas provide land titles or guarantees regarding possession. However, in other regions such as Amazonia, land ownership rights are less clear.



7 Strategy

The National Plan for the Restoration of Native Vegetation aims to allow Brazil to fulfil its national and international commitments and strengthen its role as a global leader in the large-scale conservation and restoration of ecosystems. For this to take place, it is important to identify obstacles within the country that could impede the success factors required for the large-scale restoration of native vegetation. The Plan's strategy consists of eight strategic initiatives organized under three broad success axes: motivating, facilitating and implementing the restoration of native vegetation.

Motivating

1. Awareness: launch a communication movement with focus on farmers, agribusiness, urban citizens, opinion makers and decision makers, for the purpose of raising awareness about what is restoration of native vegetation, what benefits it produces and how to become involved in and support this process.

Enabling

- 2. Seeds & seedlings: promote the productive chain of restoring native vegetation by increasing the capacity of nurseries and other structures for production of native species, and rationalizing policies to improve the quantity, quality and accessibility of seeds and seedlings of native species.
- **3. Markets:** Develop markets for ecosystem products and services generated during restoration or in already restored areas, producing income for landowners through commercialization of timber and non-timber products, protection of water resources and areas feeding aquifers, and increased carbon stock, among others.
- **4. Institutions:** define the roles and responsibilities among governmental agencies, companies and civil society, and align and integrate existing and new public policies in favor of restoring native vegetation.

Implementing

5. Financial mechanisms: develop innovative financial mechanisms to incentivize the restoration of native vegetation, including preferential bank

loans, donations, environmental compensations, fiscal exemptions and forest titles.

- **6. Rural extension:** expand the services of rural extension (public and private), with the objective of contributing to the capacity building of landowners, with emphasis on low-cost restoration methods.
- **7. Spatial planning & monitoring:** implement a national system of spatial planning and monitoring to support the process of decision making for the restoration of native vegetation.
- 8. Research & development: increase the scale and focus of investment in research and development and innovation to reduce the cost, improve the quality and increase the efficiency of restoring native vegetation, considering environmental, social and economic factors.

The following section examines the strategic initiatives proposed in this plan. For each initiative, in addition to its objective, description, justification and actors involved, a list of activities to be developed is presented.

The timetable and budget for these activities, as well as their integration with other public policies relevant to the plan referred to in Article 5 of Decree no. 8,972/2017, will be debated under the auspices of the entity responsible for the implementation, monitoring and evaluation of Planaveg, the National Commission for Native Vegetation Recovery - CONAVEG.

It is critical to note that some of the Plan's activities are already part of the operations of certain governmental agencies or companies (for example, defining guidelines for purchasing by a government agency, developing a new line of credit by a bank), and for this reason are not considered as additional costs for the Plan. The same logic applies to other costs that are already covered by existing budgets, such as the development of PRAs.

Some of the resources to be invested in restoration actions are projected to be paid directly by landowners.

Such investments should be considered part of the costs of property management that are necessary to

obtain compliance with Law no. 12,561/2012, and thereby support the implementation of sustainable intensification of agriculture, generation and diversification of income, as well as the prevention of soil degradation and loss of other natural resources. Additional costs can be financed by loans from commercial banks or new financial mechanisms, such as forest titles. Since these resources can be compensated in the future, through income generated by products and services originating from restored areas, they are not considered net costs. In this way, the only net cost for the government involves a loan subsidy, which is used to cover additional costs related to restoration.

It is also anticipated that the costs of restoration will gradually decline over time for various reasons. First, landowners tend to use the cheapest approaches to restoration before adopting more costly approaches. Second, it is likely that various areas in Brazil are undergoing natural regeneration, which presents very low costs, and that these areas have still not been identified or monitored. Third, restoration costs per hectare will decline due to the increased scale of the Plan's implementation over time, and also due to technological innovations generated by research and development in the field of restoration ecology.

It is also worth noting that investment costs will be compensated by the benefits of restoration such as access to markets, income derived from the commercialization of timber and non-timber products, and payments for environmental services. Furthermore, public benefits of restoration should be accounted for, such as improved water supplies for urban and rural areas, employment generation, biodiversity conservation and climate change mitigation and adaptation.

7.1 Motivating Axis

This axis anticipates the adoption of the following strategic initiative to inspire and motivate landowners and other key actors to support and implement efforts for restoring native vegetation.

7.1.1 Strategic Initiative:

Awareness - Launch a communication movement with focus on farmers, agribusiness, urban citizens, opinion makers and decision makers, for the purpose of raising awareness about what is recovery of native vegetation, what benefits it produces and how to become involved in and support this process. **Objective:** Raise awareness among landowners, companies in the agricultural sector, the urban population, potential financers, leaders and opinion makers, and governmental agencies about the details involving restoration of native vegetation in Law no. 12,561/2012, the concept of restoring degraded or altered areas, the benefits associated with restoration, where and how to receive technical assistance and obtain available incentives to implement restoration projects.

Description: Develop and implement communication campaigns aimed at sensitizing four target audiences about restoration of native vegetation:

- *Rural population:* including landowners, rural communities, companies in the agricultural sector and entities that provided technical assistance and rural extension.
- Urban population: including citizens in urban centers.
- *Financing sources:* including companies such as banks and credit cooperatives, with a view to obtaining long-term loans at reduced interest.
- *Leaders and opinion makers:* including representatives of agricultural sector associations, the private sector, government agencies and non-governmental organizations who would be spokespeople about what is necessary to restore native vegetation and the benefits derived from this activity.

The communication media, the messages and the spokespersons of this campaign will vary according to the target audience. For example, the campaign to raise awareness will use various media (e.g., TV, radio, internet, on-line videos, newspapers and printed media), including official media (e.g., public TV networks, "Hour of Brazil," green rooms, etc.). In relation to the site or sites selected for restoration, the campaign should present to the general population teaching schemes and data on maps – in fairs, school events, internet, etc. – that can be obtained from CAR.

The campaign will communicate:

• What does the Law for Native Vegetation Protection propose? The campaign will clarify the meaning of the clauses in the Law for Native Vegetation Protection (Law no. 12,651/2012), what is permitted, and what is required by the federal and state regulations regarding the restoration of native vegetation in RLs and APPs.

