WWF

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FUNDACIÓN VIDA SILVESTRE ARGENTINA

STATE OF THE ATLANTIC FOREST

Three countries, 148 million people, one of the richest forests on Earth

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WWF is one of the world's largest and most experienced independent conservation organizations, with over 5 million supporters and a global network active in more than 100 countries.

WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.

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Vida Silvestre is an independent non-governmental organization that was created in 1977 in Argentina. Its mission is to promote solutions for environmental conservation, sustainable use of natural resources and responsible behaviour in the context of climate change.

Since 1988 Vida Silvestre has been associated and has represented WWF in Argentina.
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FOREWORD

The Atlantic Forest is an ecoregional complex of remarkable biodiversity, high plant and animal endemism and a great cultural blend of people from various parts of the world. As it crosses Argentina, Brazil and Paraguay, the Atlantic Forest houses several languages, being the most common Spanish, Portuguese and Guarani. This ecoregion is also characterized by the diversity of political and economic systems and forests with different levels of degradation.

WWF began its conservation efforts in the Atlantic Forest of Brazil in 1995, driven by the identification of several endemic species. Despite its high endemism, this ecoregion had undergone rapid and continuing deforestation, where the main focus was to give way to the development of agriculture and livestock. In Paraguay, this process began in the 1960s and up to 2001 these forests were considered an obstacle to development, as stated in Paraguay´s Agrarian Statute. Changes in land use in Eastern Paraguay were mainly fomented by the increase of international markets for large-scale export of raw materials such as meat, soybeans and cotton.

In Argentina, the change in land use was slower and less noticeable. Agriculture and cattle raising were concentrated in the Pampas and Chaco regions, while Misiones – the province that houses the Atlantic Forest– was marginal to the national economy. Nowadays, the transformations in this region are due to several causes: small- and large-scale agriculture as well as production activities displaced from the central regions, mainly livestock raising.

In 2000, WWF together with Fundación Vida Silvestre Argentina created the tri-national Atlantic Forest program under its Ecoregion Based Conservation Initiative. Within this initiative, WWF scientists had identified, worldwide, ecoregions of high value for biodiversity that were endangered due to the alarming transformation of their natural habitats.
The Atlantic Forest of Brazil, Paraguay and Argentina was identified as one of those ecoregions where WWF would focus its conservation efforts to implement conservation measures, creating partnerships with public sector, academy and civil society.

The tri-national team has clearly demonstrated a strong commitment to the Atlantic Forest's sustainable development. Many people have worked on this program and dedicated long hours over several years struggling with the huge challenges of deforestation and degradation. WWF is currently focusing its conservation work in collaborating with "The Global Goals for Sustainable Development 2030", organizing it around six practices: Forest, Wildlife, Water, Oceans, Food, Climate and Energy. It is committed to work with governments and private companies to face the great challenges ahead.

The State of the Atlantic Forest Report summarizes 15 years of contributions, lessons learned, stories of successes and failures, as well as the initiatives that represent major milestones in implementing the conservation of nature in the ecoregion within these three countries. This work includes the contributions of institutions, organizations, donors and individuals committed to changing attitudes and behaviour towards what is held as the common good "natural forests and the numerous environmental services they provide". The work that WWF and Vida Silvestre carry out in the Atlantic Forest brings a deep understanding of what works efficiently and effectively, in order to save the last remnants of this unique and wonderful source of life and water.

Roberto Troya
LAC Secretariat VP & Regional Director

SUMMARY

Once covering nearly one tenth of the South American continent, currently the Atlantic Forest is a fragile treasure, significantly reduced in its extension and scattered in hundreds of thousands of fragments. While it remains one of the most diverse, rich and distinct forests on Earth, it will require an enormous effort from society to ensure its continuing existence for the coming generations.

Composed of tropical and subtropical rainforests, the Atlantic Forest is actually a complex of 15 terrestrial ecoregions, which originally covered 1,345,300 km^2. This ecoregional complex stretches along more than 3,300 kilometres of the Brazilian Atlantic coast, and inland to the west, almost 1,000 kilometres from the ocean, reaching north-eastern Argentina and eastern Paraguay.

The lands originally covered by the Atlantic Forest are today predominantly a human-modified landscape, retaining 16.8 per cent of their original forests. The forest landscape is presently a combination of a few large old-growth forest tracts and many small and medium sized fragments, with varying levels of disturbance. Secondary forest patches, recovering from land abandonment, also add to the forest dynamic.

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The Atlantic Forest possesses not only an extraordinary diversity of species, but also an exceptionally high number of endemic species. This noteworthy biological richness coexists with a highly concentrated human population, particularly in Brazil. The Atlantic Forest is one of the best studied tropical biota, thus a valuable source of knowledge on these complex biological systems. The importance of this ecoregion for global biodiversity is extraordinary: 7 per cent of the Earth's plant species and 5 per cent of the vertebrate species are found in the Atlantic Forest; 443 species of trees were recorded in just one hectare of Atlantic Forest; 3 to 12 million species of unknown bacteria are estimated to live in Atlantic Forest's trees. About a third of South America's human population lives in the Atlantic Forest

ecoregion, with more than 148 million people living in the area. The average human population density in the Atlantic Forest is 110 people/km^2, almost twenty-five times the density of the Amazon ecoregion. Two of the 30 largest cities in the world – Sao Paulo and Rio de Janeiro – are located in the heart of the Atlantic Forest. The human population has not yet stabilized in the ecoregion, as the three countries show positive population growth trends. These facts emphasize the heavy human pressure on the Atlantic Forest´s biological resources and ecosystem services.

THE ATLANTIC FOREST NOW

This report describes the current state of the Atlantic Forest ecoregion, evaluating a series of ecological indicators used by WWF and Fundación Vida Silvestre Argentina to monitor the changes that are occurring in the ecoregion.

How much of the original Atlantic Forest is left? In 2014 forests covered an area of 226,124 km^2, which represents 16.8 per cent of the original - or pre-colonial - ecoregional extent, according to the last national native forests surveys conducted by the three countries (Brazil, Argentina and Paraguay). The number reported in this document has replaced the previous value of 7.4 per cent reported in the Biodiversity Vision for the Upper Paraná Atlantic Forest Ecoregion, as more in-depth analysis on forest cover has been conducted by the three countries.

How is the remaining Atlantic Forest distributed? The analysis conducted in the Upper Paraná and Serra do Mar ecoregions – which are the two focal areas of WWF and Vida Silvestre´s work - shows highly fragmented forests. Core forests, the areas of forest best preserved from the negative effects of isolation and edge conditions, occupy only 3 per cent of the total domain of these two ecoregions (an area of 590,900 km^2, combining both focal ecoregions). Edge forests cover 4 per cent of the landscape. Isolated forest patches are scattered throughout the ecoregions and occupy 6 per cent of the total landscape. They add up to more than 20,000 fragments, and around 70 per cent of them have less than 1 km^2.

How much of the original Atlantic Forest is protected? A total area of 109,783 km^2 of the Atlantic Forest ecoregional complex is under some type of protection, which represents 8.2 per cent of the land in the domain. Only 2.8 per cent holds a strict protection status, while 5.4 per cent falls in the sustainable use class. The total number of protected areas officially registered in 2015 was 915. Between the years 2000 and 2015 the three countries that share the ecoregion have made significant efforts and achieved an increase of more than 20 per cent in the total protected area – either strict protection or sustainable use status-, going from 86,000 km^2 to about 110,000 km^2. A total of 558 new protected areas were created.

Regarding the provision of ecosystem services, the evaluation of Upper Paraná and Serra do Mar ecoregions – forests and non-forests included - reveals that 10 per cent of their area[1] provide a high level of ecosystem services and that this provision was stable during the 2000-2014 period; they are thus considered to be healthy areas. On the other hand, the most prevalent situation, comprising 74 per

1 For methodological reasons, only 68% of the total combined area of the Upper Paraná and the Serra do Mar ecoregions were subject of this analysis.

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cent of the studied area, provided low or medium level of services and evidenced decreasing trends or no changes of provision over time, and thus are considered as degraded areas. In intermediate status, there are areas in process of degradation or recovery, which comprise 16 per cent of the studied area and represent a situation between the healthy and the degraded conditions.

Regarding the status of the Atlantic Forest´s biodiversity, it was found that many of the species, particularly the endemic ones, are threatened with extinction at different scales and intensities. However, in contrast with the massive loss of habitats - which exceeds 80 per cent of the Atlantic Forest original coverage - very few plants or animals have been recorded as extinct in the region. Although in some cases in critically small populations, almost all species are still present.

The structure of the biological communities and the functioning of ecosystems are both being impacted by two ongoing processes that have substantial consequences in the remaining Atlantic Forest: a widespread impoverishment of tree communities that leads to homogenous forests, with fewer species; and the process of defaunation. This last phenomenon is producing the so-called empty forests, either entirely lacking medium and large-sized vertebrates or sustaining them in very reduced populations.

The jaguar is an important participant in the intricate web of nature in the Atlantic Forest, acting as a top regulator of the ecosystem. Its population in the Atlantic Forest ecoregional complex is estimated at about 202 individuals, which according to one authority is less than one per cent of the population that may have existed in the region before the Europeans' arrival. The species is currently found in less than 4 per cent of the region, in 13 isolated fragments, only two of which – in the Serra do Mar and Upper Parana ecoregions - currently hold populations of more than 50 individuals. In most areas where it persists, population densities are very

low and local extinctions seem imminent. Jaguars persist in areas that still contain relatively large tracts of native forest, with low accessibility and relatively high protection and where human population density is relatively low.

THE LONG PATH TOWARDS ATLANTIC FOREST CONSERVATION

A few years after the Atlantic Forest was designated as one of the Global 200 Priority Ecoregions for Conservation in the mid-1990s, WWF and Vida Silvestre established the Atlantic Forest Ecoregional Programme in an effort to contribute securing its future. The programme was based on the understanding that in order to reach the desired conservation goals, the most effective strategies were: a) protect or recover habitats and species; b) promote a sustainable use of forest resources and a responsible production of food and commodities; and c) develop legal and financial mechanisms to secure forest protection.

In partnership with governments, companies, media, academia and other NGOs, the Atlantic Forest Ecoregional Programme has accomplished or contributed to the success of a number of shared long-term conservation goals, and after 15 years of work it reports its main achievements:

1 FORGE A PATH AWAY FROM DEFORESTATION, WORKING TO RESTORE AND REHABILITATE FORESTS IN SENSITIVE WATERSHEDS WHERE FORESTS WERE LOST.

WWF and Vida Silvestre´s forest rehabilitation and restoration work focused in eight watersheds, in the three countries that share the Atlantic Forest. To date, more than 5,300 hectares of deforested or heavily degraded lands are in the process of recovering their forest habitats, ecological processes and services. This accomplishment is part of ongoing larger-scale, multi-stakeholder forest restoration initiatives in the three countries. Considering all initiatives, more than 95,000 hectares have been restored in the Atlantic Forest ecoregion over the last nine years.

2 INCREASE FOREST AREA UNDER LEGAL PROTECTION STATUS AND SUPPORT THE EFFECTIVE MANAGEMENT OF PUBLIC AND PRIVATELY-OWNED PROTECTED AREAS.

Protected areas are one of the best-known mechanisms to conserve natural ecosystems and are core to the conservation of biodiversity and sustainable development in the Atlantic Forest. The Atlantic Forest Conservation Programme supported the creation of 23 new protected areas; boosted the impact of 22 existing parks and reserves through better management and capacity-building; enhanced financing for 33 protected areas, mostly through sales of their ecosystem services; and established or strengthened 3 networks of protected areas.

3 SECURE THE LONG-TERM SURVIVAL OF ONE ECOREGIONAL PRIORITY SPECIES, THE JAGUAR, THROUGH SCIENCE-BASED CONSERVATION PLANNING, MANAGEMENT AND PUBLIC AWARENESS.

WWF and Vida Silvestre initiated an intense effort in 2003 aimed at securing the survival of the jaguar population of the Upper Paraná cross border area of Argentina, Brazil and Paraguay, which is undoubtedly in crisis. The last field data, gathered in 2014 in the largest Argentine-Brazilian forest block, recorded an increase in density and total number of jaguars, increasing from an initial population of 43 in 2004 to an estimated 68 adult jaguars in 2014. This 60 per cent increase in population size indicates a slight recovery and offer hope for this important population.

4 MAINSTREAM SUSTAINABLE FOOD AND COMMODITY PRODUCTION IN THE ATLANTIC FOREST IN ORDER TO INTEGRATE NATURE CONSERVATION WITH HUMAN CONSUMPTION NEEDS.

The Atlantic Forest Conservation Programme promoted the introduction, development, and expansion of voluntary certifications for responsible commodity production, with the goal of increasing the area of productive lands under certification. The Forest Stewardship Council (FSC), the Bonsucro Standard, the Round Table on Responsible Soy (RTRS), and the Global Roundtable for Sustainable Beef (GRSB) were introduced and expanded in the Atlantic Forest, bringing the opportunity to change the production systems of the main commodities that cover the ecoregion: timber and pulpwood, sugarcane, soy and beef. As an example, 32 per cent of the tree plantation area in Argentina, 37 per cent in Paraguay and 67 per cent in Brazil achieved FSC certification by 2015.

5 DECREASE HIGH DEFORESTATION RATES THROUGH LEGAL LIMITATIONS TO FOREST CONVERSION (IN ARGENTINA AND PARAGUAY); AND ORGANIZE SOCIAL CONTROL OVER THE IMPLEMENTATION OF A NEW LEGISLATION THAT WEAKENS FOREST PROTECTION (IN BRAZIL).

To decrease high deforestation rates in Argentina and Paraguay, legal instruments were advocated to prevent forest conversion. In Paraguay, the Forest Conversion Moratorium or Zero Deforestation Law was approved in 2004, which has produced an 82 per cent reduction in the annual forest loss; in Argentina, the National Law for Native Forests Protection was passed in 2007, establishing prohibition of conversion for 73 per cent of the remaining forests. In Brazil, WWF organized social control over the implementation of new legislation that weakens forest protection through the Forest Code Watch Initiative.

6 SUPPORT THE ESTABLISHMENT OF PAYMENTS FOR ECOSYSTEM SERVICES (PES) AND THE REDD+ MECHANISM TO REDUCE CURRENT THREATS TO NATURE AND PEOPLE POSED BY UNSUSTAINABLE FOREST USE AND TO PRODUCE A SHIFT TOWARDS CLIMATE RESILIENCE.

Seeking to reduce the loss and degradation of their forests, the governments of Argentina, Brazil and Paraguay are advancing with the basic UN-REDD Program requirements for REDD+ readiness. The three countries have also developed legal tools to implement PES initiatives; PES projects have been rapidly multiplying in Brazil, funded by the government and other sectors, reaching about 40,000 hectares in the Atlantic Forest, including payments for private reserves. Argentina and Paraguay have new and growing examples of PES schemes, with three programmes in the Atlantic Forest of Argentina and at least three transactions completed so far in Paraguay.

WE, THE PEOPLE OF THE ATLANTIC FOREST, DECIDE ITS FUTURE

The last decade has witnessed a slowdown in the pace of deforestation in the Atlantic Forest. At the same time, many new and creative conservation tools are being put in place in an effort to protect what little is left of the natural forest and to recover it over deforested lands.

These two facts provide hope that we might be reaching a turning point, from where protection and recovery can begin to outpace loss and degradation.

However, to reach this point, urgent action is needed, and the time to act is now. Four paths are essential to secure the future of the Atlantic Forest, and to ensure a lasting flow of the ecosystem services it provides:

- Protect the large forest blocks that remain, because they represent the only opportunity to preserve the most threatened populations in the long term, as well as the ecological and evolutionary processes that sustain biodiversity.
- Conserve and integrate smaller forest fragments as elements of functional mosaics, and enhance connectivity among the larger fragments.
- Recover forests on degraded lands and re-establish the ecosystem services for people and biodiversity.
- Build sustainable and resilient landscapes that integrate large forest blocks, smaller forest fragments, recovery areas and productive lands, providing connectivity, buffering, and proper management of threatened species and the entire biota of the ecoregion.

The Atlantic Forest's people and the global community will need to work to build cross-sector consensus and change the forces that until now have mostly caused harm to the natural habitats. The tools are all there, but must be strengthened: enforcement of environmental policies, multi-sectorial integrated governance, markets oriented to sustainable goods and services, and environmentally sustainable businesses and finance.