- What is restoration of native vegetation? The campaign will use visual resources (e.g., photos and videos showing "before and after") to explain and illustrate good examples of restored areas in Brazil.
- What are the benefits of restoration? The campaign will explain and give examples of the economic, social and environmental benefits generated by restoring native vegetation. Benefits include generation of employment, opportunities for diversifying income for landowners and communities, increase in the supply of timber and non-timber products, protection of water resources that supply urban centers and rural populations, food security, reduction of soil erosion and silting of water resources, increased opportunities for recreation and tourism, biodiversity conservation, carbon sequestration, compliance with Law no. 12,651/2012, etc. The campaign will also show how restoration of natural vegetation can reduce the risks of natural disasters such as landslides and flooding.
- *How can restoration initiatives become a good business?* Based on economic studies, the campaign will show the financial benefits of restoration. In addition, the campaign will identify how restoration of native vegetation can be a low-cost alternative for improving the quality of water, assuring its supply to cities, and avoiding the silting of reservoirs used for generating electricity, irrigation and supplying drinking water, and for income generation through payments for environmental services to rural producers.
- *Who benefits?* The campaign will include stories and testimonies of landowners, companies, cities and citizens who have benefitted from the restoration of native vegetation. For example, the campaign will share how the restoration of native vegetation can help improve agricultural production and at the same time diversify the income sources of agricultural producers through new sources of income, such as timber from restored areas and payments for environmental services.

• *How to participate?* The campaign will explain how landowners can receive technical and financial assistance and incentives, when available, to start the process of restoration of vegetation in their lands. In addition, it will reveal other forms of participation via voluntary programs.

The awareness raising approach should seek to communicate in a way that is tangible to the reality of rural producers, in the sense of adapting to that reality without attempting to change it abruptly. An approach that could be efficient is cognitive confrontation, using everyday situations known by the producer (e.g., the impact of a thermal blanket in the production of milk and meat, the lack of pollinators in the fields, the occurrence of a pest and the absence of predators, the lack of timber to repair a fence, etc.). In this sense, it should be clear that forests can provide benefits and advantages that are easily recognized by the producer.

Justification: Few people, in both urban and rural areas, are sufficiently informed about the details of the Law for Native Vegetation Protection (Law no. 12,561/2012) in relation to the issue of restoring native vegetation, including the various techniques and methods for restoring degraded areas, the benefits derived from restoration and how to receive assistance and support for its implementation. A campaign to raise awareness about restoration of vegetation can mobilize efforts to respond to and resolve these gaps.

Possible actors: Ministry of Environment; Ministry of Agriculture, Livestock and Food Supply; Ministry of Agrarian Development; Ministry of Social Development; state governments; municipal governments (e.g., Secretaries of Environment, Municipal Councils of Environment); Committees of Hydrographic Basins; private sector; charity and class associations; commercial farming organizations; non-governmental organizations; multilateral initiatives related to this issue; and academic institutions, among others. Table 6. Activities anticipated in the sensibilization strategic initiative.

	Activity
1	Create and launch an awareness raising campaign targeting the agricultural sector
1.1	Develop the strategy of the awareness raising campaign, including objectives, messages, spokespersons, means of communication to reach target audiences, forms of media, deadlines and budget. The strategy should address the gaps detected previously during a pre-campaign to evaluate the sensibility of the target audiences and should be adapted to address the needs of each biogeographic region
1.2	launch the campaign
1.3	prepare, publish and divulge a manual explaining the pertinent details of Law no. 12,651/2012 in relation to restoration of native vegetation
1.4	carry out periodic evaluations on the "level of sensibility" of the target audiences while the campaign is running to monitor its progress
2	Create and launch a awareness raising campaign targeting the urban population and municipalities
2.1	Develop the strategy for the awareness raising campaign, including objectives, messages, spokespersons, means of communication to reach target audiences, forms of media, deadlines and budget. The strategy should address the gaps detected previously during a pre-campaign to evaluate the awareness of the target audiences and should be adapted to address the needs of each biogeographic region
2.2	launch the campaign
2.3	carry out periodic evaluations on the "level of awareness" of the target audiences while the campaign is running to monitor its progress and results
3	Mobilize leaders and opinion makers to increase awareness about the importance of restoring native vegetation
3.1	identify leaders and opinion makers considered to be good disseminators about the need for and benefits of restoring native vegetation
3.2	engage these leaders as spokespersons and contribute to their capacity to mobilize the awareness raising campaign, informing them about the Brazilian targets for restoring vegetation, the strategies and benefits, as well as other messages developed for dissemination
3.3	Mobilize leaders in the awareness raising campaign through newspapers, radio, television, and public appearances on a - continuing basis
4	Raise awareness among financial agents (credit sources, such as banks and credit cooperatives) about the importance of restoring Native vegetation and its economic returns with a view to increasing and facilitating the concession of loans with reduced interest rates, and extended grace periods and amortization
5	Raise awareness among states, municipalities and non-governmental organizations to create voluntary programs for the population to participate in restoring native vegetation
5.1	review the performance of voluntary programs (e.g., tree planting) carried out to date in Brazil and identify what worked well and can be replicated
5.2	prepare a manual on "best practices" for launching and identify well-managed volunteer programs that could assist with the restoration of native vegetation
5.3	encourage states and municipalities to include voluntary programs as part of their plans for restoring degraded areas (PRADAs)

7.2 Enabling Axis

This axis foresees the adoption of strategies to create the necessary conditions for facilitating and making viable the large-scale restoration of native vegetation.

7.2.1 Strategic Initiative:

Seeds & Seedlings – Promote the productive chain of restoring native vegetation by increasing the capacity of nurseries, of seed producers and other structures for production of native species and enabling policies to improve the quantity, quality and accessibility of seeds and seedlings of native species.

Objective: Increase the quantity, quality and access to seeds and seedlings of native species required for ecosystem restoration for rural producers and project implementers.

Description: Implement policies and programs that increase the quantity, quality and access to seeds and seedlings of native species for large- scale restoration of vegetation.

Justification: The success of restoring vegetation requires the availability and diversity of seeds and seedlings of native species and sufficient quality and quantity, at the right time and place, and at an accessible cost. In general, these seeds and seedlings can come from two sources:

1. Remnants of native vegetation: these are important sources of propagules of native plant species that can spontaneously colonize nearby degraded sites or can be disbursed to more distant sites. As a result, it is critical to conserve remnants of native vegetation to assure that these sources of propagules of native species remain protected and can be disseminate by natural agents such as wind, water and animals. 2. Nurseries and seed collectors: in altered landscapes where there are few fragments of native vegetation, it is necessary to develop strategies to enable the recolonization of native species. In such cases it is critical to develop a productive economy for this purpose, which can start by identifying the closest fragments (sources of propagules), encourage the establishment of seed orchards (by even encouraging the development of seeds of native field species), organize the collection of seeds and propagules of native species and the establishment of nurseries for seedling production to meet the demand for restoring native vegetation.

Although natural regeneration is a lower cost strategy than restoration of native vegetation, the former has some restriction in some parts of Brazil due to the lack of remnants of natural vegetation, the extreme level of degradation, the absence of seed banks and the low resiliency of degraded sites. In these situations, restoration should occur primarily by planting seeds and seedlings, which requires a high capacity of production. While capacity varies considerably according to the state, Brazil as a whole does not currently possess a sufficient number of nurseries and seed collectors to permit large-scale restoration of native vegetation. Under these circumstances, it is critical to preserve genetic diversity, which is essential for the long-term maintenance of populations. Measures are urgently needed to reduce depression due to endogamy and exogamy.

Possible actors: Ministry of Environment; Ministry of Agriculture, Livestock and Food Supply; state and municipal governments; federal and state universities; SENAR; private sector companies, research and extension institutions; networks of seed collectors and nurseries; CAN; multilateral initiatives related to restoration of vegetation; SEBRAE and non-governmental organizations.

Table 7. Activities anticipated in the seeds and seedlings strategic initiative.

	Activity
1	Review or create (when necessary), in a participatory way, legal regulations to encourage increased demand for and supply of native seeds and seedlings
1.1	review legal regulations that affect the sustainable collection of seeds for restoring protected areas (Conservation Units, Indian Lands and others) and, when necessary, adjust them with a view of obtaining the ideal balance between conservation of these areas and restoration in other locales
1.2	define and implement zoning for collection and use of seeds
2	Expand the development of seed and seedling production and the financing and donations destined for the establishment of seed orchards and nurseries of native species (including community nurseries)
2.1	Carry out a technical study to define seed and seedling production costs, identifying opportunities for reducing these costs and increasing profitability
2.2	create credit lines or donations dedicated to support the establishment of seed banks of native species and the expansion of seed orchards and nurseries for seedlings of native species
3	Create and implement a national on-line system for registering and tracking seeds and seedlings
3.1	include a catalogue to identify native seeds and seedlings, that registers the collection site and distribution of seeds, the location of nurseries and other data that can assist in aligning supply of and demand for seeds and seedlings
3.2	link the proposed system with other existing systems and data banks (RENASEM, RENAM, Sistema DOF, SINAFLOR, CNCFlora, Lista da Flora Digital, Inventário Florestal) assuring interoperability of the systems
3.3	link the system with the "spatial planning and monitoring system for the restoration of native vegetation" (see section 7.3.3)

7.2.2 Strategic Initiative:

Markets – Develop markets for products and ecosystem services generated during the process of restoration or in areas already restored, producing income for landowners involved in commercializing timber and non-timber forest products, as well as payment for the provision of ecosystem services such as protecting water resources and areas for recharging aquifers, and increasing carbon stocks, among others.

Objective: Strengthen the "economy for restoring ecosystems" based on the creation of markets for products and services generated by areas under restoration or already restored.

Description: Make viable the commercialization of products and services originating from private areas under restoration or already restored. Contribute to the increase and diversification of income on rural properties, improvising the means of subsistence and Complying with the Law for Native Vegetation Protection (Law no. 12,651/2012). The products and services originating from areas under restoration or already restored with greater likelihood of commercialization are:

- timber products for furniture and other valueadded products such as posts, cellulose and biomass for generating energy;
- non-timber products such as, for example, palm heart, honey, açaí, rubber, essential oils, fruits, seeds, etc.;
- environmental services, such as improving the quantity and quality of water (mainly drinking water for urban and rural populations) and carbon sequestration;
- natural areas suitable for local tourism, leisure and recreation;
- restored areas that constitute surplus in relation to the requirements for Legal Reserve of Law no. 12,651/ 2012 and that are eligible for Environmental Reserve Quotas CRAs).

Justification: The commercialization of products and services originating from areas under restoration or that have already been restored is an important economic and financial incentive to encourage landowners to plant or permit the natural regeneration of native species from Brazilian ecosystems. This approach goes beyond the sanctions for failing to fulfil the Law forNative Vegetation Protection (Law no 12,651/2012), since it can encourage the restoration of degraded areas beyond the limits of Areas of Permanent Protection and Legal Reserves.

The income generated from products originating from areas under restoration or that already have been restored enables landowners, in addition to covering the costs of restoration, to increase and diversify the income obtained from their properties. In addition, the mechanisms associated with "Payments for Environmental Services" can generate an important and complementary source of income, considering that prices for agricultural products are sensitive to market fluctuations.

To achieve the final objective of restoring natural vegetation, the combination of native and exotic species of economic interest can help finance the costs of restoration for environmental compliance of rural properties to Law no. 12.651/2012. For example, the Harvesting of some high-valued species during the first years of restoration can generated income over the short-term, thereby helping landowners to cover

the costs of establishing plantations and, in addition, permitting the introduction of other native species (with or without economic value) into the plantations over time (Brancalion et al. 2012).

The "economy of restoring ecosystems" can even bring benefits to agriculture, by creating jobs and means of subsistence for poor populations in rural areas, increasing the supply of legal timber and nontimber products and generating ecosystem services for millions of people and companies. Furthermore, it has the potential to attract private capital than can complement public investments in the restoration of native vegetation.

Possible Actors: Ministry of Environment; Ministry of Agriculture, Livestock and Food Supply; Ministry of Agrarian Development; Ministry of Finance; Ministry of Planning; National Water Agency; BNDES; all of the states for the Federation; the private sector (e.g., industries for managing and commercializing timber, certifiers of the chain of custody and sustainable management of forest products, beverages and energy); public water distributors.

Table 8. Activities anticipated in the market strategic initiative.

	Activity
1	Stimulate the supply of timber and non-timber products originating from areas undergoing restoration of native Vegetation
1.1	Carry out a technical study on the supply of timber and non-timber products originating from areas undergoing restoration of native vegetation
1.2	Develop legal mechanisms by which timber and non-timber products originating from the planting and sustainable management of native vegetation for commercial purposes and restoration of RL serve as guarantees for loans
1.3	Simplify the processes of managing native species on private lands that are restored or under restoration restored de áreas recuperadas ou em recuperação em terras privadas
1.4	Regulate the management and stimulate the commercialization of products originating from areas that are restored or under - restoration (informatized system that is accessible on the internet, virtual network of products with regularized origin, etc.)
1.5	Incentivize that forest management certification programs include or improve methods for identifying or tracing timber and non-timber products harvested sustainably from areas that are restored with native vegetation or under restoration
1.6	Incentivize the development of local cooperatives and fairs for selling timber and non-timber products originating from sustainable management of areas restored or under restoration
1.7	Incentivize the development of machines and implements that optimize the production and harvest of timber and non- timber products originating from sustainable management of areas restored or under restoration.
2	Stimulate the demand for timber and non-timber products originating from areas under restoration or restored areas under sustainable management
2.1	Carry out a technical study on the demand timber and non-timber products originating from areas undergoing restoration of native vegetation
2.2	Develop and implement public purchasing programs of timber traced from areas under sustainable management and of products harvested sustainably from restored areas or areas under restoration
2.3	Create mechanisms to encourage large corporate buyers (e.g., civil construction companies) to consume timber traced from sustainable managed forests, restored areas or areas under restoration (e.g., purchase of guaranteed volumes)