ABOUT THIS REPORT

Once covering nearly ten per cent of the South American continent, now at the beginning of the third millennium the Atlantic Forest is a fragile treasure, significantly reduced in its extension and scattered in hundreds of thousands fragments. However, it remains one of the most diverse, rich and unique forests on Earth, and it requires an enormous effort from society to secure its existence for the coming generations.

WWF-Brazil, WWF-Paraguay and Fundación Vida Silvestre Argentina vision for the Atlantic Forest is *"to limit further species extinctions and to maintain critical environmental services by taking immediate actions to ensure the long-term viability of representative biodiversity of the Atlantic Forest"*.

Two out of the fifteen ecoregions of the complex are the focus of conservation efforts by WWF-Brazil, WWF-Paraguay and Fundación Vida Silvestre Argentina´s[2] Atlantic Forest Ecoregional Program: the Upper Paraná Atlantic Forest and the Serra do Mar Atlantic Forest. They encompass 36 and 8 per cent, respectively, of the original extension of the Atlantic Forest and combined retain 41 per cent of the remaining forest. Considering their present forest coverage and the fact that they preserve the largest forest tracks, they embody the greatest chance of the Atlantic Forest to maintain and recover biological values and ecosystem services.

In 2003 and 2006, the Atlantic Forest Ecoregional Program concluded the Biodiversity Vision for the Upper Paraná Atlantic Forest Ecoregion and the Biodiversity Vision for the Serra do Mar Atlantic Forest Ecoregion, respectively. Those two central documents gave shape to the subsequent work of the program, and allowed the establishment of fruitful partnerships to tackle the immense challenge of the conservation work in the Atlantic Forest. Year 2015 marked the celebration of one and a half decades of the Atlantic Forest Ecoregional Program´s presence and over ten years since the publication of the first Biodiversity Vision. It was the time to reassess the state of the ecoregion and to review the impact of the program's conservation actions.

In this report, updated information on the status of the Atlantic Forest is presented at two different scales: some analyses are provided for the entire Atlantic Forest ecoregional complex, including all of its 15 ecoregions, while others are presented exclusively at the scale of the two focal ecoregions of WWF and Vida Silvestre conservation program.

In Part 1 the report describes the current state of the Atlantic Forest ecoregion, presenting a series of ecological indicators that are used by WWF and Vida Silvestre to monitor the changes that occur in the Atlantic Forest. Several of these indicators were estimated for the first time for this report and will be set as baselines to evaluate changes in the future.

In Part 2 the report presents an account of relevant conservation actions and impacts that have occurred since the ecoregional program was established. Some

2 Hereafter WWF-Brazil and WWF-Paraguay are mentioned simply as WWF, and Fundación Vida Silvestre Argentina, a WWF associate organization, as Vida Silvestre.

of them were led by WWF and Vida Silvestre in partnership with several other institutions. Others were very ample initiatives in which WWF and Vida Silvestre were part of large teams behind a common goal. Finally, we report some local-scale projects that were deployed in the field by staff and resources of the WWF and Vida Silvestre Atlantic Forest programme alone. Even though their scale impact is smaller, they either constitute pilot experiences, reach particularly vulnerable beneficiaries, or allow building capacities for future partnerships.
With this report, WWF and Vida Silvestre seek to:

- Assess the current status of the Atlantic Forest ecoregional complex, and of particular focal ecoregions, using a series of five ecological indicators.
- Contribute with updated information on the ecoregion that can help governments, the conservation community, companies and society in general to better understand patterns and processes occurring in the ecoregion.
- Highlight again the continuous environmental crisis of the Atlantic Forest, a place where people's concern and society's resources must produce a large scale impact for conservation in the coming years.
- Provide examples of constructive solutions for an ecoregion in crisis, as well as inspiration for future positive developments in conservation and sustainability.

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INTRODUCTION

THE BIOLOGIST NORMAN MYERS COINED THE TERM **HOTSPOT** TO DENOTE 25 DIMINUTIVE REGIONS OF THE EARTH THAT ARE BOTH MARVELOUS **CENTERS OF BIODIVERSITY** AND ALARMINGLY IMPERILED BY HUMAN ACTIVITIES. CONCENTRATED STRONGLY BUT NOT EXCLUSIVELY IN THE TROPICS, THESE HOTSPOTS SUSTAIN UP TO **HALF OF THE PLANET'S BIOLOGICAL DIVERSITY** IN JUST OVER 1% OF ITS LAND AREA. **FEW HOTSPOTS ARE HOTTER THAN THE ATLANTIC FOREST.**

William F. Laurance[3]*, 2008*

THE ATLANTIC FOREST HAS BEEN DECLARED:

- One of the eight hottest hotspots for conservation priorities (Myers et al., 2000)
- A Global 200 Priority Ecoregion for Global Conservation (Olson and Dinerstein, 2002)
- One of the World's 10 Most Threatened Forest Hotspots (by Conservation International in 2011)
- One of the World´s 11 Major Deforestation Fronts - with Gran Chaco (by WWF in 2015)
- A UNESCO MAB Biosphere Reserve - Brazilian share (by the UNESCO MAB Programme in 1993 and 2009)

Magnificent trees with enormous trunks and beautiful foliage, a rich variety of smaller plants that grow beneath their canopy, such as smaller trees, shrubs, epiphytes and vines; a myriad of animal pollinators, dispersers, predators, and scavengers of the most varied taxonomic groups; an intricate and complex fabric of interactions that connect these elements...the Atlantic Forest of South America is one of the most breathtaking places on Earth.

Composed of tropical and subtropical rainforests, the Atlantic Forest is actually a complex of 15 terrestrial ecoregions (Figure 1), which originally covered 1,345,300

3 William F. Laurance is a renowned multi-award winner scientist and active conservation advocate, who has been involved in numerous conservation initiatives worldwide. He is founder and leader of the Alliance of Leading Environmental Researchers & Thinkers (ALERT).

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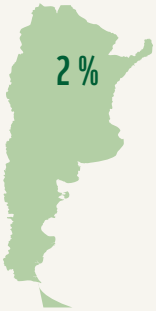
km². [4] The ecoregional complex stretches along more than 3,300 kilometres of the Brazilian Atlantic coast, and to the west inland, almost 1,000 kilometres from the sea, reaching northeast Argentina and eastern Paraguay. Along the Brazilian coast the Atlantic Forest ranges from close to the Equator (3°S) to nearly the country's southern border (31°S), that is, the majority of the territory - 92 per cent - within Brazil.

The lands that were originally covered by the Atlantic Forest are today predominantly a human-modified landscape, retaining 16.8 per cent of their original forests. [5] The forest landscape is today a combination of a few large old-growth forest tracts and many small and medium sized fragments, with varying levels of disturbance. Secondary forest patches, recovering from land abandonment, also add to the forest dynamic (Joly, Metzger, & Tabarelli, 2014).

HOW WAS THE ORIGINAL FOREST DISTRIBUTED AMONG THE THREE COUNTRIES?

ARGENTINA



BRAZIL

PARAGUAY

Figure 1. *The Atlantic Forest ecoregional complex of South America. Fifteen ecoregions are recognized within the Atlantic Forest due to the vast heterogeneity of the forest communities and other types of vegetation formations (ecoregion classification follows Olson and Dinerstein, 2002)*

4 The Atlantic Forest is thought to have originally ranged from 1 to 1.5 million km². Different sources provide distinct estimations on the original size of the ecoregional complex, depending on the interpretation of its limits and coverage: 1.48 million km² in Ribeiro et al., 2009; 1.36 million km² in Fundação SOS Mata Atlântica, 1990 (only for the Brazilian fraction), among other sources.

5 This percentage was estimated using data of national surveys of native forest cover conducted by Argentina, Brazil and Paraguay in 2014. Other studies estimate the remaining forest cover – although restricted to Brazil - at 11.4% to 16.0% (Ribeiro et al., 2009) or 8.5% to 12.5% (Fundação SOS Mata Atlântica & INPE, 1993); see details on all these studies in Part 1 of this report.

WHAT MAKES THE ATLANTIC FOREST SPECIAL?

© LUIZ FERNANDO RIBEIRO

Brachycephalus frogs are minute and strongly endemic to the Southern parts of the Brazilian Atlantic Forest. Seven new species were recently discovered. Some species are restricted to only one or two mountaintops (Ribeiro et al., 2015). Brachycephalus verrucosus (in the picture) measures in average 11.35 mm.

The Atlantic Forest possesses not only an extraordinary diversity of species, but also an exceptionally high number of species endemic to the ecoregion (Mittermeier et al., 2005; Olson & Dinerstein, 2002). This incredible biological richness coexists with the significant presence of concentrated human populations within the ecoregion, particularly in Brazil. Many centuries of human occupation brought about the loss of most of the original forest cover. However, most species, even large birds and mammals, still exist in the Atlantic Forest, evidencing a remarkable resilience of its fauna amidst numerous threats (Joly et al., 2014).

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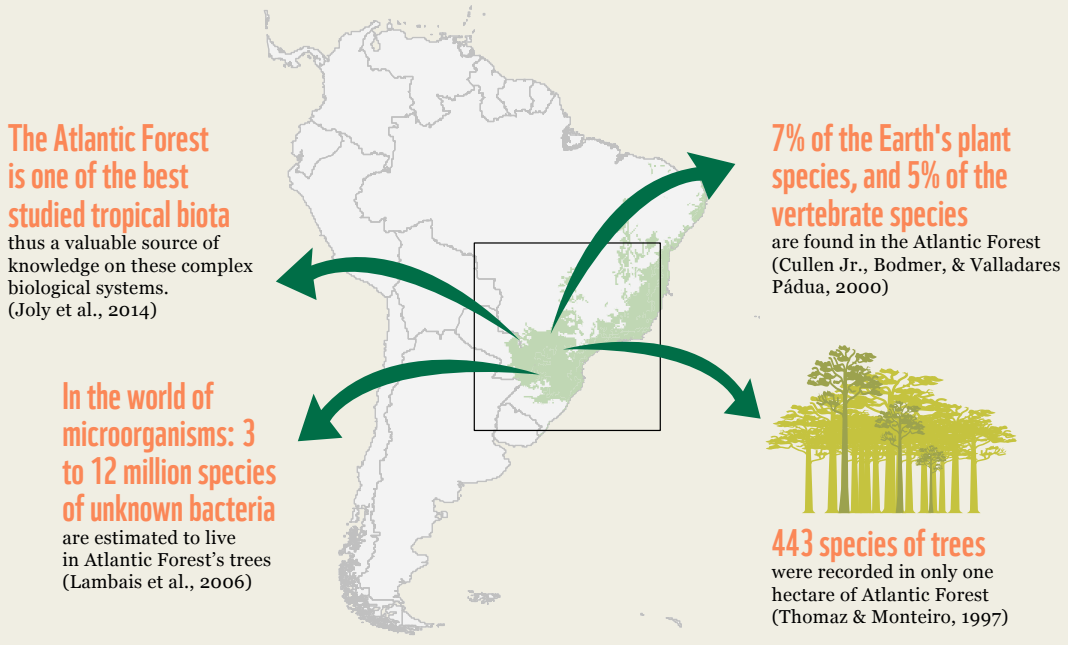
A UNIQUE BIODIVERSITY

The second highest concentration of biodiversity in the Americas is found in the Atlantic Forest, after the Amazon, although the number of species per unit of area is higher in the former (Morellato & Haddad, 2000; Thomas et al., 1998). Even though the Atlantic Forest is one of the best studied tropical forests, new species continue to be found and recorded by scientists. Since 1990 more than 30 mammal species, 9 bird species, and about 100 species of frogs have been discovered (Paglia et al., 2012; Ribeiro et al., 2015).

A handful of mesmerizing facts can provide insight into the extraordinary importance of this ecoregion for global biodiversity:



© ADRIANO GAMBARINI.

Southern muriqui (*Brachyteles arachnoides*) the largest primate of Americas. Only lives in the Atlantic Forest.

© ADRIANO GAMBARINI.

Paraná pine (*Araucaria angustifolia*) is a living fossil - dating back to the Mesozoic age - restricted to the Atlantic Forest.

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Tapir (*Tapirus terrestris*) is the largest land mammal in South America.

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The Black-fronted piping-guan (*Pipile jacutinga*) is a peculiar bird of the Atlantic Forest. It is endangered, with less than 7,000 mature individuals remaining in nature.

The forest's long north-south stretch, its irregular topography and the diverse climatic patterns, including temperature and rain, fostered the emergence of a rich diversity of flora and fauna in the Atlantic Forest.

Species diversity and endemism in the Atlantic Forest:

20,000 TREES AND SHRUBS SPECIES, 8,000 ENDEMIC
(Mittermeier et al., 2005)

MORE THAN 2,000 VERTEBRATE SPECIES LIVE IN THE ATLANTIC FOREST, OF WHICH ABOUT 30% ARE ENDEMIC
(Mittermeier et al., 2005)

298 MAMMAL SPECIES, 90 ENDEMIC
(Paglia et al., 2012)

24 SPECIES OF MONKEYS, ABOUT 80% ENDEMIC, INCLUDING 2 ENDEMIC GENERA
(Mittermeier et al., 1998; Paglia et al., 2012)

1,023 BIRD SPECIES, NEARLY 200 ENDEMIC
(Marini & Garcia, 2005)

475 AMPHIBIAN SPECIES, 286 ENDEMIC
(Mittermeier et al., 2005)

350 FRESHWATER FISHES, 133 ENDEMIC
(Mittermeier et al., 2005)

60 SPECIES OF EUGLOSSINI BEES WHICH ARE IMPORTANT CROP POLLINATORS
(Peruquetti et al., 1999)

306 REPTILE SPECIES, 94 ENDEMIC
(Mittermeier et al., 2005)

68 PALM SPECIES, 64% ENDEMIC
925 BROMELIAD SPECIES, 70% ENDEMIC
(Quintela, 1990 in Valladares-Padua, Padua, & Cullen Jr., 2002; JBRJ, 2016)

Local extinctions may have occurred across the Atlantic Forest's ecoregions, but the complex at large still has extant, although small, populations of most of the large vertebrates that existed 500 years ago when the Europeans arrived to the Americas, including jaguars (*Panthera onca*), pumas (*Puma concolor*), lowland tapirs (*Tapirus terrestris*), muriquis (*Brachyteles sp.*) and harpy eagles (*Harpia harpyja*).

THE PEOPLE

About a third of South America's population lives in the Atlantic Forest ecoregion, which comprises Brazil, Paraguay and Argentina, with more than 148 million people living in the area (Figure 2). People of European and African descent, indigenous Americans and a blend of these human groups provide a rich cultural diversity to the ecoregion. The average human population density in the Atlantic Forest is 110 people/km^2, almost twenty-five times the density of the Amazon ecoregion (4.5 people/km^2, Maretti et al., 2014). Two of the 30 largest cities in the world – Sao Paulo and Rio de Janeiro – are located in the heart of the Atlantic Forest. The human population has not stabilized in the ecoregion, as the three countries show positive population growth trends (Figure 2). These facts point out the huge human pressure on the Atlantic Forest and all its biological resources.