2.4	Implement public purchase programs (dispensed of competitive bidding) for acquiring seeds and seedlings of native species produced by family farmers or traditional populations.
2.5	Encourage the use of purchase contracts with up-front payments for seeds and seedlings to strengthen the supply of these Products
2.6	Encourage the policy of using native species in urban tree planting, in increasing the green areas in cities and in landscaping Projects
3	Carry out a study to verify the potential of commercializing environmental reserve quotas (CRA) to stimulate the restoration of native vegetation and, as a result, increase landscape connectivity
4	Incentivize payments for environmental services (PES) programs in priority areas
4.1	develop a technical study to stimulate the development of PES programs originating from areas under restoration
4.2	Influence the formulation of a National Program of Payments for Environmental Services (PES), so as to establish the mechanisms for how this approach will function
4.3	Involve public and private sector entities that benefit from ecosystem services (e.g., electric generating companies, public services for furnishing water and beverage companies) to formulate PES programs
4.4	Train states and municipalities to administer PES programs
4.5	Raise awareness and encourage watershed committees to invest in green infrastructure
5	Incentivize sustainable tourism and leisure in areas restored or under restoration
5.1	Stimulate and develop volunteer programs for restored areas or areas under restoration
5.2	Train tourism agents for restored areas or areas under restoration

7.2.3 Strategic Initiative:

Institutions–Define the roles and responsibilities among governmental agencies, companies and civil society, and align and integrate existing and new public policies in favor of restoring native vegetation.

Objective: Assure that the roles and responsibilities for implementing the National Plan for Restoration of Native Vegetation are clearly defined and coordinated between the government, civil society and the private sector and that the public policies that relate to restoring native vegetation are aligned, coherent and mutually reinforcing.

Description: Establish procedures to assure institutional cooperation at the federal, state and municipal level between governmental agencies, civil society and the private sector, to achieve successful restoration of native vegetation. In addition, the federal government should establish procedures to assure that public policies at all levels are aligned and are mutually supporting to promote the large-scale restoration of native vegetation.

Justification: The restoration of native vegetation has greater chances of success when the functions and responsibilities for the implementation of the National Plan for Restoration of Native Vegetation are clearly defined, integrated and agreed among all interested parties. The lack of such coordination may lead to insufficient implementation of the anticipated actions due to failure to carry out important functions or due to the allegation of overlapping institutional responsibilities.

By the same token, restoration will have greater chances of success when there is alignment and integration of the public policies at all three levels of the federation that are relevant to restoration. Without such alignment and integration, the policies promoted by one governmental agency may invalidate or conflict with other existing policies, thereby undermining the progress of restoration.

Possible Actors: States; Ministry of Environment and linked agencies; Ministry of Agriculture, Livestock and Food Supply; Ministry of Agrarian Development; Attorney General and public promoters for the environment; Tribunal for Public Accounts of the Union (TCU); Municipal Council for the Environment (CMMA); National Confederation of Industry (CNI); National Confederation of Agricultura (CNA); universities; federal institutes; and other non-governmental organizations. Table 9. Activities anticipated in the institutions strategic initiative.

	Activity
1	order a technical document to review the set of public policies at the federal, state and municipal levels on relevant sectors that affect the restoration of native vegetation. The technical document will identify policies that lack coherence, policies that impede restoration or those that could create confusion among landowners in relation to what they should do to promote the restoration of native vegetation. Furthermore, the document will identify which public policies effectively contribute to the restoration of native vegetation.
2	regulate the general criteria for restoring RLs and APPs (defining the dimension for using exotic species, the possibilities for clear cutting, size of plots, etc.)
3	Establish minimum patterns required under Projects for Restoration or Recomposition of Degraded or Altered Areas, so as to encourage efficiency and coherence in the implementation of projects
4	Carry out training workshops for state and municipal agencies for environment (through seminars and application of training materials) about how to assure alignment of policies and coordination of execution, so as to encourage mutual support in the restoration of native vegetation.

7.3 Implementing Axis

This axis anticipates the adoption of strategies for effective mobilization of capacities and resources to implement the National Plan for Restoration of Native Vegetation.

7.3.1 Strategic Initiative:

Financial Mechanisms – Develop innovative financial mechanisms to incentivize the recovery of native vegetation, including preferential bank loans, donations, environmental compensations, specific fiscal exemptions and forest titles.

Objective: To strengthen the portfolio of longterm financial mechanisms (e.g., loans, nonreimbursable loans, donations, fiscal incentives and environmental compensation funds) for restoring native vegetation.

Description: Develop or improve financial mechanisms for restoring native vegetation. These mechanisms may include:

• *Loans.* Lines of credit administered by public and private banks for landowners, companies or their intermediaries that are designed to finance activities related to restoration of native vegetation. Although some lines of credit are available, there are poorly divulged, inaccessible to small-scale landowners or are not financially attractive because their grace periods and payment schedules are not compatible with the cash flow associated with products generated from areas of native vegetation under restoration.

- *Donations.* These are non-reimbursable funds dedicated to help finance the costs of restoring native vegetation. Some donations can complement lines of credit, reducing interest rates and making loans more attractive to landowners.
- *Forest titles.* These are a form of negotiated financial insurance that represents a commitment to make a future payment with interest pre-determined by the time interval of the title, as well as by the total nominal value of the obligation to be paid by the holder of the insurance. A "forest title" is a title in which the income used for payment comes from the value generated by a forest.
- *Fiscal incentives.* Tax exemptions and other exemptions on inputs, financial investment (infrastructure debentures), or activities associated with the restoration of native vegetation.

Justification: Financal mechanisms help landowners pay the costs related to restoring native vegetation, especially the initial costs which are higher. These costs are related to activities such as: planting native species, removing weeds, constructing fences (to isolate the area under restoration from degrading factors such as, for example, he trampling of cattle), among other activities. Some forms of financial mechanisms, such as reducing taxes, not only lower implementation costs but also permit increased net income from the restoration of native vegetation. In some case, the restored native vegetation can generate financial returns, such as the sale of timber and non-timber products, which enables landowners to pay off their loans. In other cases, in which the restored areas do not generate financial returns, donations can provide a more suitable financial mechanism. And in still other cases, a mix of loans, donations and fiscal incentives can be more appropriate and viable. The most suitable instrument will vary according to the type of restoration and the circumstances of the landowner. **Possible Actors:** Ministry of Environment; Ministry of Finance; Federal Revenue Services; Ministry of Agracian Development; National Bank for Economic and Social Development (BNDES); large public and private commercial banks (e.g., Bank of Brazil, Caixa Economical Federal, Rabobank, Santander, Itau, Bradesco); Brazilian Biodiversity Fund (Funbio) and international multilateral and bilateral institutions.