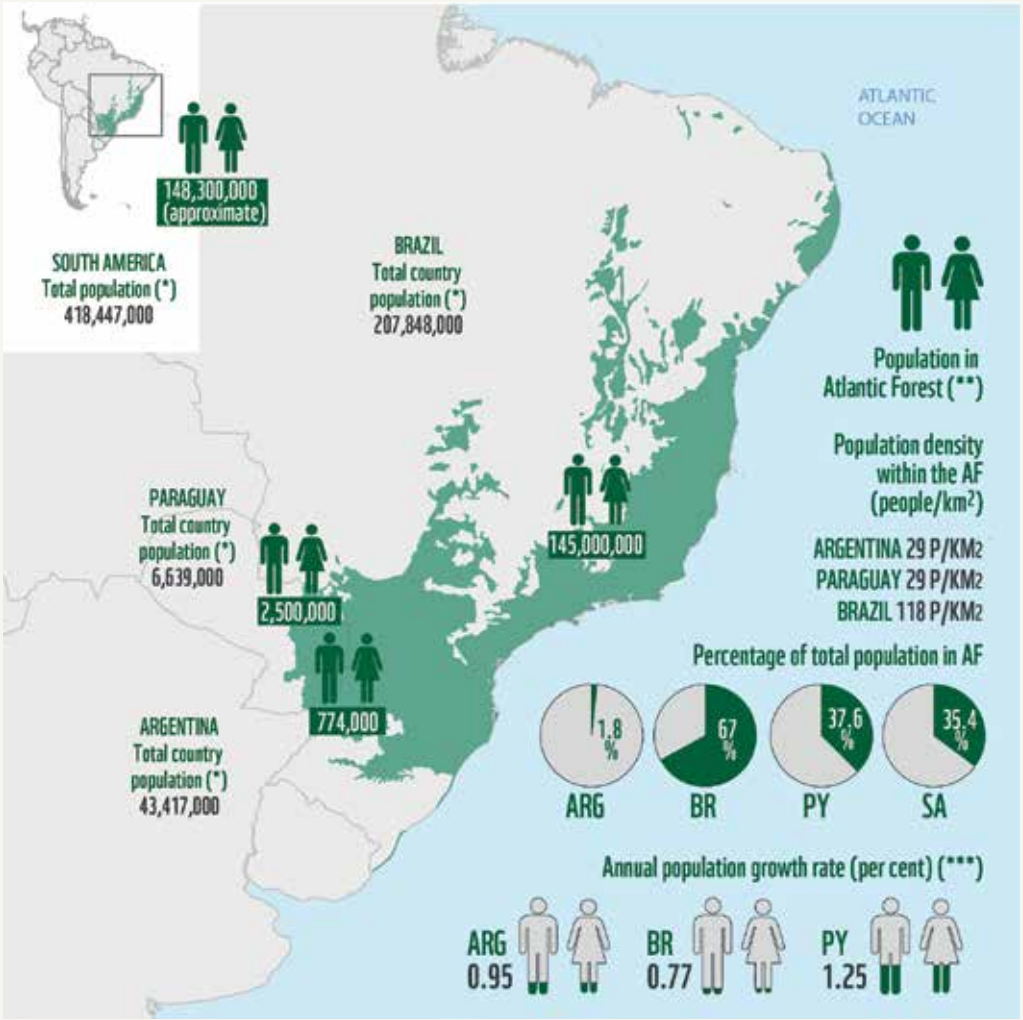

Figure 2. *The Atlantic Forest's people.*
(*) Source: United Nations Population Division: http://esa.un.org/unpd/wpp/
(**) Sources: Estimations based on sub-national data (Argentina: INDEC 2013; Brazil: IBGE 2010; Paraguay: STP and DGEEC 2012).
(***) Source: CIA 2016 (www.cia.gov/library/publications/the-world-factbook/).

WHAT DOES THE ATLANTIC FOREST DO FOR PEOPLE?

Forests contain an immensely rich natural capital, from the genetic diversity compraised in the biota, to the fine hardwood of old growth stands and the water streams formed in the forests' understorey.

While tropical forests make up less than five per cent of the Earth's land surface, they are the terrestrial ecosystem with the highest level of ecosystem services (Brandon, 2014).[6] The ecosystem services concept has an important role in the diagnosis, planning and management phases of land use policies. Many initiatives, like the Millennium Ecosystem Assessment (MEA, 2005), the Economics of Ecosystems and Biodiversity (TEEB, 2010) and the Intergovernmental Panel on Biodiversity and Ecosystem Services (Turnhout et al., 2012), promoted the use of the ecosystem services idea as a way to improve the relations between modern societies and nature.

6 Ecosystem services are defined as the aspects of ecosystems utilized - actively or passively - to produce human well-being (Boyd & Banzhaf, 2007; Fisher & Kerry Turner, 2008).

The Atlantic Forest provides the goods and services behind the economies and the wellbeing of people in one of the most populated and prosperous areas of South America. Vital ecosystem services directly sustain the livelihoods of all people living in the Atlantic Forest, as well as indirectly benefit the global human population. These services can be divided into four categories (MEA, 2005):

PROVISION SERVICES:

DRINKING WATER: most of the people that live in the Atlantic Forest - millions of urban and rural dwellers - depend on it to obtain their drinking water (Calmon et al., 2011). The Atlantic Forest also contributes to replenish the Guaraní Aquifer, one of the largest groundwater reservoirs on Earth and a main source of water supply for human consumption.

FOOD AND MATERIALS: forest habitats provide multiple resources to rural settlements, in particular indigenous people, such as wild food, traditional medicines, materials for dwelling construction, fuel, etc.

HYDROELECTRIC ENERGY SUPPLY: watersheds nurtured by forest produce hydroelectric energy; hydroelectric stations in the ecoregion generate about 62 per cent of the electricity produced in Brazil, 75 per cent in Paraguay and 60 per cent in Argentina.

SUPPORT SERVICES:

POLLINATION: Pollinators provide vital services to agriculture systems in the Atlantic Forest. The production of fruits, nuts, oil and fibre crops can increase if proper pollination occurs. In Brazil, 29 % of crops are either essentially or greatly dependent on pollinators (141 crops were analysed). The total annual contribution – at country level – of pollinators is estimated to be about one third of the dependent crop annual value, or about US$ 12 billion/year (Giannini et al., 2015).

BIODIVERSITY: core areas of large forest tracts provide the highest habitat quality for biodiversity compared to other land uses (Fundación Ambiente y Recursos Naturales & Fundación Vida Silvestre Argentina, 2010; Izquierdo & Clark, 2012).

REGULATION SERVICES:

SOIL PROTECTION: continuous forest cover retains soils, preventing soil loss, avoiding river and dam siltation, maintaining stable river levels during rainy or dry periods. In the Atlantic Forest, healthy ecosystems show high soil retention capacity, estimated to be an average of 3 tons per hectare per year (Izquierdo, De Angelo, & Aide, 2008); forest habitats protect vulnerable communities on hilly landscapes from landslides.

CLIMATE REGULATION: the forest plays a crucial role in local climate stability, as it maintains high levels of evaporation from the canopy, generates and regulates rainfalls, prevents and mitigates droughts and floods and moderates extreme temperatures. The Atlantic Forest also contributes to regulate the global climate by storing and sequestering CO2, a greenhouse gas, lowering its levels in the atmo-

sphere and reducing the greenhouse effect. One hectare of forest in the Upper Paraná ecoregion can store an average of 223.5 tons of carbon (Gasparri, Grau, & Manghi, 2008); for the Serra do Mar ecoregion the carbon stock per hectare was estimated between 320 and 460 tons, depending on elevation (Vieira et al., 2011). One hectare restored in the Atlantic Forest can remove about 13 tons of CO2 from the atmosphere per year (Calmon et al., 2011).

CULTURAL SERVICES:

Forests offer spiritual enjoyment and recreational spaces for residents and visitors. They are part of the spiritual life and traditional knowledge of indigenous communities. Tourism provides relevant income and other benefits to many villages and cities in the ecoregion.

DRIVERS OF FOREST LOSS, FRAGMENTATION AND DEGRADATION: FIVE CENTURIES OF PRESSURES ON THE ATLANTIC FOREST

The Atlantic Forest has provided resources to humans for more than 11,000 years (Dean, 1997). But it was with the arrival of Europeans to the Atlantic Forest on the coast of Brazil in 1500 that a long history of large-scale deforestation commenced, as settlements and farming spread in the area over the following centuries (Dean, 1997). The first crops to be grown in large scale in Brazil over former forestlands were sugarcane, coffee and cocoa. In the south-eastern portion of the ecoregion, in Argentina and Paraguay, the exploitation and transformation of the Atlantic Forest took place much more recently, within the 20th century, first with an intense selective logging of hardwood, and later converting forests to croplands or pastures (Cartes, 2003; Chebez & Hilgert, 2003).

As is the case in most Neotropical forests, nowadays commercial and subsistence agriculture continue to be the main direct drivers of receding forests in the Atlantic Forest. Commercial agriculture in the ecoregion includes primary commodities for global markets, mainly soybean and sugarcane. Cattle ranching and industrial forestry (Eucalyptus and Pinus plantations primarily for pulp and paper manufacture) come after agriculture in order of relevance of their impact (WWF, 2015).

HISTORIC DRIVERS: brazilwood and other hardwood extraction, yerba mate, sugar cane, coffee, cocoa, cattle.

CURRENT DRIVERS: soybean, sugar cane, pulpwood, cattle, infrastructure and urban growth.

INCOMING DRIVERS: climate change, mining.

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The previous statement holds true for the ecoregional complex as a whole. Drivers, however, are not equal and do not operate in the same way in the three countries that share the Atlantic Forest. Soybean cultivation is currently the main driver of deforestation in Paraguay. Agriculture, pulpwood plantations and cattle ranching are exerting the most pressure in Argentina's remaining forests. In Brazil, forest loss is not directly caused from farming production, but urban areas and large infrastructure (roads, pipelines and water reservoirs) are still advancing over forestlands (Lapola et al., 2013).

Most of the forests that remain, without drastic land use changes are, however, affected by two widespread phenomena that lead to ecosystem degradation: the poaching of wildlife and the extraction of timber, firewood and wood for charcoal production. These activities have a less evident result than the absence of forests, but cause a great impact on biodiversity: the defaunation of standing forests and the erosion of plant diversity (Cullen et al., 2000; Tabarelli et al., 2012).

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In addition to the existing threats to the Atlantic Forest and its people are the overarching effects of climate change, affecting biodiversity, ecosystem services, economic activities and human well-being, with impacts that are still mostly unknown.

Underlying the direct drivers of forest loss and degradation there are indirect drivers, which result from cultural, socioeconomic, political and technological processes (Kissinger, Herold, & De Sy, 2012). Some indirect driving forces that affect the persistence and integrity of the Atlantic Forest operate at an international scale, such as global population growth and the ever-increasing demand for agricultural products, beef, pulp for paper and timber in the global markets. At a national scale, the most relevant indirect drivers are inadequate government policies, poor governance, insufficient law enforcement, weak forest sector governance and institutions, frequent absence of coordination among sectors, as well as poverty and social inequality.

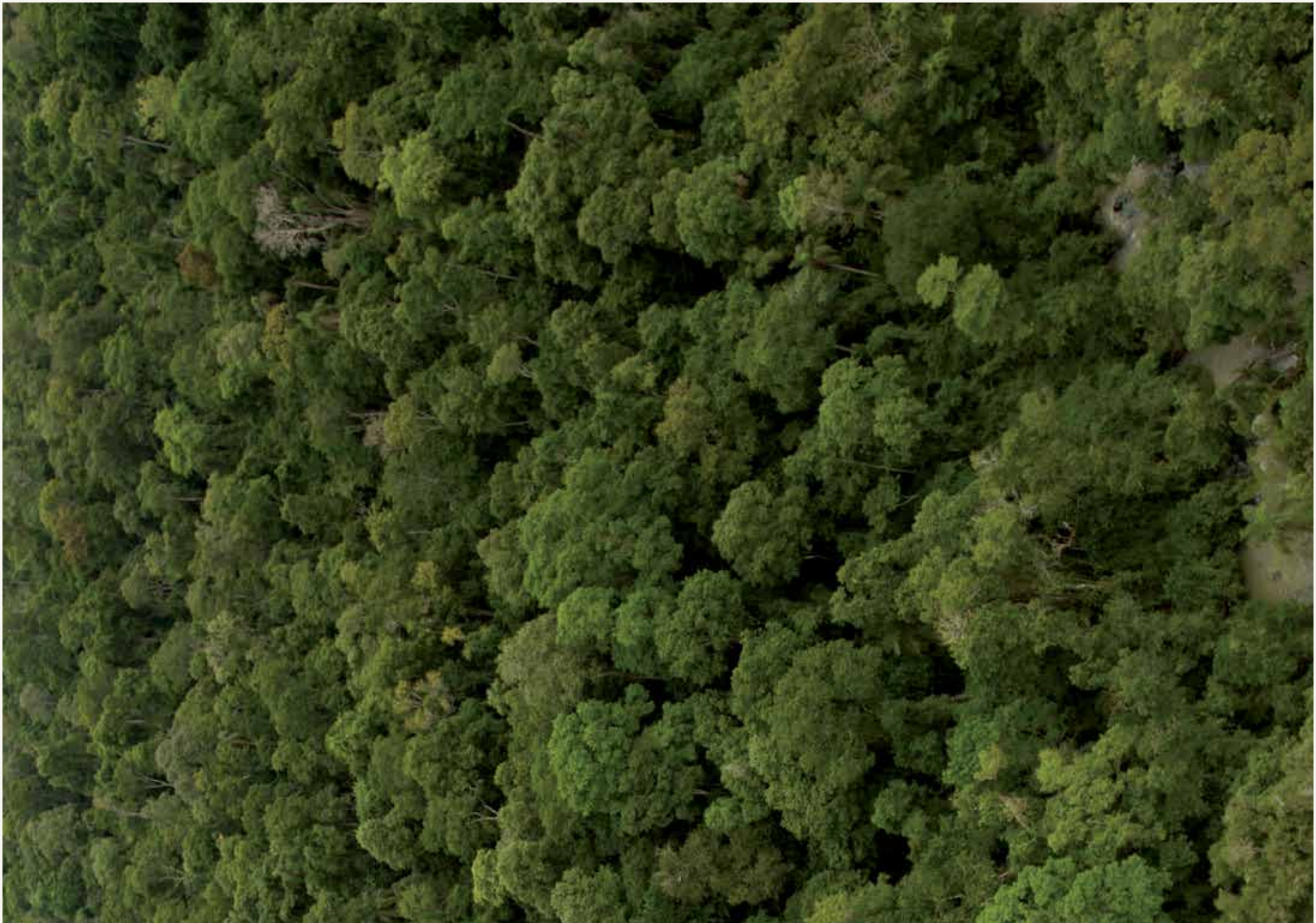
Global trends indicate that human population and global demand for agricultural products will continue to grow, as well as national economic growth of commodities markets (Kissinger et al., 2012). New pressures, such as new regional markets for commodities, increased access to financial loans, changing habits of food consumption, improvements in consumption patterns in developing societies, increasing urbanization, and climate change impacts are all to be considered when studying the future of the forests.

PART 1. THE STATE OF THE ATLANTIC FOREST

In 2003 and 2006, the analyses conducted to build respectively the Visions of Biodiversity of the Upper Paraná and Serra do Mar ecoregions of the Atlantic Forest ecoregional complex highlighted the meagre area of the remaining forest, its extreme degree of fragmentation, and the high percentage of threatened species. Holding the largest forest blocks, these two ecoregions were the best conserved of the ecoregional complex. But even still, taking the Upper Paraná ecoregion as a reference, it retained just 7.8 per cent of its original forest cover, with only 28 fragments of forests over 10,000 hectares and more than 15,000 fragments between 25 and 500 hectares (Di Bitetti, Placci, & Dietz, 2003). This worrying situation not only affected nature, but also an enormous number of people that depend on forests for their economic livelihoods and general wellbeing.

This part of the report presents data on several indicators, updated for 2014 or 2015 [7], which allows an understanding of the current state of the ecoregion: how much forest is left, its degree of protection and fragmentation, its capacity to provide ecosystem services, as well as the intensity of the threats on its biodiversity.

7 Most baseline data presented in this report refers to year 2000.



1. HOW MUCH OF THE ATLANTIC FOREST IS LEFT?

The original expanse of the fifteen-ecoregion Atlantic Forest complex, across the political borders of Brazil, Argentina and Paraguay, is estimated to be 1,345,286 km^2. In 2014 forests covered an area of 226,124 km^2, which represents 16.8 per cent [8] of the original (pre-colonial) ecoregional extent, according to the last national native forests surveys conducted by the three countries [9] (Figure 3). This area equals about five times the size of Switzerland.

Within the Atlantic Forest ecoregional complex, the distribution of remnant forests is uneven, with a few ecoregions containing most of the forest coverage (Figure 4). In general, the southern parts of the Atlantic Forest retain most of the coverage, while the northern ecoregions have suffered more intense deforestation and contribute less to the total remaining forest.

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8 The percenge of remaining forest cover reported in this document has replaced the previous value of 7.4 % reported in the Biodiversity Vision for the Upper Paraná Atlantic Forest Ecoregion, as more in-depth analysis on forest cover has been conducted by the three countries. However, this type of anaysis presents large discrepancies depending on the method used for its calculation. For example: 18.5% according to Fundação SOS Mata Atlântica & INPE, 2003), and 27% according to the Instituto de Estudos Socioambientais do Sul da Bahia (IESB), IGEO/UFRJ and UFF (2007), considering the the Brazilian share of the complex in the years 2000 and 2002, respectively.

9 The estimation of the forest coverage in 2014 results from the sum of the forest area surveyed by each country's official institutions. It is important to clarify that each country applies its own definition of forest to conduct its forest cover assessment. They have some technical complexities, but in a simplified expression: Argentina considers as forest all areas larger than 10 hectares of woodland with at least 20% canopy cover; Paraguay considers as forests all areas larger than 1 hectare of woodland with at least 30% canopy cover and Brazil uses a minimum area of 3 hectares of forest cover. In Paraguay, the UN-REDD National Programme calculated the forest coverage in 2015; therefore, the forest coverage in 2014 has been estimated using the deforestation data collected by WWF-Paraguay´s GIS Lab for the years 2014 and 2015. This value has been added to the 2015 data. This is an approximation for forest coverage as methods are different.