Table 10. Activities anticipated in the financial mechanisms strategic initiative.

	Activity
1	Prepare technical documents to (a) carry out an inventory to determine the current availability of loans, donations and fiscal incentives for restoring native vegetation; (b) improve or define new kinds of financial incentives; analyze the potential impact of these incentives on the success of restoration efforts; and (d) evaluate the impact of these financial incentives on the national economy, including impacts on the banking and agricultural sectors
2	Develop systems of financial rewards to family producers who are restoring or already have their APPs and RLs totally preserves (e.g., in the Program for Acquiring Food - PAA or in the National Program for Food in Schools – PNAE)
3	Create or expand credit lines designed to encourage restoration of native vegetation with native species, with interest rates, conditions and terms that are more favorable than those currently practiced by the market, in addition to simplified qualifying procedures (examples of such credit lines include but are not limited to: a) lines of financing for integrated property encompassing both farmlands and natural areas; b) lines conditioned to compliance with the Law for Native Vegetation Protection; c) lines of credit in which farmers who conform to legislation and are actively engage in restoration have higher credit limits and/or lower interest rates; d) lines that include technical assistance for restoring native vegetation during implementation; e) lines that finance agricultural activities combined with subsidies to finance the restoration of APPs and RLs on the property; f) lines for small- and medium-scale landowner to finance restoration of RLs with sufficiently long deadlines to permit the sale of timber and non-timber forest products)
4	Generate sources of financing for sustainable businesses that use as a source of raw materials products originating from sustainably managed areas that are restored or under restoration: small-scale sawmills, installations for distilling essential oils and processing centers for native fruits
5	Improve the ABC program to provide financial incentives for projects restoring APPs and Legal Reserves
6	Improve existing credit lines of Pronaf (Agroecology, Forestry and Productive Oriented)
7	Evaluate and develop long-term financial mechanisms for restoring native vegetation, such as forest titles
8	Create programs of donations or non-refundable financing for restoring native vegetation to help finance and Amortize the initial costs of implementation (beneficiaries could be small- or medium-scale landowners, communities and non-governmental organizations that que promote restoration in priority areas)
8.1	Identify and recruit funding sources (e.g., bilateral and multilateral agencies, BNDES, public and private foundations, philanthropic contributions and crowd sourcing
9	Explore the creation or improvement of fiscal incentives to permit restoration with native species
9.1	Based on the results of the technical documents (see Activity 1), consider fiscal deductions, tax exemptions and reduced taxation on inputs for restoration (e.g., cattle fencing, seeds), products (e.g., products from native vegetation in areas restored or under restoration), services (e.g., entities that provide services related to implementing restoration suppliers of native seeds and nurseries) and/or financing (e.g., funds that invest in restoration) or additional taxation on, for example, timber not completely traced
10	Promote the emission of infrastructure debentures incentivizing projects for restoration, management of native vegetation and silviculture of native species
11	Encourage conversion of simple environmental fines to finance large-scale restoration projects

7.3.2 Strategic Initiative:

Rural Extension – Expand the services of rural extension (public and private) with the objective of contributing to the capacity building of landowners, with emphasis on low-cost recovery methods.

Objective: Create and implement capacity building and training programs and expand services for technical assistance and rural extension to assist land owners in undertaking low-cost restoration of native vegetation using state-of-art knowledge in accordance with the requirements of the Law for Native Vegetation Protection.

Description: Increase programs for capacity building, services of technical assistance and rural extension for landowners, communities, cooperatives and associations of rural producers, and non-governmental associations. The expansion of technical assistance and rural extension should:

- include restoration of native vegetation as part of the services of technical assistance and rural extension.
- introduce a large program of "training multiplies" for restoration of native vegetation.
- use information technology and communication to expand knowledge transfer, promote capacity building and increase the reach of services for technical assistance and rural extension.

It is important to note that those who carry out extension and capacity building under this Plan can include representatives of government, the private sector, non-governmental organizations and/or universities.

Justification: The services of capacity building, technical assistance and rural extension focused

on restoring native vegetation are essential to the success of restoration as a result of:

- providing technical assistance, training and capacity building in technique for restoring native vegetation, including seed collecting, production and planting of seedlings, management and related techniques related to natural regeneration (e.g., fencing).
- offering training on management and enrichment practices of remnants of native vegetation for conservation and sustainable use (from field days to short- and medium-term training).
- facilitating the involvement of rural landowners, an approach that has proved effective in Brazil and internationally.
- complementing and improving existing services of agricultural technical assistance and rural extension.
- complement other actions to sensitize landowners and communities about the concept and benefits of restoring native vegetation.

Possible Actors: States (responsible for implementing national environmental policies in accordance with Complementary Law no. 140/2011); Ministry of Environment; Ministry of Agriculture, Livestock and Food Supply; Ministry of Agrarian Development; Brazilian Agricultural Research Corporation (Embrapa); National Service for Rural Learning (SENAR); National Agency for Technical Assistance and Rural Extension (Anater); Enterprise for Technical Assistance and Rural Extension (Emater); Brazilian Service for Support to Micro and Small-scale Companies (Sebrae); federal universities; private sector; farmer cooperatives and associations; and non-governmental organizations.

Table 11. Activities anticipated in the rural extension strategic initiative.

	Activity
1	Establish and implement a large program for "training multipliers" to create an extensive network of agents who are involved in exchanges for visiting outstanding actions in their regions, and who can mobilize private landowners to restore native vegetation. The program will include a system of technical assistance and rural extension (public and private), farmer associations and cooperatives, National Service for Rural Learning (SENAR), Sebrae, volunteer programs and universities, among others.
2	Establish and implement fairs for exchanging seeds and seedlings and training programs for seed and seedling producers, aimed at training and production techniques and management of nurseries (e.g., finance, administration, management of human resources, among others)
3	Strengthen the capacity of the system for technical assistance and rural extension to provide services related to restoration of native vegetation and the sustainable use of native species with economic potential
3.1	Expand demonstration units showing different restoration strategies through support from rural extension services
3.2	increase the number of specialists in restoration of native vegetation within the system for technical assistance and rural extension, especially in state and private extension services
4	Intensify the use of information and communication technologies (e.g., cell phone applications, on-line videos, radio) to increase the dissemination of technical assistance and rural extension, and the spread of practices related to agroecology and biodiversity conservation

7.3.3 Strategic Initiative:

Spatial Planning & Monitoring – Implement a national system of spatial planning and monitoring to support the process of decision making for the recovery of native vegetation.