14,032 KM² OF FORESTS WERE LOST BETWEEN 2000 AND 2014: ABOUT 1 % OF THE ATLANTIC FOREST ORIGINAL EXTENSION

Figure 3. *Forest cover of the Atlantic Forest ecoregional complex in 2014.*
Sources: national surveys of native forests in 2014 conducted by: Unidad de Manejo del Sistema de Evaluación Forestal, Ministerio de Ambiente (Argentina); Sistema Nacional de Monitoreo Forestal, Secretaría de Ambiente e Instituto Nacional Forestal (Paraguay); SOS Mata Atlântica and INPE (Brazil).

The Upper Paraná and Serra do Mar ecoregions, combined, retain 42% of Atlantic Forest's current forest cover.

Figure 4. *Contribution of each ecoregion of the Atlantic Forest ecoregional complex to the total forest cover remaining in 2014.*

The two focal ecoregions of the WWF and Vida Silvestre Ecoregional Program, Upper Paraná and Serra do Mar ecoregions, have a combined extension of 587,315 km2. The Upper Paraná ecoregion retained 24.8 per cent of the total forest coverage left in the complex in 2014, while Serra do Mar kept 17.3 per cent of that total. Combined, both ecoregions contained 42 per cent of the existing forests.

Mostly driven by human activities, between 2000 and 2014 the total forest cover in the Atlantic Forest ecoregional complex was reduced by 14,032 km2, [10] which represented a 1.04 per cent loss of its original extension. [11] The forest continued to be lost during the 2000-2014 period in our focal areas (Figure 5), but the intensity of deforestation decreased along those years in both ecoregions. When segmenting the process in three 5-year periods, the area of forest loss in the Upper Paraná ecoregion went down markedly: during the last period (2010-2014) there was a 23 per cent decrease in the total area deforested compared to the first period (2000-2004). In the Serra do Mar region, the drop in deforested areas was also remarkable, with about 60 per cent less deforested area, on average, at the end of the reported period.

Forest loss in the Upper Paraná and Serra de Mar ecoregions

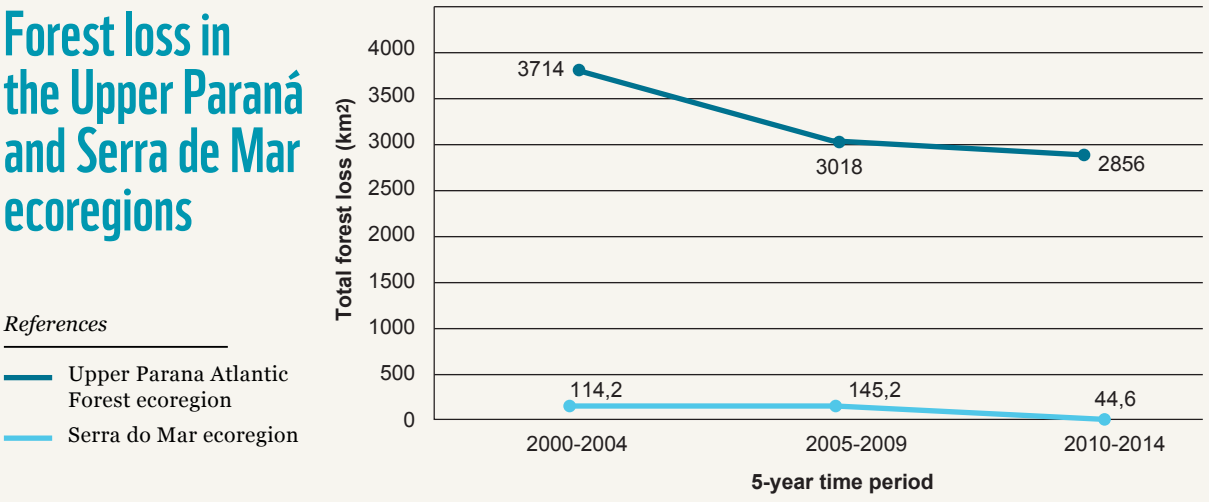

Figure 5. *Forest loss in theUpper Paraná and Serra do Mar ecoregions between 2000 and 2014.* [12]

10 Sources of deforestation data: Unidad de Manejo del Sistema de Evaluación Forestal, Ministerio de Ambiente (Argentina); Sistema Nacional de Monitoreo Forestal, Secretaría de Ambiente e Instituto Nacional Forestal (Paraguay); SOS Mata Atlântica (Brazil).

11 The original extension of the Atlantic Forest ecoregional complex was 1,345,286 km2.

12 This figure was created using secondary data from different sources, therefore the methodologies that each country applied might also be distinct. Argentina: Unidad de Manejo del Sistema de Evaluación Forestal, Ministerio de Ambiente (http://snmb.ambiente.gob.ar/portal/); Paraguay: UN-REDD National Program. Forest loss includes native forest and reforested areas (http://snmf.infona.gov.py:8091/portal/); Brazil: SOS Mata Atlantica (https://www.sosma.org.br/).

The Atlantic Forest is still under pressure, and addressing the drivers of deforestation in the region remains an imperative challenge. During the last decade and a half, WWF, Vida Silvestre, other NGOs, governments and the private sector have been conducting and supporting forest restoration programs, promoting environmental policies and law enforcement, strengthening public and private protected areas systems and market transformation among other initiatives, in order to tackle deforestation. These actions are described in Part 2 of this report. However, as shown in Figure 7, the problem remains. Further investments, aligned with social innovation and engagement, are necessary to find a way to balance economic development, forest conservation and human well-being.

2. HOW IS THE DISTRIBUTION OF THE REMAINING ATLANTIC FOREST?

Forest fragmentation [13] has been one of the most evident processes in the Atlantic Forest. Different from the vast forest blocks in the Amazon, the Atlantic Forest remains mostly in large numbers of small patches interspersed in a matrix of transformed lands (Ribeiro et al., 2009). Isolation of small forest patches creates a detrimental situation for the survival of both plant and animal populations. Most species need pristine forest as well as larger fragments to survive (Barlow et al., 2007; Harris & Pimm, 2004), and diminishment of continuous forests to fragmented ones will likely lead to the extinction of many species (Metzger et al., 2009). Fragmentation puts biodiversity and the provisioning of ecosystem services at risk (Kareiva & Marvier, 2011).

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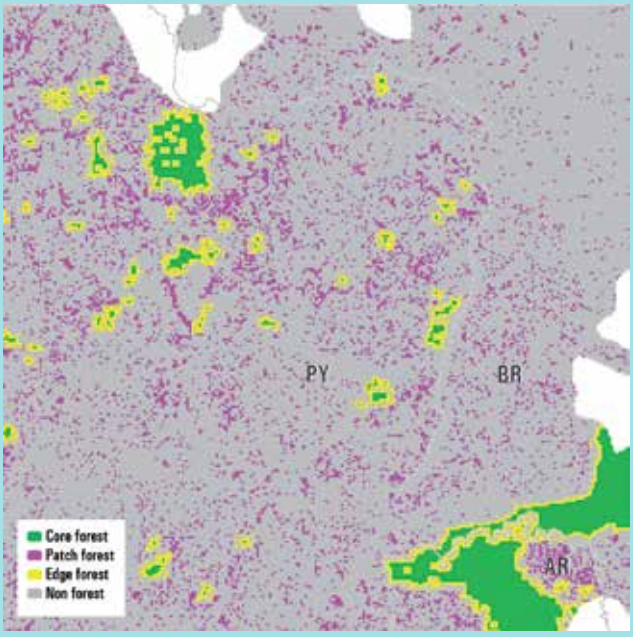
13 Fragmentation is the process of breaking up continuous habitats, thereby causing habitat loss, patch isolation and edge effects (Bogaert et al., 2011). Edge effects are the conditions that occur near the edge of a forest fragment, at the interface between the forest and the new ecosystem that surrounds it. They include changes in temperature and solar radiation, changes in species composition and introduction of exotic species, as well as changes in species interactions near the edge, such as increased rates of predation.

This section of the report presents the status of the forest landscape fragmentation observed in 2014, restricted to the two focal ecoregions of WWF: Upper Paraná and Serra do Mar. This analysis allows an understanding of the ecological role of each spot of forest that remained in 2014 – defined as a one-hundred-hectare cell - according to its spatial location in the landscape, ranging from an isolated patch to the centre of a large forested area. [14] The analysis was conducted using the methodology presented in Vogt et al. 2007 (see Box: Methodology used to determine landscape fragmentation).

Methodology used to determine landscape fragmentation

Landscape fragmentation was modeled using a pixel-level classification that allows mapping and monitoring of spatial patterns on binary land-cover maps. This analysis considered the "window size" of 3x3 = 9 km^2 to visualize the forest landscape pattern. From a matrix of forest and nonforest, the model detects three classes of forest elements: 1) **core forest,** that is forest relatively far from de forest-nonforest boundary; 2) **patch forest**, which comprises coherent forest regions that are too small to contain core forest and 3) **edge forest**, which includes the exterior boundaries of core forest regions, in direct contact with the nonforest matrix, as well as the interior boundaries with forest perforations (Vogt et al., 2007).



Example of the three classes of forest elements

14 For Paraguay, native forests and reforested areas are included in the analysis.

The highly fragmented condition of Upper Paraná and Serra do Mar ecoregions is evident in the representation of the forest categories in the landscape matrix. Core forests, the areas of forest best preserved from the negative effects of isolation and edge conditions, are concentrated in the coastal region of the Serra do Mar ecoregion, and in the tri-national border of the Upper Paraná ecoregion (Figure 6). This category of landscape occupies only 3 per cent of the total domain of these two ecoregions. [15] Patch forests are scattered throughout the ecoregions and occupy 6 per cent of the total landscape, showing no particular pattern of distribution. Edge forests cover 4 per cent of the landscape (Figures 6 and 7).

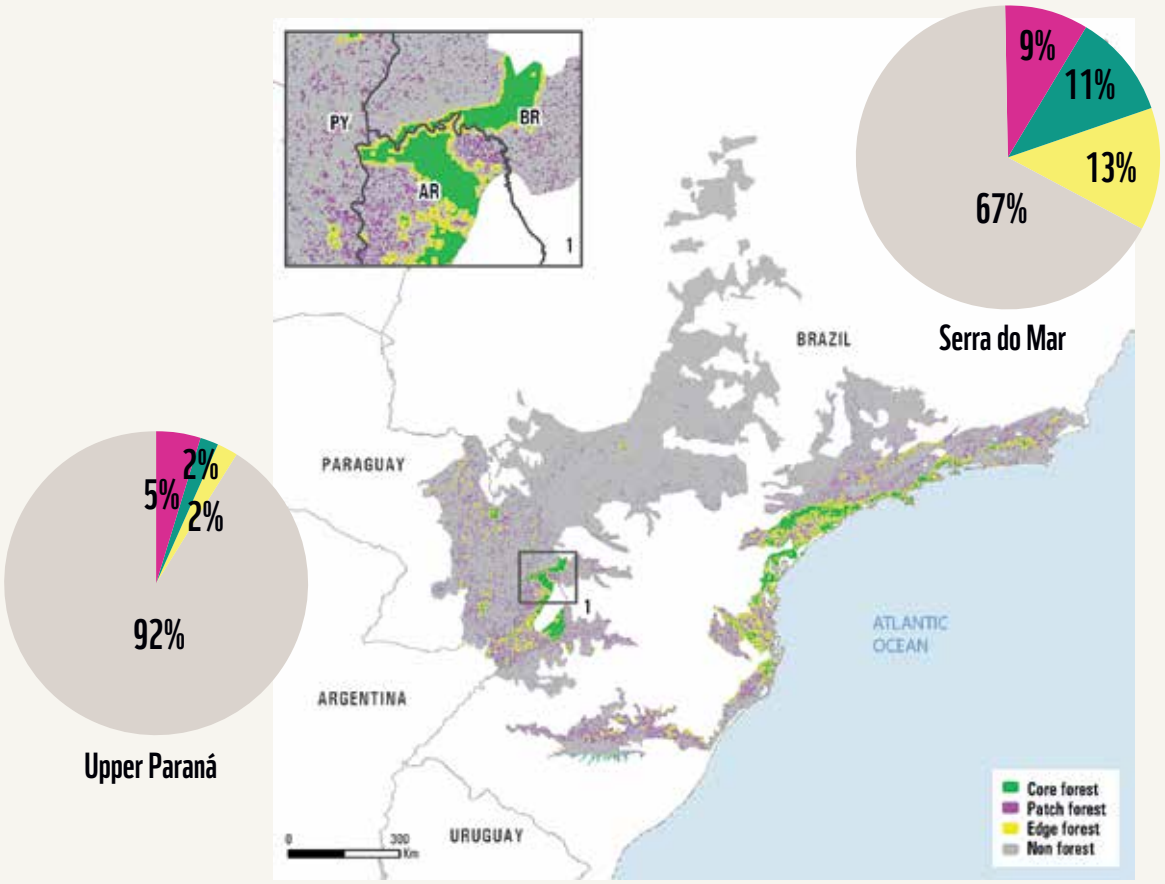


Figure 6. *Distribution of core forests, patch forests and edge forests in Upper Paraná and Serra do Mar ecoregions of the Atlantic Forest ecoregional complex. The inner box highlights the tri-national border area between Argentina, Brazil and Paraguay.*

The core areas of forest, which represent 3 per cent of the whole landscape in the Upper Paraná and Serra do Mar ecoregions, are dispersed in 371 separated fragments (124 in Upper Paraná and 247 in Serra do Mar), considering areas larger than 10 km² (or 1,000 hectares). As expected, most of these fragments are in the lower size range (from 10 up to 100 km²) and very few are large core areas above 1,000 km² (Figure 8).

15 The total area analysed for Upper Paraná and Serra do Mar Atlantic Forest ecoregions combined, using a forest/non-forest matrix, was 590,900 km².

CORE FORESTS, THE AREAS OF FOREST BEST PRESERVED FROM THE NEGATIVE EFFECTS OF ISOLATION AND EDGE CONDITIONS, OCCUPY ONLY 3% OF THE TOTAL DOMAIN OF UPPER PARANÁ AND SERRA DO MAR ECOREGIONS.

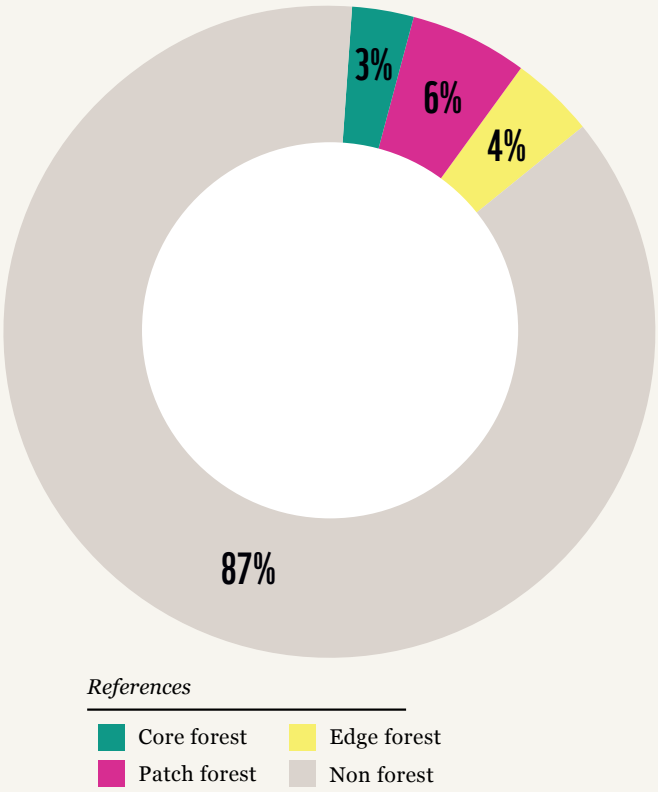


Figure 7. *Percentage of total area of Upper Paraná and Serra do Mar ecoregions (combined) covered by each category of forest landscape element in 2014.*

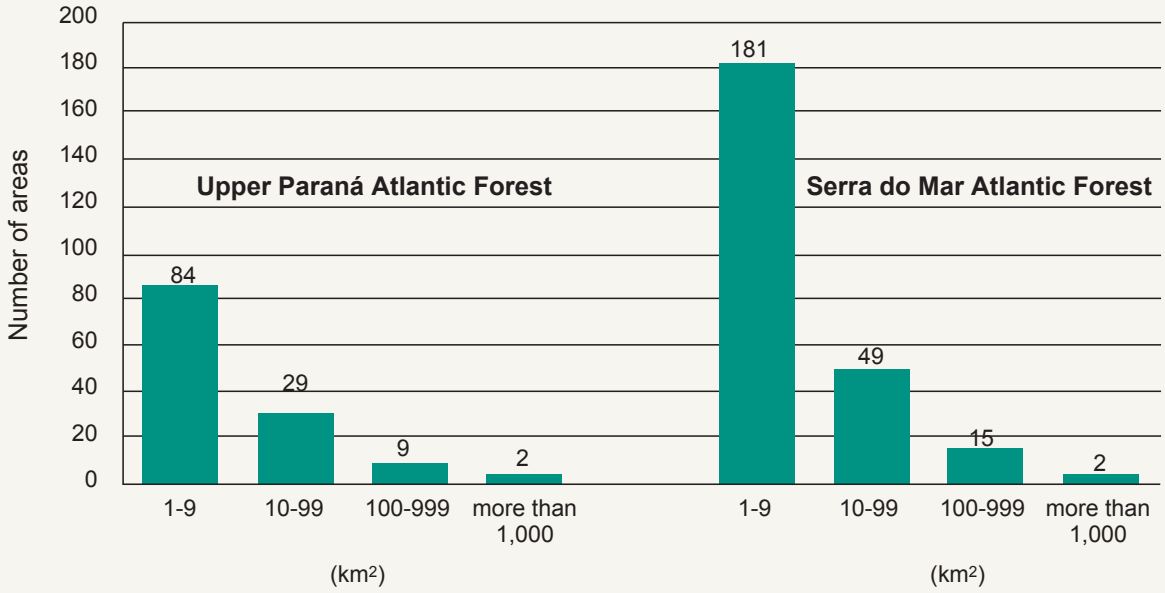


Figure 8. *Size of the forest core areas within the Upper Paraná and Serra do Mar Atlantic Forest ecoregions. Columns indicate the total number of core areas in each size range (fragments smaller than 1 km² were excluded).*

The isolated forest patches (patch forest elements of the analysis), which represent 6 per cent of the whole landscape in the Upper Paraná and Serra do Mar ecoregions, add up to more than 20,000 fragments, 78 per cent of them in the Upper Paraná. Around 70 per cent of the fragments have less than 1 km2 (Figure 9).

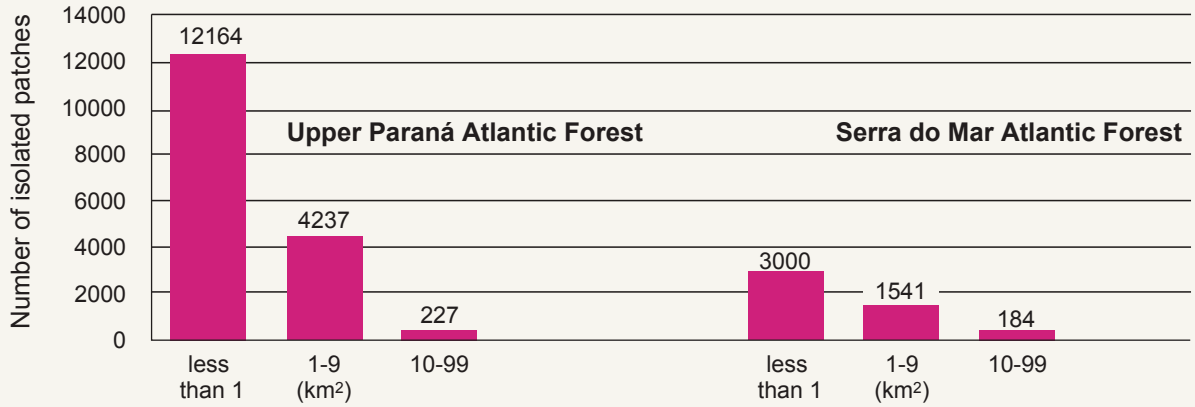


Figure 9. *Size of the isolated patches of forest within the Upper Paraná and Serra do Mar Atlantic Forest ecoregions. Columns indicate the total number of fragments in each size range.*

IN THE ATLANTIC FOREST A SHARP PREDOMINANCE OF SMALL ISOLATED PATCHES PERSISTS OVER LARGER TRACTS OF FOREST, LEADING TO LOSS OF BIODIVERSITY, ALTERED FOREST ECOSYSTEM FUNCTIONING AND STABILITY, AND DIMINISHED FOREST ECOSYSTEM SERVICES FOR HUMAN WELL-BEING.

The degree and impacts of forest fragmentation need to be well understood to develop effective conservation programs (Bogaert et al., 2011; Kareiva & Marvier, 2011), as fragmentation leads to loss of biodiversity, altered forest ecosystem functioning and stability, and hence diminished forest ecosystem services for human well-being. In the Atlantic Forest a sharp predominance of small isolated patches persists over larger tracts of forest. The latter are the ones needed to sustain viable populations of large vertebrates as well as ecological and evolutionary processes. Initiatives that include a landscape approach need to be carried out to restore the functionality of forest ecosystems and stop their degradation.

3. THE STATE OF PROTECTION IN THE ATLANTIC FOREST

According to IUCN's assessments on the Red List of Ecosystems, approximately 55 per cent of the remaining Atlantic Forest ecosystems are considered critically endangered, 36 per cent endangered and 9 per cent vulnerable (IUCN 2014).

Protected areas [16] are one of the most effective ways known so far to protect natural ecosystems (Butchart et al., 2012; Geldmann et al., 2013; Joppa & Pfaff, 2010). Well-implemented protected areas not only play their essential role of halting biodiversity loss, but they also provide ecosystem services and economic benefits for people, from local to global scales (Watson et al., 2014).

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THE ATLANTIC FOREST ECOREGIONAL COMPLEX HAS 915 OFFICIALLY REGISTERED CONSERVATION UNITS, COMPRISING 8.2% OF ITS DOMAIN.

The Atlantic Forest ecoregional complex has a total area of 109,783 km^2 under some type of protection, which represents 8.2 per cent of the land in the domain (Figure 10). The total number of conservation units officially registered in 2015 was 915.

16 According to the International Union for Conservation of Nature (IUCN), a protected area is described as a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.

NUMBER OF PROTECTED AREAS IN EACH COUNTRY:

ARGENTINA
63

BRAZIL
818

PARAGUAY
34

TOTAL
915

Figure 10. *Distribution of protected areas in the Atlantic Forest ecoregional complex in 2015. Both strict protection and sustainable use categories of protected areas are included.* Sources: Argentina: National System of Protected Areas (SIFAP) and Misiones' Ministry of Ecology and Natural Renewable Resources (MEyRNR); [17] Brazil: National Census of Conservation Units, Ministry of Environment; [18] Paraguay: National System of Protected Areas (SINASIP). Exclusively marine protected areas were excluded.

Some of the protected areas in the Atlantic Forest are of great visibility and prominence, as are the UNESCO World Heritage Sites Iguazú National Park in Argentina and Iguaçu National Park in Brazil, both located along each side of the Iguazu River and sharing the protection of one of nature's great wonders, the Iguazú Falls. Moreover, a group of five protected areas in the Serra do Mar [19] ecoregion have been highlighted as highly irreplaceable in a global irreplaceability analysis (Le Saout et al., 2013). Also remarkable are the Mbaracayú (Paraguay) and the Yaboty (Argentina) Man and Biosphere (MAB) Reserves, home to Mbyá Guaraní and Aché indigenous communities. There are also a few protected areas, which are the core of the last large fragments of Atlantic Forest, still maintaining populations of large mammals such as tapirs (*Tapirus terrestris*) and jaguars (*Panthera onca*).

17 http://www2.medioambiente.gov.ar/sifap/default.asp and http://www.ecologia.misiones.gov.ar/ecoweb/index.php/anp-descgen

18 http://www.mma.gov.br/areas-protegidas/cadastro-nacional-de-ucs

19 The five irreplaceable areas are: Serra do Mar State Park, Serra do Mar State Environmental Protection Area, Atlantic Forest Southeast Reserves, Itatiaia National Park and Serra da Mantiqueira Environmental Protection Area.

3.1. ECOREGIONAL REPRESENTATION WITHIN PROTECTED AREAS

One of the challenges that the Atlantic Forest ecoregional complex faces is the uneven protection of natural resources across its 15 ecoregions (Figure 11). This situation threatens species and ecological communities, as some of them might be underrepresented in the existing systems.

In 2015, three of the fifteen ecoregions - Araucaria moist forests, Bahia interior forests and Pernambuco interior forests – only protected less than 5 per cent of the presently existing native forests. On the other hand, five ecoregions have an area under protection that surpasses a quarter of their forests (Ilha Grande mangroves, Serra do Mar coastal forests, Campos Rupestres montane savanna, Caatinga Enclaves moist forest and Bahia mangroves ecoregions protect, respectively, 67 per cent, 38 per cent, 29 per cent, 28 per cent and 26 per cent of their total areas). (Figure 11).

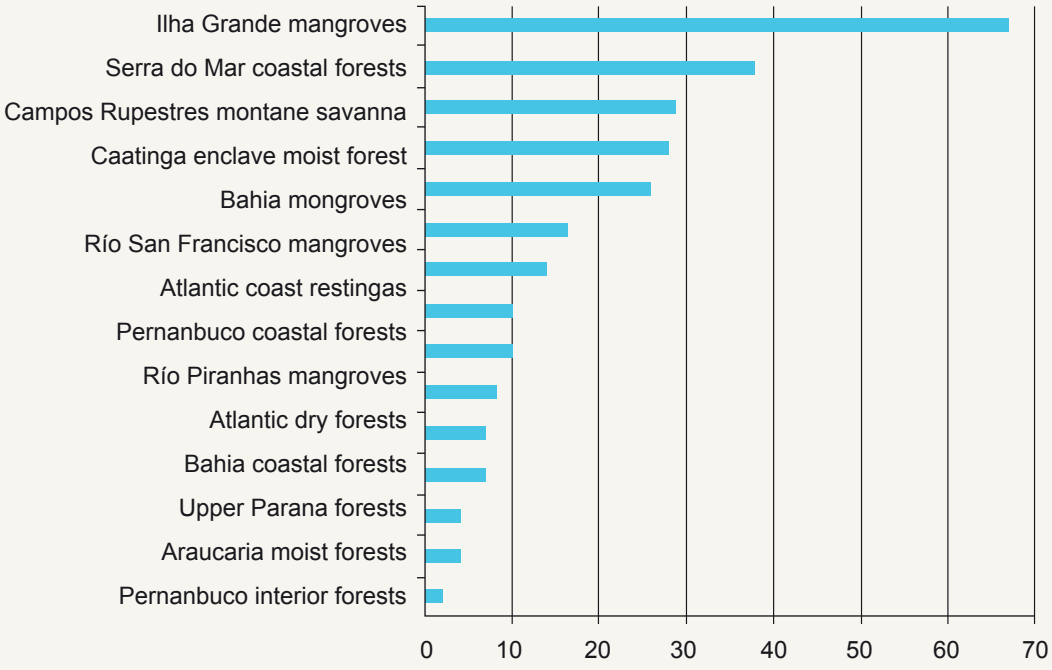


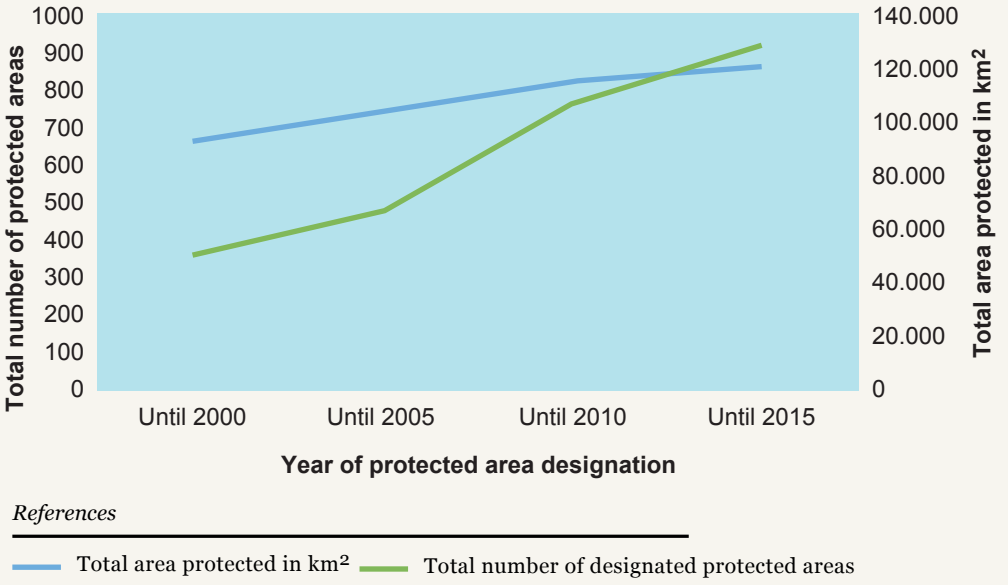
Figure 11. *Percentage of each Atlantic Forest ecoregion´s remnant forests protected in 2015.*

3.2. EVOLUTION OF THE FOREST PROTECTION

Between 2000 and 2015 the three countries that share the ecoregional complex have made an effort to conserve some of the most important ecosystems within the Atlantic Forest ecoregional complex, and achieved an increase of more than 20 per cent in the total area with protection status (Figure 12). The size of the total protected land increased from 86,000 km^2 to about 110,000 km^2, reaching 8.2 per cent of the original Atlantic Forest expanse under either strict protection or sustainable use protection status. [20] A total of 558 new protected areas were

20 While IUCN defines six categories of protected areas, for the analysis in this report those categories were combined into two: strict protection, that includes areas with limited use set aside to protect biodiversity, and sustainable use, that includes some type of natural resources management (corresponding to IUCN Management Categories IV to VI).

created, including private reserves. While the area increased by about one fifth, the number of conservation units almost tripled, as larger tracts are becoming less available, increasing the protection achieved through smaller areas.



11 MILLION HECTARES CURRENTLY PROTECTED. MORE THAN 2 MILLION HECTARES WERE ADDED TO THE PROTECTED AREA SYSTEMS SINCE 2000.

Figure 12. *Growth of the total area protected in the Atlantic Forest ecoregional complex (2000-2015), considering the number and area of conservation units.*

Focusing on each country, during that period Paraguay produced a 162 per cent increase of its protected area system in the Atlantic Forest, while Brazil incremented 27 per cent and Argentina 7.6 per cent, compared to what was protected just before year 2000 (Figure 13A). These increases inversely relate to the proportion of Atlantic Forest protected in each country, with Argentina having under protection about 18 per cent of what was originally present in the country, Brazil reaching about 8 per cent and Paraguay a little more than 3 per cent (Figure 13B).

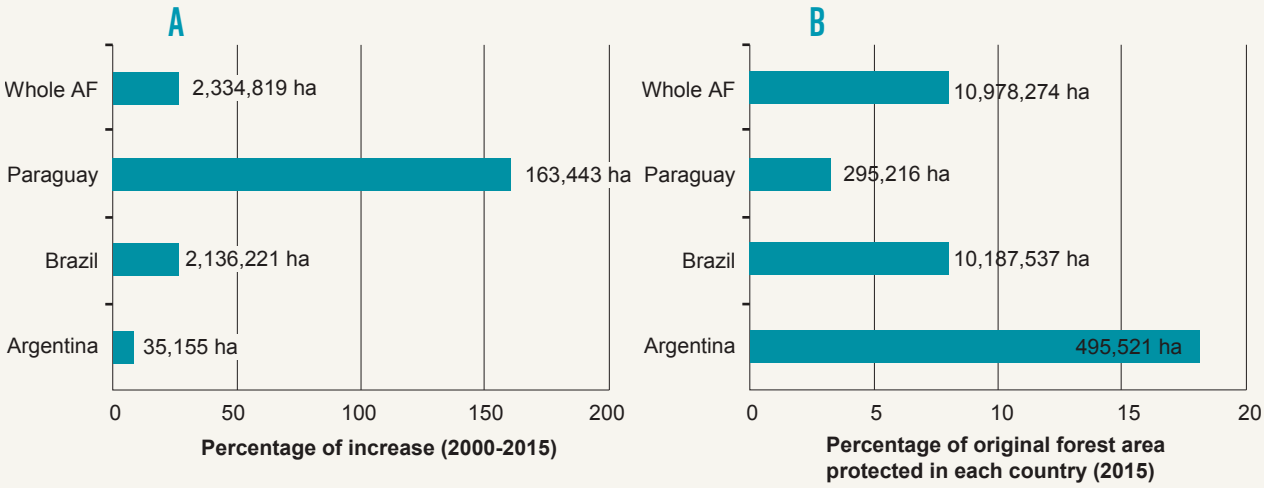


Figure 13. *The percentage of increase of the Atlantic Forest area under protection in each country, from year 2000 to 2015 (A), and the percentage of the original area of Atlantic Forest in each country currently under protection (B). Numbers indicate the area newly protected, in hectares (A) and total area currently protected, in hectares (B).*

3.3. ARE THE ATLANTIC FOREST PROTECTED AREAS WELL PROTECTED?

ONLY NEARLY 30 PER CENT OF THE TOTAL PROTECTED AREA IN ATLANTIC FOREST HOLDS TODAY A STRICT PROTECTION STATUS.