Objective: Develop and implement a spatial planning and monitoring platform at the national level to support decision making related to restoration of native vegetation, incorporating existing data and systems and interacting with the National Program for Environmental Monitoring of Brazilian Biomes.

Description: Develop and implement a national online system for spatial planning and monitoring that assists governments, the private sector, landowners and others in planning, prioritizing and monitoring the restoration of native vegetation in Brazil. The system should include maps of soil use dynamics and vegetational cover, mathematical spatial planning models, a data bank of potential areas for restoration (to facilitate contacts between landowners and homesteaders who possess areas that could be restored and entrepreneur seeking such areas to fulfill environmental commitments such as reforestation and environmental compensation) and other data relevant to restoring native vegetation, including the definition of priority areas that involve, for example, the implementation of ecological corridors.

The system will be comprised of five components: on-line platform: an on-line interactive platform that contains data in spatial and tabular formats.

- *field checking:* Terrestrial data, including periodic field surveys, combined with ad hoc observations using digital cameras and cellphone applications to photograph the process of ongoing restoration and uploading to the on-line platform.
- *spatial observations:* Remote sensing data with satellite images and aerial photographs.
- *complementary data:* Relevant plans of spatial information, data banks and complementary systems incorporated or linked.
- *territorial planning*: Landscape planning and modeling tools that permit modeling of scenarios and identification of priority areas.

The priorities that the system should contain or generate include:

- land cover and use maps (e.g., Terra Class, PROBIO, SOSMA/INPE).
- maps of areas with potential for restoration of native vegetation, including deficits of APPs and RLs (obtained by SiCAR), degraded lands with low agricultural potential and degraded lands suitable for agroforestry systems and silviculture.
- maps of priority areas for restoration, based on modeling of multi-criteria scenarios (e.g., water production, employment generation, establishment of ecological corridors and climate

change mitigation and adaptation). This map will also serve as a basis for indicating the order of priority for restoration.

- annual and bi-annual maps, satellite images and terrestrial photos of areas in the process of restoring native vegetation.
- field data for monitoring the process of restoration of native vegetation.

As a second level of priority, the system should contain or generate:

- maps and data on the locales of and lessons learned from existing restoration projects.
- maps with the location of nurseries that produce native seedlings and areas for collecting native seeds.
- maps of areas with potential for sustainable intensification of agriculture.
- data from SiFlor (Information System for Forestry Planning).
- decision support tools, with recommendations on restoration techniques and methodologies, supply chain, consultants, nurseries, seed collectors, etc. (e.g., Web Ambiente - Embrapa).

The system will incorporate, on a single platform, existing or preliminary data on governments (national, state and municipal), research institutes and non-governmental organizations. The system will also be capable of connecting with and complementing planning and monitoring systems at the federal (e.g., National Infrastructure of Spatial Data – INDE), state and municipal level, enabling data exchange and interoperability. In particular, this system will be constructed based on the SiCAR system so that users can link information on restoration of native vegetation with detailed data on the deficits and gains of native vegetation.

Justification: Governments (federal, state and municipal), landowners and squatters, civil society, private sector and research institutes need a unified and shared infrastructure for spatial planning and monitoring of vegetation restoration. The proposed system will meet these objectives by:

integrating relevant spatial data and data banks but currently disparate (including those that exist as well as those under development):

- establishing a spatially defined and quantifiable baseline with respect to which restoration of native vegetation can be measured over time, including deficit maps of native vegetation;
- prioritizing targeted areas for restoring native vegetation, emphasizing landscape ecology and conservation of ecological processes;
- locating, quantifying and monitoring areas with potential relevance for natural regeneration, as well as areas that require actions for restoration of vegetation;
- monitoring restoration of native vegetation over time.
- Functions or capacities that will be added subsequently to the system include:
- connection of priority areas for restoring vegetation with economic incentives and other incentives for landowners;
- identification of gain and loss trade-offs between economic, social and environmental objectives;
- assistance to landowners in identifying the supply of and demand for inputs to (e.g., seeds, seedlings, fencing) and products from (e.g., non-timber products) the restoration of native vegetation;
- identification and communication of successful cases to increase awareness, strengthen public support and accelerate the adoption of practices for restoring native vegetation;
- the possibility of revising and adjusting restoration strategies when necessary, adopting an approach based on adaptive management.

Possible Actors: National Institute for Space Research (INPE); Ministry of Environment; Ministry of Agriculture, Livestock and Food Supply; Ministry of Science, Technology and Innovation; Embrapa; state and municipal governments; University of Sao Paulo and research institutes experienced in spatial modeling, remote sensing and data processing; nongovernmental organizations; and the private sectors. Table 12. Activities anticipated in the spatial planning strategic initiative.

	Activity
1	Refine the scope, objectives and functionality of the system and incorporate lessons learned based on experiences of other analogous systems of spatial planning and monitoring
1.1	Carry out a joint inventory of relevant existing data and systems
1.2	Carry out seminars with national and international specialists and managers
2	Create a top-down component for spatial monitoring within the platform
2.1	Identify and evaluate options existing options of remote sensing for the system
2.2	Select the system or combination of systems to be used, based on factors such as desired applications, spatial and temporal resolution, periodicity and cost of acquiring data, among others
2.3	Carry out required research on how to detect areas under restorations based on remote sensing images, how to extrapolate from a multi-sensor system, etc.
2.4	Create a reference baseline on land use and land cover, including the identification of areas with a deficit of native vegetation and areas under restoration
2.5	Define priority areas for restoration, based on modeling of multi-criteria scenarios
3	Create a bottom-up component of field monitoring for the platform
3.1	Identify and evaluate existing approaches for field observations
3.2	Select the system or combination of systems to be used, based on factors such as desired applications, spatial and temporal resolution, periodicity and cost of acquiring data
3.3	Develop protocols for carrying out terrestrial monitoring
3.4	Identify entities that will collect primary data, determining how to maintain relatively low data acquisition costs and developing a continuous training program
4	Gather and integrate sets of complementary data and systems
4.1	Identify existing planning systems and data banks that will be incorporated and made available on the platform and assure safe access to this set of data
4.2	In the case of non-existing data, invest in research and development
5	Create a component for spatial monitoring within the platform
5.1	Define spatial planning functions and applications
5.2	Develop the necessary capacity for modeling and formulation of scenarios
6	Design the on-line architecture of the platform, including:
6.1	Create on-line capacity storing and exhibiting information related to spatial planning and monitoring
6.2	Integrate components of spatial planning and monitoring
6.3	Integrate pertinent data and systems that are already available (e.g., SiCAR)
6.4	Develop and integrate the desired functionality of analysis, including map of overlap, capacity, tools for quantifying area, photos and data, application load, etc.
7	Develop and operationalize "Version 1.0" of the system
7.1	Launch the system and train users
7.2	Add new contents and functionality continuously in response to technological advances, policy needs and the evaluation of users, and update the version of the system whenever necessary

7.3.4 Strategic Initiative:

Research, Development and Innovation – Increase the scale and focus of investment in research, development and innovation to reduce the cost, improve the quality and increase the efficiency of recovering native vegetation, considering environmental, social and economic factors.