Although the total lands located in protected areas cover 8.2 per cent of the Atlantic Forest domain, it is very important to distinguish between strict protection and sustainable use protection categories, as they entail different impacts on biodiversity conservation. Sustainable use protected areas allow a variety of uses such as agriculture, forestry, livestock production and even urbanization; although they have an important role, especially regarding traditional communities, they do not secure full protection of the remaining forests or other natural ecosystems.

Taking the mentioned 8.2 per cent, only 2.8 per cent holds a strict protection status, while 5.4 per cent falls in the sustainable use class; that is, only nearly 30 per cent of the total protected area holds today a strict (no-take) protection status. Around half of the protected areas in Argentina (46 per cent) and Paraguay (52 per cent) are sustainable use areas, while in Brazil this category encompasses 70 per cent of the protected lands (Figure 14).

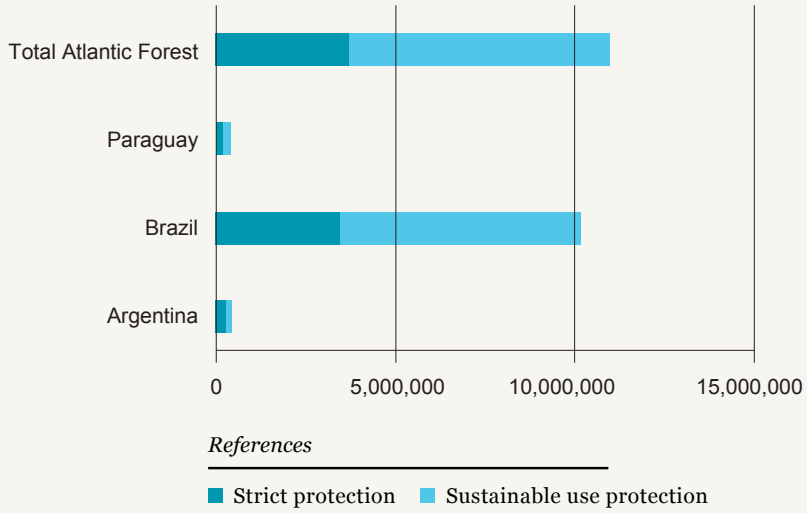
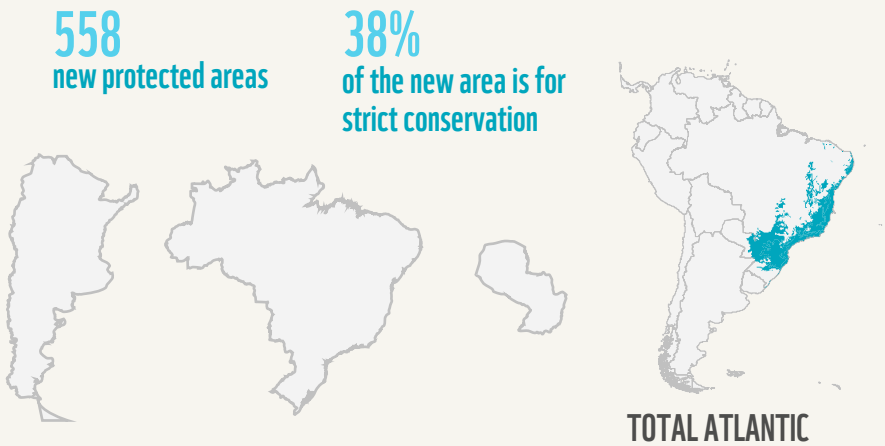


Figure 14. *Total protected area within the Atlantic Forest in each country, by management category (2015).*

In what concerns the strict protection management category, the data evidence that in the 2000-2015 period 38 per cent of the new protected areas became strict protected estate (Figure 15). Paraguay almost tripled its area under strict protection; in Argentina, the focus was overwhelmingly on the creation of strictly protected areas; and in Brazil, almost one million hectares was added to the strict protection categories.



	ARGENTINA	BRAZIL	PARAGUAY	TOTAL ATLANTIC FOREST
STRICT PROTECTION In hectares #of conservation units	27,955 18 PAs	984,931 156 PAs	32,243 2 PAs	1,045,129 (38% of total added) 176 PAs
SUSTAINABLE USE PROTECTION In hectares #of conservation units	7,200 9 PAs	1,512,790 353 PAs	156,888 20 PAs	1,676,878 (62% of total added) 382 PAs

Figure 15. *Management categories of protected areas created between 2000 and 2015. Note: data on protected area management categories show differences compared to information previously shown in this section; these differences are due to different methodologies applied by government agencies in the three Atlantic Forest countries, used as sources to produce the reported analyses.*

4. THE ATLANTIC FOREST'S ECOSYSTEM SERVICES

While tropical forests make up less than five per cent of the Earth's land surface, they are the terrestrial ecosystem with the highest level of ecosystem services (Brandon, 2014). The ecosystem services concept has an important role in the diagnosis, planning and management phases of land use policies. Many initiatives promote the use of the ecosystem service concept as a way to improve the linkages between modern societies and nature, like the Millennium Ecosystem Assessment (MEA, 2005), The Economics of Ecosystems and Biodiversity (TEEB, 2010) and the Intergovernmental Panel on Biodiversity and Ecosystem Services (Turnhout et al., 2012).

While the fact that people receive benefits from ecosystems is very well known, there are still many information gaps about the quantification, value and dynamics of ecosystem services (Daily & Matson, 2008; De Groot et al., 2010; MEA, 2005). Geographic Information Systems (GIS) have been used to quantify and

map ecosystem services by scientists like Tallis et al. (2008) who developed the Integrated Valuation of Ecosystem Services and Tradeoffs (InVest), a tool to support environmental decision-making processes. Scientists like Ayanu et al., 2012; Boyd & Banzhaf, 2007; Burkhard et al., 2012; Metzger et al., 2006; and Stephens et al., 2015 also used GIS with this purpose.

Despite the relevance of the use of the ecosystem services concept, one of the main problems is the lack of consensus in the selection of the ecosystem attributes to be analysed (Wong et al., 2015). To evaluate the status of the ecosystem services in the Atlantic Forest ecoregion in this report, the standard classification of Ecosystem Services (i.e. the four categories mentioned in the Introduction section of this report) was not used. Instead, the methodology proposed in this section helps to characterize two attributes of primary net production that represent an important portion of spatial variability of ecosystem services provision linked to total carbon gains: the Ecosystem Services Provision Index (ESPI) based on the vegetation activity and its variation over time (see Box: Evaluating Ecosystem Services through Remote Sensing). It provides a method that can be repeated at different spatial and temporal scales at low cost. To facilitate map reading and general description, the ESPI is presented in three ranks of values: high levels of provision (> 0.7), middle levels (0.6-0.4), and low levels (< 0.3), as seen in Figure 16.

Evaluating Ecosystem Services through Remote Sensing

For this report two attributes derived from MODIS sensor onboard the EOS Terra satellite MOD13A1 (EVI) between 2000 and 2014 were used: the annual mean (EVI mean), an indicator of total carbon gains and the intra-annual EVI's Coefficient of Variation (EVI CV), a descriptor of seasonality (Paruelo et al., 2016). These attributes are proxies of net primary production - one of the ecosystem´s fluxes - and were combined into an Ecosystem Services Provision Index ESPI = EVI mean*(1-EVICV). This approach was linked to soil carbon sequestration, avian richness and groundwater recharge in a subcontinental study (Paruelo et al., 2016). Data at 1 km^2 resolution were used to map the ecosystem services provision and its temporal trends. Values were normalized considering the highest and lowest values of the index to scale it up to the 0-1 range. More details of this methodology can be found in Paruelo et al. (2016). The ESPI Index model has already been field tested in two different South American ecosystems: the Gran Chaco dry forests and the Pampas grasslands, confirming that an important portion of the spatial variability is covered by the two attributes considered in ESPI (Paruelo et al., 2016).

In this study the status of the ecosystem services provision was analysed, both in space and time. The ecosystem services analysis was done for the Upper Paraná and Serra do Mar ecoregions, both of which are focus of WWF and Vida Silvestre's work. [21] The period considered was from 2000 to 2014, which is the aim of this report. The methodology applied in this analysis has several advantages over other forms of measuring the performance of different ecosystems in terms of services provision:

21 Of the total area of the two ecoregions, only 68% had enough information to analyse the ESPI and its trends. A large portion of the Serra do Mar ecoregion was not included in the analysis due to presence of clouds or high-slope terrains.

it allows for the increase in temporal and spatial scale of the ecosystem services analysis coverage by reducing costs and time. Mapping changes of ecosystem services provision allows for the identification of areas where negative trends in provision deserve particular attention, like areas experiencing intense degradation. The ecosystem services index used was particularly sensitive to changes associated with land use/land cover transformations (Paruelo, Burke, & Lauenroth, 2001).

4.1. HOW IS THE PROVISION OF ECOSYSTEM SERVICES DISTRIBUTED IN THE LANDSCAPE?

FOREST AREAS PROVIDE ALMOST THREE TIMES MORE ECOSYSTEM SERVICES THAN PASTURES OR CULTIVATED AREAS.

In this analysis, in contrast with the previous studies in this report (forest cover, fragmentation, forest protection, etc.), the focus is not restricted to the forest ecosystems. As described in previous pages, the Atlantic Forest is a mosaic of interspersed forest habitats and a variety of human-transformed productive lands. All types of land uses – natural and transformed – within the two focal ecoregions were subjected to the analysis, making it possible to compare how they rank as ecosystem services providers based on C gains. The map of Mean Provisions of Ecosystem Services shows how these services are distributed in the Upper Paraná and Serra do Mar ecoregions (Figure 16). Thirteen per cent of the analysed area provided the highest level of ecosystem services and was concentrated in areas of native forests and afforestation. Medium and low levels of provision were associated mainly with areas under extensive and intensive commodity production (Figure 16). In general terms, forest areas provide almost three times more ecosystem services than pastures or cultivated areas.

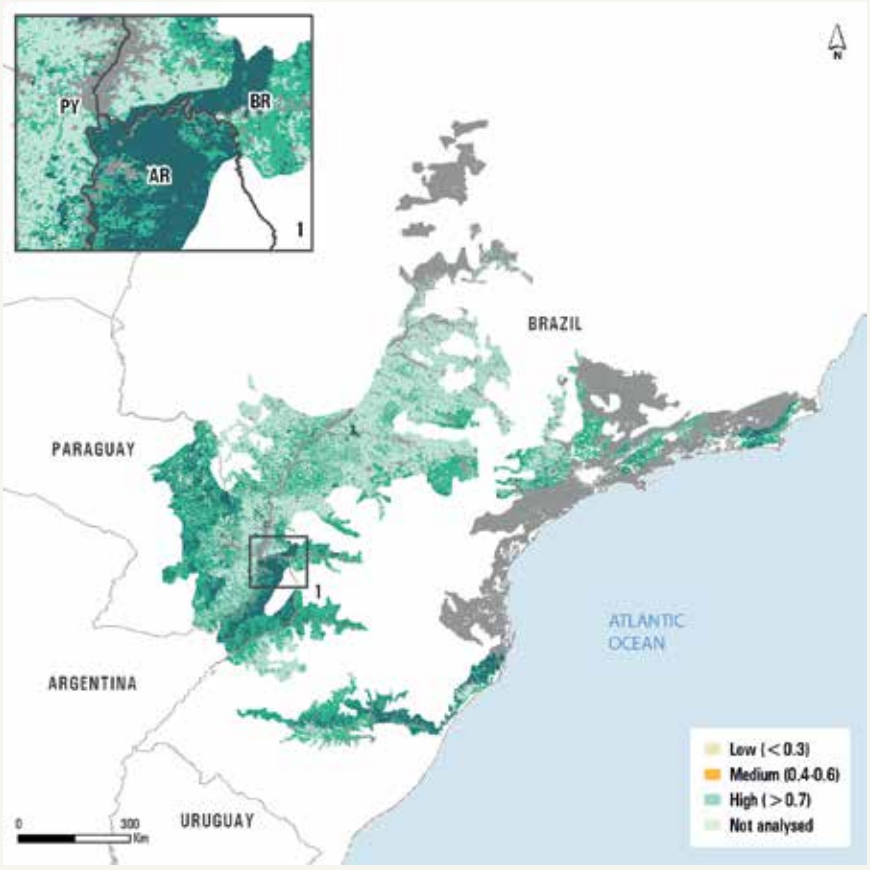


Figure 16. *Mean provision of ecosystem services between 2000 and 2014. Values are shown in 3 ranks: low levels (<0.3), medium levels (0.4-0.6) and high levels of provision (>0.7). Dark grey are mask areas such as water bodies, cloudy or high mountain areas.*

4.2. HOW IS THE PROVISION OF ECOSYSTEM SERVICES CHANGING OVER TIME?

A large fraction of the analysed area - 54 per cent - presented no significant changes of ecosystem services provisions during the 2000-2014 period, meaning that in these areas the dynamic of carbon gains was stable (Figure 19). Areas of native forest showed this no-change pattern in their provision, suggesting a constancy of the forest functionality dynamic during the evaluated period. On the other hand, areas that are covered by other types of vegetation, such as pastures or rotation crops, also presented no differences between years in the ecosystem services provision, indicating that the transformation from forest to other land use occurred before 2000, the first year of the analysed period [22] (Figure 17).

Even tough the coarse scale of the study, 14 per cent of the analysed area presented significant trends in the 14-year period covered by the report. The negative trends, or a decrease in carbon gains in ecosystem services provision, were related mainly to forest losses (in the Paraguayan forest, left side of the map) or degraded areas – low crop yields or soil losses (in Rio Grande do Sul and Paraná Brazilian states). The positive trends or increase in carbon gains were mostly concentrated in areas where native forests were replaced by tree plantations (Figure 17), what happened only in Argentina and Brazil. The positive trends nearly didn´t appear in the Paraguayan territory.

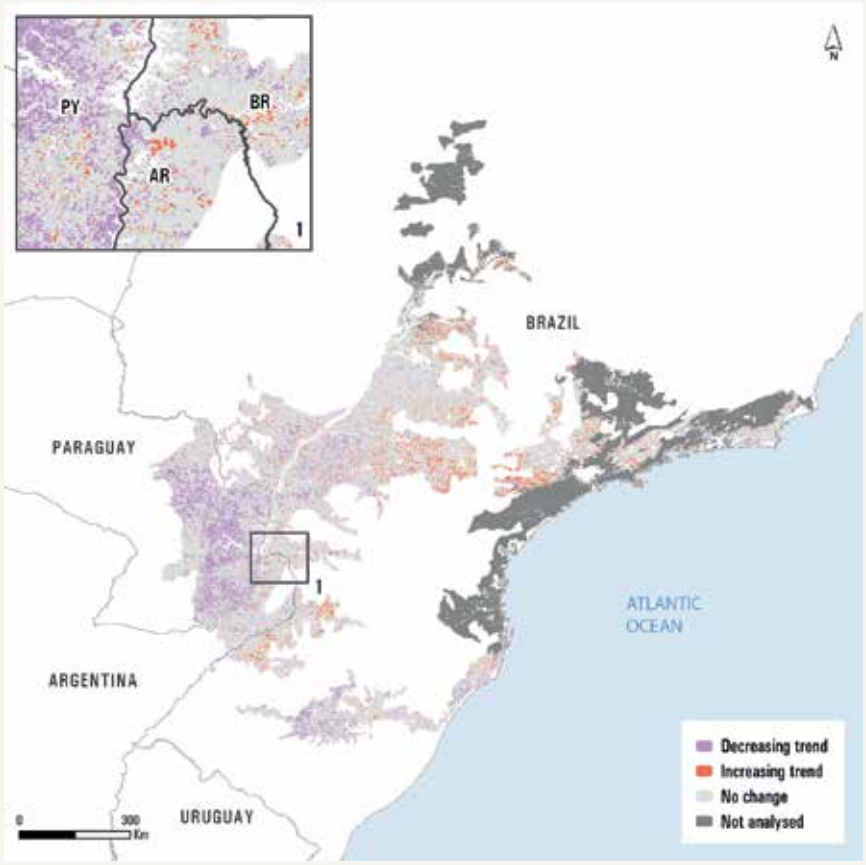


Figure 17. *Changes in ecosystem services provision between 2000 and 2014. Values are shown in 3 categories: decreased provision, increased provision and no significant changes in ecosystem services provision.*

22 It is important to remark that as this is a regional -scale study and the minimum area analysed was 1 km^2, it is not possible to differentiate small-scale land use changes.