Objective: Promote research, development and innovation programs on restoration of native vegetation.

Description: Promote basic and applied research on restoration of native vegetation, covering fields such as Restoration Ecology, Silviculture of Native Species, Conservation Biology, Ecosystem Services, Ecological Economics, Social Sciences and other related disciplines that aim to reduce costs, accelerate restoration, increase efficacy and expand social, environmental and economic benefits. The priority topics will include, among others:

- conditions, policies, incentives and techniques (e.g., fencing) that reduce per hectare costs of restoring native vegetation.
- potential for natural regeneration and spatial planning.
- restoration poorly studied biogeographic regions (e.g., Caatinga, Cerrado and Pampa).
- weed control practices (e.g., Brachiaria spp.) efficiently and at low cost.
- impact of herbicide use on restoration projects.
- fire management in restoration of savanna ecosystems.
- viable financial and economic models for restoration, including the use of timber and non-timber product harvested from native vegetation.
- · social perceptions of restoration
- ecology of native species (e.g., genetic diversity, growth curves, functional groups, life forms, species diversity, reproduction, mix of species, silvicultural behavior) and commercial applications.
- techniques for producing seeds and seedlings of native species.

- management and enrichment practices of vegetation remnants for sustainable use and conservation.
- relations between biodiversity and ecological processes in restoration.

Ethnopharmacological research on medicinal uses of native plants in Brazil, with emphasis on locations where there are still remnant indigenous populations that can indicate plant use.

- social, economic and environmental impacts of native vegetation restoration, quantified over the short-, medium- and long-term.
- low-cost methods of monitoring and evaluation.
- effective agroforestry practices with economic, social and environmental benefits.
- lessons learned from demonstration projects on restoration of native vegetation.
- methods to accelerate the rate of knowledge diffusion on restoration of native vegetation and its adoption by landowners.
- silviculture of native species
- generation of ecosystem services by areas under restoration
- management of information about programs on restoration and information technology
- remote monitoring of restoration
- business plans on restoration

Justification: Brazil is a world leader on restoration tropical forests, pioneering successful of technologies for restoring native forest in tropical biogeographic regions. Yet it is necessary to expand research and knowledge generation if Brazil is to attain the scale of restoration envisioned by the Plan. For example, numerous questions remain about restoring other types of vegetation, such as Pampa, Cerrado and Pantanal and about how to restore millions of hectares in an economically viable, socially acceptable and environmentally sustainable fashion. By the same token, research on restoration needs to have greater focus on priority

issues, with greater synergy among professions and less dispersion of research efforts in order to permit significant advances of knowledge.

The directioning of calls for proposals in research and development by state and federal agencies could contribute greatly toward gains of efficiency in the sector and, as a result, advancing restoration in Brazil and fulfilling the targets of this plan. Only through research, development and innovation will it be possible to identify and overcome the main obstacles to the advance of restoration in Brazil.

The expansion and greater targeting of research and development by public and private sectors will help

assure that all the other strategies of the National Plan for Restoration of Native Vegetation will be supported by advances in physical, social and economic sciences. Accordingly, investment in research and development will generate short- and long-term dividends.

Possible Actors Ministry of Environment (including Forest Service funds for research on forestry development); Ministry of Science, Technology and Innovation; National Council for Scientific and Technological Development; Brazilian Society for Scientific Progress; Embrapa; private sector; research networks and research centers linked to universities and institutions (federal, state and municipal).

Table 13.	Activities	anticipated i	n the research	development	and innovation	strategic initiative.
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	Activity
1	Improve research focus on restoration of native vegetation and restoration ecology
1.1	Prepare a list of "priority research topics" on restoration of native vegetation by biogeographic region with a view to focusing research on the most relevant short-, medium- and long-term topics and concentrate the flow of existing research funding to maximize investment returns
1.2	Expand the dissemination of research on priority topics through publications with different profiles
2	Expand the quantity of resources invested in restoration of native vegetation and restoration ecology
2.1	Prioritize the theme of native vegetation restoration in financing programs for research, including solutions in technological research on restoration of degraded areas and legal reserves, with native species of economic value for sustainable use
2.2	Create a public-private "program of research fellowships on restoration of native vegetation" supported by funds from governments, companies and philanthropy
2.3	Prepare calls for research proposals on knowledge gaps in restoration ecology, with a focus on propagation of native species in vivo (technology and management of seeds and seedlings) and management of vegetation for economic or environmental purposes
3	Increase the number of courses on restoration of native vegetation and restoration ecology in undergraduate and graduate Programs (academic or vocational) in Brazilian universities, with a view toward increasing knowledge and the number of specialists on degraded or altered areas. In addition, strengthen content on restoration of native vegetation in academic programs in forestry and agriculture
4	Promote international exchanges in research, development and innovation on sustainable management and silviculture using native species
5	Strengthen the activity of research networks (e.g., REBRE and RIACRI) to promote the exchange of experiences and knowledge on restoration of native vegetation and disseminate its application throughout the country

Photo 9. Tatiana Horta – Cachoeiras de Macacu-RJ

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8 Relation between Planaveg and the success factors in recovering native vegetation

The National Plan for the Restoration of Native Vegetation addresses the gaps of the main success factors, reduces restoration costs for landowners and makes possible all stages of the "chain of custody" for restoration. Table 14 synthesizes the strategies that can help reduce restoration costs for landowners and create incentives for restoration. Figure 6 show how each of the main stages of the "chain of custody" for restoring native vegetation is addressed by at least one strategy. In addition, Table A, which is presented in the Annex, explains how the eight strategic initiatives address gaps related to the main success factors for restoring native vegetation identified in Chapter 6.

	Strategic initiatives				
	Seeds & seedlings (7.2.1)				
Cost reduction	Institutions (7.2.3)				
	Financial mechanisms (7.3.1)				
	Rural extension (7.3.2)				
	Raise awareness (7.1.1)				
Creation of incentives	Markets (7.2.2)				
	Financial mechanisms (7.3.1)				

Table 14. Strategic initiatives that can reduce the sotes of and create positive incentives for restoration.