Combining the information obtained on the level of ecosystem service provision (Figure 16) and the changes of this provision over time (Figure 17), and adding information about land use and land cover, four types of situations were detected in the two ecoregions studied [23] (Figure 18):

- "Healthy areas": areas that provide a high level of ecosystem services and do not change over time. They represent 10 per cent of the surveyed area, and correspond to core areas of native forests. These areas overlap with native forest remnants in map of Figure 3 and core areas of Figure 6.
- "Reconnection and reforestation areas": zones that provided from low to high levels of ecosystem services, and showed an increasing trend in provision. They cover 7 per cent of the surveyed area, and can be identified as areas where native forest recovery and exotic forest plantation are occurring.
- "Increasing degradation areas": these sectors provided medium and high levels of ecosystem services, but showed a decreasing trend along the studied period. They cover 9 per cent of the surveyed area and mostly match with areas that lost native forests in Paraguay.
- "Degraded and fragmented areas": areas that provided low or medium level of services, and evidenced decreasing trends or no changes of provision over time. It is the most prevalent situation, representing 74 per cent of the area. Predominant land use is agriculture over lands deforested before the year 2000.

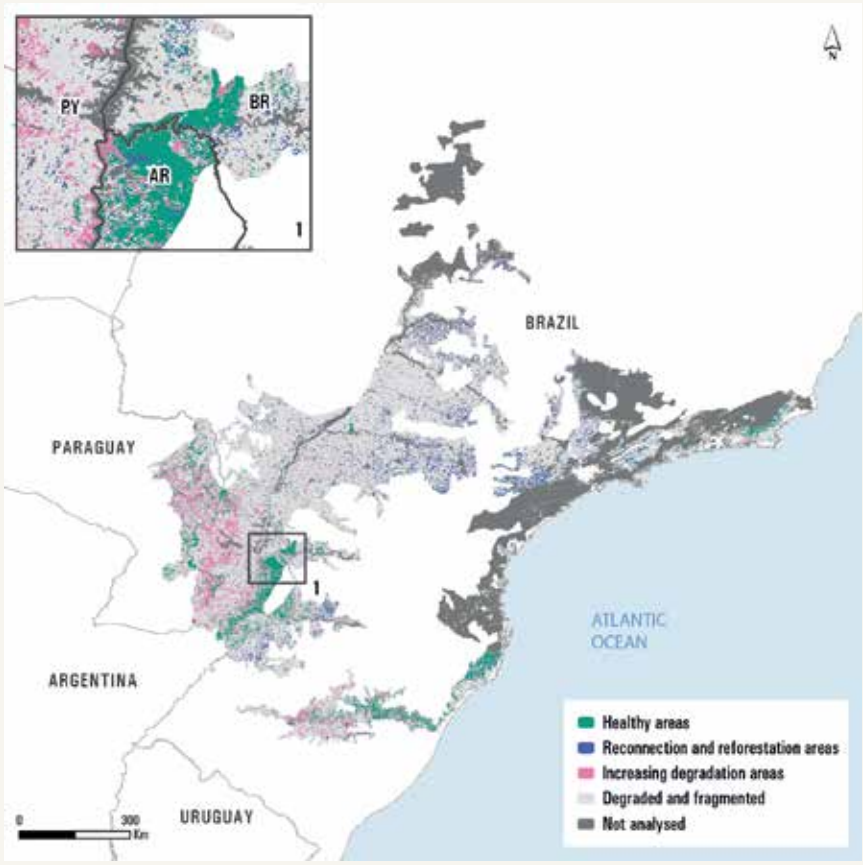


Figure 18. *Four categories of ecosystem service provision areas in the Upper Paraná and Serra do Mar ecoregions. They are defined according to their level of provision of ecosystem services and changes in provision over time.*

23 Out of the total area of the two focal ecoregion, only 68% provided enough information to allow analysis (see Box: Evaluating Ecosystem Services through Remote Sensing for more details).

However, as the interpretation of these results depends on the context and on subjective values, further information like ecosystem services provision within areas of reference, such as protected areas, should be explored to discriminate the influence and the change over time of global and local drivers on ecosystem services provision changes (Cabello et al., 2012; Garbulsky & Paruelo, 2004).

Additional information and complementary indexes like different land use and land cover areas, biodiversity indexes, ecosystem representativeness, water provision and soil conservation should be considered for a complete diagnosis of the ecosystems' state. Further studies are needed to evaluate the costs and benefits that the forest provides with respect to historic intensive extraction models, to find ways in which economic development, forest conservation and human wellbeing are integrated and balanced. However, the ESPI and its trends allow the identification of areas where changes are happening and deserve attention. With a relative low cost of update, this could work as an alert to monitor changes over time and improve efforts for conservation, restoration and policy decisions.

5. THE STATE OF BIODIVERSITY AND WILDLIFE IN THE ATLANTIC FOREST

An extraordinary richness of species – more than 2,300 vertebrate species – and a very high level of endemism - more than one third of the vertebrates are unique to this ecoregion - are the most striking characteristics of the Atlantic Forest's biodiversity. Many of its species, particularly the endemic ones, are threatened with extinction at different scales and intensities. However, very few plants or animals have been recorded as extinct in the ecoregion (Joly, Metzger, & Tabarelli, 2014) and, although in some cases in critically small populations, almost all species are still present.

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	Total number of species	Threatened / Extinct	Source
Plants (shrubs and trees)	20,000	1,544 (7 extinct trees)	Martinelli & Moraes, 2013; MMA, 2014
Mammals	298	35 (0 extinct mammals)	Paglia et al., 2012
Birds	1,023	112 (0 extinct birds)	Brooks, Tobias, & Balmford, 1999 Marini & Garcia, 2005
Reptiles	306	3	Mittermeier et al., 2005
Amphibians	475	104 (1 extinct frog)	Mittermeier et al., 2005 Trindade-Filho, de Carvalho, Brito, & Loyola, 2012

Figure 19. *Numbers that reflect the current threats on species.*

What is remarkable about the Atlantic Forest is that after such an intense and widespread habitat loss, the extinction of flora and fauna species has not occurred at the degree predicted by theoretical models (as the 1967 island biogeography theory of MacArthur and Wilson). Several studies have researched the reasons behind this phenomenon. Three possible processes may explain this paradox, namely why so few species went extinct in the Atlantic Forest (Joly et al., 2014); all three have been documented in the ecoregion:

- Landscape complementation and supplementation: for most species the effective habitat size is not limited to the size of forest fragments, but is the sum of several fragments and even the area of the matrix – the man-transformed lands - among them, if this matrix allows for biological movements or provides even low quality habitat (Martensen, Pimentel, & Metzger, 2008; Pardini et al., 2009; Schroth et al., 2011).
- Non-linear extinction of species: the extinction of species only occurs after the forest cover falls below an "extinction threshold". Before that threshold is reached, species still persist even though a significant area of habitat has been

lost. For several groups of plants and animals in the Atlantic Forest, local extinction is triggered when their habitat is less than 30 per cent of the original landscape cover (Lima & Mariano-Neto, 2014; Martensen et al., 2012; Pardini et al., 2010; Rigueira, da Rocha, & Mariano-Neto, 2013).

- Time-lagged responses to deforestation and changes in the landscape: some species have not yet responded to the most recent deforestation events, and there is an "extinction debt" (Lira et al., 2012; Metzger et al., 2009; Rigueira et al., 2013).

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5.1. PROCESSES BEHIND BIODIVERSITY LOSS IN THE ATLANTIC FOREST

Human disturbances, from agriculture-driven forest conversion to selective logging and poaching, produce changes in the abundance and frequency of plant and animal species. The structure of the biological communities and the functioning of ecosystems are both impacted. Two ongoing processes have huge impact in the remaining Atlantic Forest, because even if deforestation stops, they continue to diminish the biological richness across the ecoregion.

(A) HOMOGENOUS FORESTS: TREE COMMUNITIES' IMPOVERISHMENT

Surveys of tree species in human-modified Atlantic Forest's landscapes show the emergence of impoverished tree assemblages in small forest fragments and forest edges. Compared to non-modified habitats, the reduction in the number of tree species can reach up to 50 per cent, giving way to a new state of the tree communities dominated by species adapted to the edge's altered conditions (Joly et al., 2014).

THE PROCESS OF TREE IMPOVERISHMENT IS WIDESPREAD IN THE ATLANTIC FOREST DUE TO ITS MARKED FOREST FRAGMENTATION, WITH THE EXCEPTION OF THE FEW LARGE FRAGMENTS, AND MIGHT LEAD TOWARD A BIOTIC HOMOGENIZATION IN THE ECOREGION.

Tree species characterized by large adults (like canopy emergent trees), large seeds and large fleshy fruits or requiring specialized pollinators become rare in the fragmented forest´s composition. Smaller species, adapted to human disturbances, with reduced aboveground biomass and small seeds, dominate it (Farah et al., 2014; Tabarelli et al., 2010). Researchers compared the flora of different locations in the Atlantic Forest of Brazil, using data collected before and after 1980, and found a 20 per cent increase in the similarity of species across-communities, a proof of this homogenization trend (Lôbo et al., 2011).

As seen in the discussion on forest fragmentation of this report, about 77 per cent of the forest remnants in the analysed area are affected by fragmentation and edge conditions. This process of tree impoverishment is thus widespread in the Atlantic Forest, with the exception of the few large fragments, and might lead toward a biotic homogenization in the ecoregion.

(B) EMPTY FORESTS: DEFAUNATION

One widespread form of forest degradation in the Atlantic Forest is defaunation resulting mainly from the non-sustainable harvesting of fauna (Peres, 2010). Defaunation is the human-driven extinction of medium and large-sized vertebrates (Dirzo & Miranda, 1991) and may represent a global environmental change (Dirzo, 2001). Defaunation is particularly important in developing countries where poaching

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is culturally accepted and there is poor law enforcement. In the Neotropical region, the vertebrates most affected by poaching are those of large body size, including large mammals, especially ungulates (tapirs, peccaries, brocket deer), carnivores (jaguar, puma, ocelot), cingulata (several species of armadillos) and large rodents

(capybara, paca and agouti), large birds (guams) and reptiles (caimans, large lizards) (Jerozolimski & Peres, 2003). The effects of poaching in the Atlantic Forest are notorious, even in relatively large forest fragments (Cullen Jr., Bodmer, & Valladares Pádua, 2000; Paviolo et al., 2009). Paviolo et al. (2009) concluded that the density of jaguars, pumas and ocelots in the Misiones Green Corridor of Argentina was positively correlated with the area's level of protection. Studies conducted by Cullen Jr. et al. (2000) identified that species under heavy poaching become depleted in forest fragments.

The local extinction [24] of vertebrates is not only the result of poaching, but also of small fragment size. Small forest fragments cannot sustain populations of large vertebrates (mammals and birds), particularly of those that require large expanses of natural habitat, like the large carnivores (Woodroffe & Ginsberg, 1998). As a result of the lack of law enforcement against poaching and small forest fragment size, most of what remains of the Atlantic Forest is affected by defaunation, suffering the half-empty forest syndrome.[25] In the Atlantic Forest, 96 per cent of the remaining fragments lack at least one of the four largest Neotropical mammals (jaguars, tapirs, white-lipped peccaries and muriquis); furthermore, these four species are completely absent in the majority of the fragments (Jorge, Galetti, Ribeiro, & Ferraz, 2013).

The reduction or local extinction of large vertebrate populations have important long term consequences on forest structure and dynamics, usually through trophic cascades or the disruption of evolutionary processes.

What comes after defaunation

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The long-term consequences of defaunation and the loss of top predators in the Atlantic Forest are starting to be understood, and they include phenomena ranging from species loss to the disruption of evolutionary

24 Local extinction refers here to the extinction of a species in a given restricted area (such as a fragment, a protected area, a state, etc.), though it still exists elsewhere in the Atlantic Forest.

25 In half-empty-forests, overhunted species are not extinct. They are still present in the community, but might be sufficiently reduced to be ecologically extinct. They no longer significantly interact with other species and their ecological role is lost.

processes and ecosystem services. For example, the seed size of palmito palm (Euterpe edulis) in Atlantic Forest fragments that lack large birds (mainly toucans and guams, the main dispersers of large seeds), is much smaller than in forest fragments where these species are present (Galetti et al., 2013). This is the result of a recent and rapid evolutionary process that has negative effects on palm recruitment and survival. This is particularly worrisome since this palm is not only a keystone species for other vertebrates, but also an important economic resource for local communities. As another example, many Atlantic Forest large trees rely on large vertebrates for seed dispersal and recruitment. The defaunation process that is taking place in the Atlantic Forest may translate into a reduction of carbon storage capacity of remnant forests, negatively affecting this important ecosystem service (Bello et al., 2015). One researcher found that changes in composition of mammal communities affect dung beetle species communities, which in turn may have cascading consequences for the ecosystem, like co-extinctions and ecosystem services damage such as the recycling of soil nutrients (Culot et al., 2013). Thus, defaunation causes a number of negative impacts on species richness and diversity (Kurten, 2013), which leads to disturbances in ecosystem functioning, ecosystem services and human well-being (Galetti & Dirzo, 2013)

In spite of the dramatic status of the Atlantic Forest in terms of forest loss, fragmentation and degradation, the fact that extinctions have occurred at an intensity and pace lower than expected is encouraging. It gives society the chance to reverse downward trends through vigorous conservation and restoration actions, maintaining the biological diversity still existent and the ecological processes associated with its health.

5.2. THE ATLANTIC FOREST´S GAUGE SPECIES: THE JAGUAR

JAGUARS ARE CURRENTLY FOUND IN LESS THAN 4% OF THIS ATLANTIC FOREST COMPLEX, WITH A TOTAL POPULATION ESTIMATED AT ABOUT 200 INDIVIDUALS.

The jaguar is an important piece of the intricate web of nature in the Atlantic Forest. It is an iconic species of relevant cultural value and, as a flagship species, important for public awareness, environmental education and fundraising campaigns (Bowen-Jones & Entwistle, 2002; Home et al., 2009). It is also important as an umbrella species (Roberge & Angelstam, 2004), given that its large territorial requirements encompass those of other species with lower requirements. Thus, it could be used, in combination with other species and ecological processes, as a tool for land use planning and biodiversity conservation (Di Bitetti et al., 2003). It is also considered a keystone species [26] because of its top-down regulation effects on prey species and its intervention in the food chain (Estes et al., 2011).