Figure 6. How PLANAVEG intends to make possible the chain of custody of the recovery of native vegetation

Photo 10. Daniel Mascia Vieira - Floresta em restauração com 1.5 anos. Porto Velho-RO

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9 Definitions

The definitions are adopted that were established by Law no. 12,651, of May 25, 2012, by Decree no. 7,830, of October 17, 2012, and the following:

Technical Assistance and Rural Extension: as defined in incision I of Article 2 in Law no. 12,188, of January 11, 2010.

Environmental surplus: areas of native vegetation still undesignated, unprotected by Brazilian environmental legislation as Conservation Units, Indigenous Lands, Areas of Permanent Protection (APPs) and Legal Reserves (RLs) or other similar instruments.

Conduction of natural regeneration of vegetation: set of interventions planned to assure the natural regeneration of the vegetation in an area undergoing restoration.

Sustainable agriculture intensification: Expansion of efforts expended in areas under cultivation with the objective of increasing the value of production per hectare in a sustainable way.

Non-timber Forest Products: products of biological origin, except wood, that are derived from tree species or from forest ecosystems. They include leaves, essential oils, resins, fruits, ornamental plants, handicrafts, etc.

Ecological rehabilitation: planned human intervention aimed at improving the functions of a degraded ecosystem, without necessarily involving the complete reestablishment of the composition, structure and function of the preexisting ecosystem.

Recovery or recomposition of vegetation: restitution of native vegetation cover, encompassing different approaches that may include establishing an agroforestry system, reforestation, conduction of natural regeneration, ecological rehabilitation, ecological restoration.

Reforestation: plantation of forest species, native or not, in pure or mixed stands, to establish a forest structure in an area originally covered by forest that was cleared or degraded.

Natural regeneration of vegetation: set of processes in which native species establish in an altered or degraded area to be restored or under restoration, without deliberate human actions.

Ecological restoration: intentional human interventions in altered or degraded ecosystems that aim to unleash, facilitate or accelerate the natural process of ecological succession.

Food or nutritional security: consists in fulfilling the right of everyone to constant and permanent access of quality foods in sufficient quantity, without undermining access to other essential needs, based on healthy practices that are environmentally, culturally, economically and socially sustainable.

Ecosystem services: benefits generated by ecosystems for society that contribute directly or indirectly to human wellbeing.

Sustainable use: use of the environment in ways that assure the permanence of renewable environmental resources and ecological processes, maintaining biodiversity and other ecological attributes in a form that is socially just and economically viable.

Photo 11. André Nave – Viveiro Bioflora, Piracicaba-SP

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11 Annexes

Table A. Evaluation of success factors in the restoration of native vegetation in five biogeographical regions – Atlantic Forest (AF), Amazonia (AMZ), Cerrado (CER), Caatinga (CAT) and Pampas (PAM.) – and their relation with strategic initiatives of PLANAVEG.

Legend	: Success	s factor present Success factor	partia	lly present		Su Su	ccess fac	tor absent
A	A	Summer for stress	Preliminary evaluation					Stuatogia Initiativa
AXIS	Aspect	Success factors	AF	AMZ	CER	CAT	PAM	
	a. Benefits	Restoration actions lead to social and environmental benefits						
		Restoration is economically viable					No data	Raising awareness (7.1.1) Market (7.2.2) Financial Mechanisms (7.3.1)
	b. Awareness	The benefits of restoration are widely divulged						Raising awareness (7.1.1)
vating	raising	The opportunities for restoration are identified						Raising awareness (7.1.1)
Ioti	c. Crises	Crises are transformed into opportunities						Raising awareness (7.1.1)
1. N	d T and	Legislation exists that requires restoration of native vegetation						Law protecting native vegetation
	Mechanisms	Legislation that requires the restoration of native vegetation is understood and fulfilled						Law protecting native vegetation
	e. Culture	A cultural connection exists with the native vegetation						Raising awareness (7.1.1)
		National recognition desired						Raising awareness (7.1.1)
	a. Ecological Conditions	Soil, eater and climate conditions are adequate for the restoration of native vegetation						Rural extension (7.3.2) Research & development (7.3.4)
		Plants and animals that can impede restoration and fires are absent						Rural extension (7.3.2) Research & development (7.3.4)
		Prompt availability of propagules, seeds and seedlings						Seeds & seedlings (7.2.1)
	b. Market	Competing demands for areas suitable for restoration (for production of food, biofuels, fiber etc.) are in decline						Sustainable intensification of agriculture
		Existence of a consolidated market for products originating from restored areas					NA	Markets (7.2.2)
ling		Ownership over land and natural resources is assured						Land regularization
2. Enab	c. Legal	The policies that influence restoration are aligned						Institutions (7.2.3)
	and Political Conditions	Existing laws prohibit and/or restrict the suppression of natural vegetation						
		Existing laws that prohibit and/or restrict the suppression of natural vegetation are applied			NA			Law protecting native vegetation
	d. Social	Local communities are involved and empowered to participate in decisions about restoration actions and initiatives						Raising awareness (7.1.1)
		The local population benefits from restoration						Markets (7.2.2) Land regularization
	e. Institutional	The responsibilities for the restoration of native vegetation are clear and defined						Institutions (7.2.3)
	Conditions	Integration occurs between different governmental agencies						Institutions (7.2.3)

* The evaluation refers to the biogeographic regions of the Atlantic Forest (AF), Amazonia (AMZ), Cerrado (CER), Caaringa (CAT) and Pampas (PAM).

Legend: Success factor present Success factor partially present

Success factor absent

A	A +	Aspect Success factors		Prelin	ninary ev	Ctanta a 1 - 1 - 14 - 4		
AXIS	Aspect		AF	AMZ	CER	CAT	PAM	Strategic Initiative
		Participation of local and national leaders						Raising awareness (7.1.1)
	a. Leaders	Existence of long-term political commitments						Raising awareness (7.1.1)
		Existence of knowledge about restoration of native vegetation						Research & development (7.3.4)
ing	b. Knowledge	Transfer of knowledge between peers and through technical assistance and rural extension						Rural extension (7.3.2)
nplement	c. Techniques and methodologies	The techniques and methodologies are sound and adapted to changing conditions (e.g., climate change)						Research & development (7.3.4)
3. I	d.Financial	Positive financial incentives are greater than negative financial incentives						Financial mechanisms (7.3.1)
	incentives	Access to financial incentives and other financial resources is facilitated						Financial mechanisms (7.3.1)
	e. System of results monitoring	Existence of an effective monitoring and evaluation system						Spatial planning and monitoring (7.3.3)
		Successful cases of restoration are divulged						Spatial planning and monitoring (7.3.3)

* The evaluation refers to the biogeographic regions of the Atlantic Forest (AF), Amazonia (AMZ), Cerrado (CER), Caaringa (CAT) and Pampas (PAM).



Por ordem do

da República Federal da Alemanha











Execution





MINISTÉRIO DO MEIO AMBIENTE CASA CIVIL