The permanence of jaguars in the Atlantic Forest is threatened (Galetti et al., 2013). The jaguar once roamed across the whole Atlantic Forest complex. However, it is

26 A keystone species is one whose impacts on its community or ecosystem are greater than would be expected from its relative abundance or total biomass. Keystone species are usually noticed when they are removed or disappear from an ecosystem, resulting in dramatic changes to the rest of the community.

currently found in less than 4 per cent of this region, in 13 isolated fragments, only two of which – in Serra do Mar and Upper Paraná ecoregions - currently hold populations of more than 50 individuals (Paviolo et al., 2016). In most areas where it continues to exist, population densities are very low and local extinctions seem imminent. Jaguars persist in areas that still contain relatively large tracts of native forest, with low accessibility and relatively high protection and where

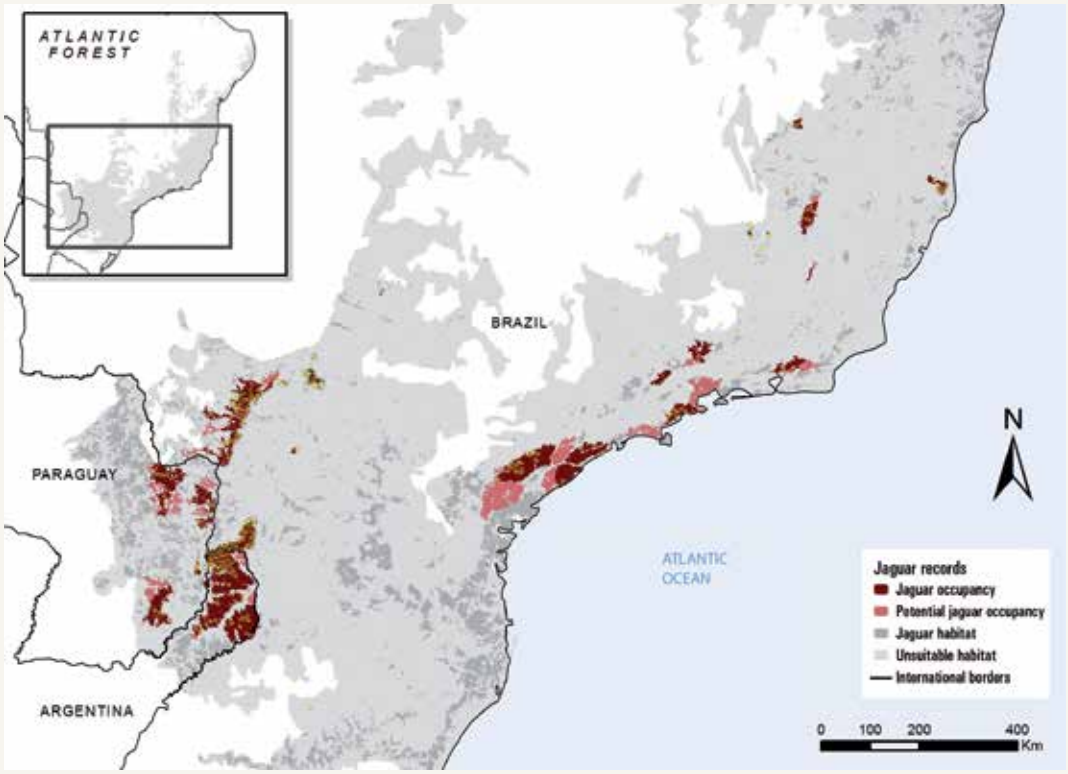

Figure 20: *Jaguar records in the Atlantic Forest. The map shows areas that represent potential habitat of jaguars, areas where the occurrence was recorded and also areas of potential jaguar occurrence (taken with permission from: Paviolo et al., 2016)*

202
JAGUARS

13
FRAGMENTS

2
POPULATIONS ABOVE 50 JAGUARS

LESS THAN 1% OF THE ORIGINAL JAGUAR POPULATION

human population density is relatively low (De Angelo, Paviolo, & Di Bitetti, 2011; De Angelo et al., 2013) (Figure 20). The jaguar population of the whole Atlantic Forest is estimated at about 202 individuals (Paviolo et al., 2016), which according to one authority is less than one per cent of the population that may have existed in the region before the Europeans' arrival (M. Di Bitetti personal communication).

Even though forest loss and fragmentation have been the main causes of the decline in jaguar populations (De Angelo et al., 2011; De Angelo, Paviolo, & Di Bitetti, 2011), poaching, preventive and retaliatory killing as a result of conflicts with livestock farmers, and roadkills are the main threats faced by local jaguar populations (Conforti & Cascelli de Azevedo, 2003; Crawshaw, 2002; Cullen Jr. et al., 2005; Paviolo et al., 2009; Paviolo et al., 2016). The small and isolated populations of jaguars that remain in the Atlantic Forest are facing the threat of becoming extinct as a result of these main threats and to random events (Desbiez et al., 2012; Zanin, Palomares, & Brito, 2015).[27] Even if small populations of jaguars may persist in a few forest fragments, one important aspect of biodiversity conservation will be lost: the genetic diversity of the Atlantic Forest jaguars is being eroded at an alarming rate (Haag et al., 2010), with unknown consequences for their fitness and long term survival. Given its role as a keystone species (Estes et al., 2011), the eradication of jaguars from most of the Atlantic Forest may have unpredictable but most probably negative consequences for biodiversity conservation and ecosystem services in this ecoregion. However, as there are many examples worldwide to demonstrate that carnivore populations can be restored, there is also hope for jaguars in the Atlantic Forest. The jaguar population of Argentina – including neighboring areas of Brazil - is increasing after a marked decline in the 1990s. Two other small populations in Brazil - one in coastal forests, other in inland forests - although isolated, have remained stable in the last decades. Ever growing collaboration for transnational conservation actions reinforces that optimism. The jaguar's conservation in the Atlantic Forest must be considered critical.

27 Random events can be either demographic or genetic, such as: by chance, birth of individuals of only one sex or randon fixation in the population of genes with negative effects. Small populations are especially prone to these stochastic events.

STATE OF THE ATLANTIC FOREST: KEY FINDINGS

THE ATLANTIC FOREST ECOREGIONAL COMPLEX HAS 226,124 KM^2 OF FORESTS, WHICH REPRESENTS 16.8 PER CENT OF ITS ORIGINAL EXTENT (YEAR 2014).

Upper Paraná and Serra do Mar ecoregions maintain 92,620 km^2 of forests or 42 per cent of the total forest in the ecoregional complex.

Upper Paraná and Serra do Mar ecoregions are highly fragmented. Core forests occupy only 3 per cent, patch forests 6 per cent, and edge forests cover 4 per cent of the original forest expanse.

MOST OF FOREST CORE AREAS ARE IN THE RANGE FROM 10 UP TO 100 KM^2 AND VERY FEW ARE LARGE CORE AREAS ABOVE 1,000 KM^2.

PROTECTED AREAS COVER 8.2 PER CENT OF THE ATLANTIC FOREST DOMAIN. ONLY 2.8 PER CENT HOLDS STRICT PROTECTION STATUS, WHILE 5.4 PER CENT FALLS IN THE SUSTAINABLE USE CATEGORY.

During the 2000-2015 period both the area under protection and the number of conservation units increased remarkably (about 20 per cent and 200 per cent, respectively).

In 2015, five of the fifteen ecoregions had an area under protection that surpassed a quarter of their forests.

In the Upper Paraná and Serra do Mar ecoregions, 13 per cent of the area provided the highest level of ecosystem services and was concentrated in areas of native forests (the area analysed was 68% of total ecoregional area).

NATIVE FOREST AREAS PROVIDE ALMOST THREE TIMES MORE ECOSYSTEM SERVICES THAN CULTIVATED AREAS.

"Healthy areas" of the territory - those that provide a high level of ecosystem services and do not change over time - represent 10 per cent of the surveyed area.

THE ATLANTIC FOREST FOSTERS TODAY ONLY ABOUT 200 ADULT JAGUARS, WHICH CORRESPONDS TO LESS THAN 1% OF THE ORIGINAL NUMBER OF JAGUARS.

PART 2. CONSERVATION ACHIEVEMENTS IN THE ATLANTIC FOREST

Besides being plentiful of life forms, the Atlantic Forest is also home to the most varied human ways of life, from the indigenous communities, which use a rich and traditional knowledge of nature for survival, to modern urban dwellers, who also depend on natural resources, although they usually do not recognize the close link between their daily requirements and nature. Food and other goods available to people in the Atlantic Forest come thus from hunting and gathering practices in some corners of the ecoregion, all the way to large-scale commodity production, industry and commerce.

Conservation work is all about people. It is about understanding our motivations, our goals and what moves us to change. It is also about proposing achievable ways to build bridges across the gap that now separates us from nature. Fifteen years ago, WWF and Vida Silvestre started a journey, joining other organizations, to build new bridges and strengthen old ones. Securing funding for conservation, engaging stakeholders, entering political negotiations, and feeding on science to define the best path towards conservation and sustainability were part of this complex construction work. The following section is an account of this endeavour.

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WWF AND FUNDACIÓN VIDA SILVESTRE IN THE ATLANTIC FOREST: 15 YEARS OF DEDICATION AND COLLABORATION

Engaging society, conserving nature, and changing patterns of production and consumption

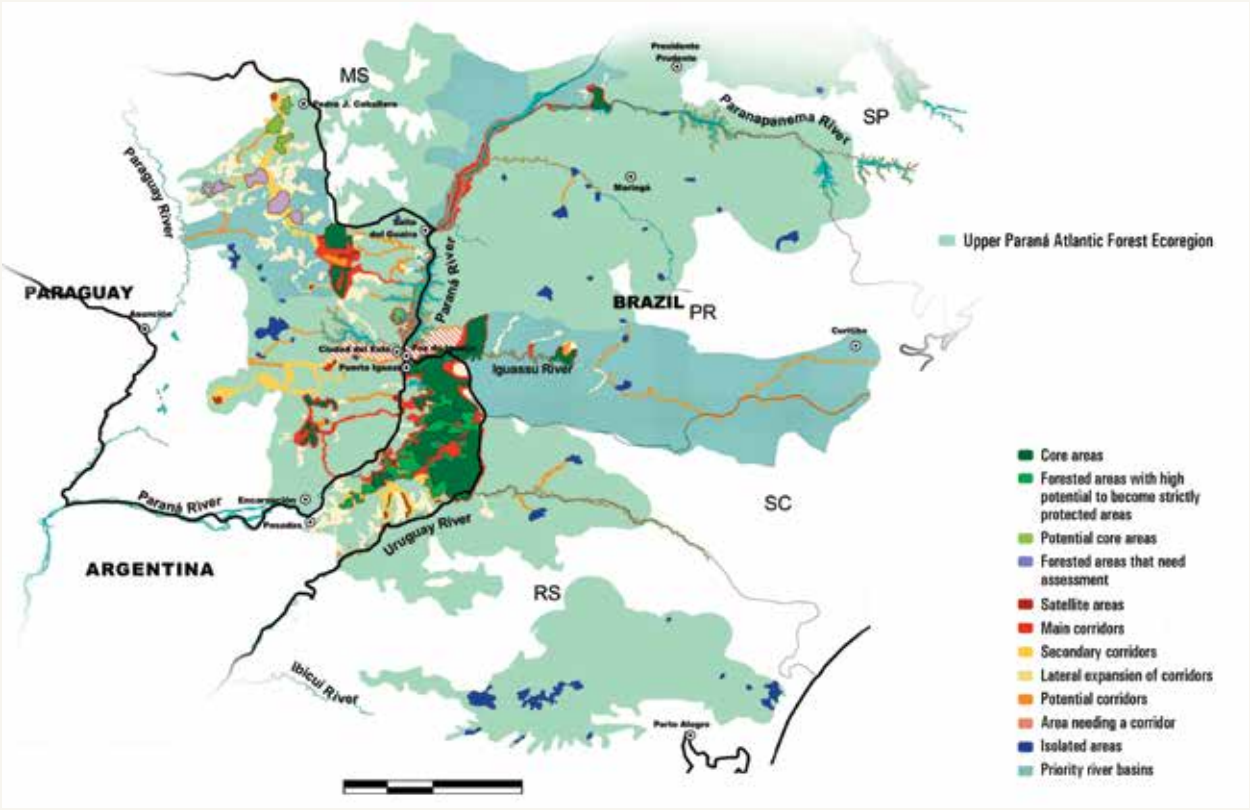
The transboundary WWF-Brazil, WWF-Paraguay and Fundación Vida Silvestre Argentina's Atlantic Forest Ecoregional Programme was born at the turn of the century, recognizing the urgency to conserve and restore one of the most important forests in the Neotropics. At the end of 1999, the first meetings attended by staff from the three countries began to take place at the tri-border city of Iguazu, and a cross-border perspective for conservation began to emerge.

The programme started with a big step: the development of the Biodiversity Vision for the Upper Paraná Atlantic Forest Ecoregion, which is the largest portion of the Atlantic Forest complex, shared by Argentina, Brazil and Paraguay. The Biodiversity Vision was an ambitious effort, which sought to inspire and gather the will of governments, NGOs and businesses to coordinate efforts for forest conservation. The Biodiversity Vision took more than three years of work engaging the technical contributions of more than 70 institutions and experts (Di Bitetti, Placci, & Dietz, 2003).

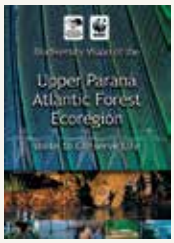
The diagnosis and planning process set a number of biodiversity conservation goals based on widely accepted principles of conservation biology and identified critical areas to be either conserved, managed or restored in order to meet those goals in 50 to 100 years. These areas were identified through a science-based process that relied on the best available biodiversity data and socioeconomic information.

The Upper Parana Atlantic Forest Biodiversity Vision was followed by the Serra do Mar Atlantic Forest Biodiversity Vision, which was published in 2011. Both instruments have guided the conservation actions in those ecoregions, where the work of WWF and Vida Silvestre is more intense, given their relevance in the ecoregional complex.

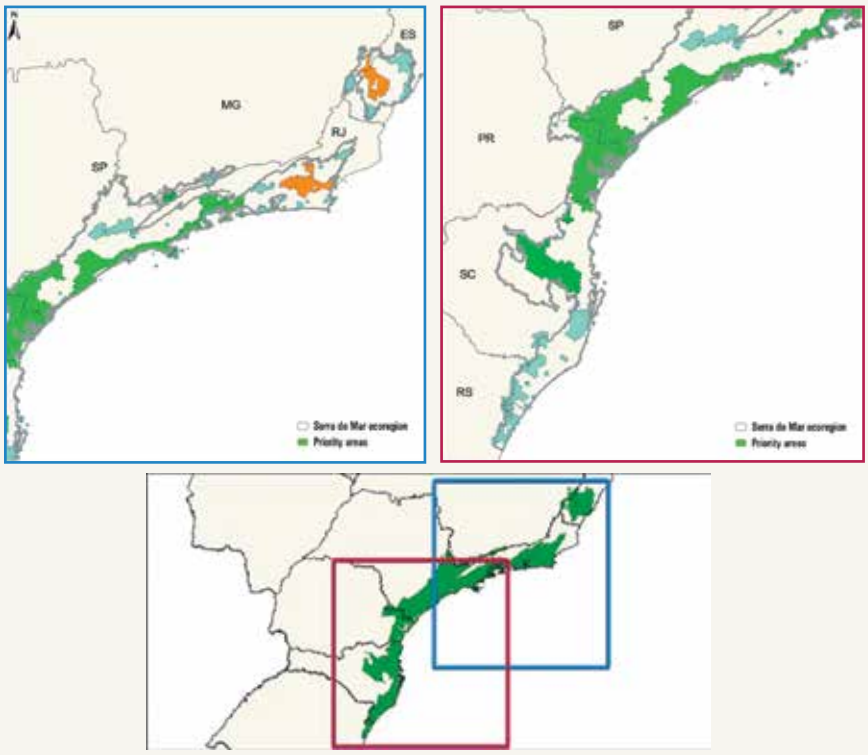
Based on the long-term vision of the initial broad analysis, an additional planning document was later produced to define the Programme's conservation actions: the Atlantic Forest Ecoregion Action Plan. This plan was produced in 2010 to cover a three-year period, and it was reviewed in 2013 and extended for another five years, until 2018. This planning tool established the conservation strategies to be implemented by WWF and Vida Silvestre in the two focal ecoregions. The broad strategies identified as the most adequate and effective to reach the conservation goals included: a) habitat and species protection or recovery; b) sustainable use of forest resources and responsible production of food and commodities; and c) legal and financial mechanisms to secure forest protection.



The centerpiece of the Biodiversity Vision for the Upper Paraná Atlantic Forest Ecoregion is the ***Biodiversity Conservation Landscape*** *(above). The map shows the landscape components necessary to achieve the Vision. It proposes how each type of land use should be distributed to maintain environmental services and biodiversity conservation.*



The Biodiversity Vision for the Serra do Mar Atlantic Forest Ecoregion establishes ***priority areas*** *to achieve biodiversity conservation in the ecoregion, and gives* ***management recommendations****, according to different number and size of forest fragments. The maps on the right represent the priority areas and the main management categories resulting along the planning process.*



Having reached 15 years of conservation work, the Programme decided to produce this State of the Atlantic Forest Report as a way to compile, review and evaluate all efforts made, not only within the WWF network, but also in collaboration with partners and external stakeholders.

WWF AND VIDA SILVESTRE ATLANTIC FOREST ECOREGIONAL PROGRAMME TIMELINE

1971 (BACKGROUND)

Beginning of the first WWF projects in Brazil, aiming at recovering the Golden Lion Tamarin population, in Serra do Mar Atlantic Forest.

1995 (BACKGROUND)

Birth of the Trinational Initiative, a transnational forum of numerous conservaton organizations, which triggered the creation of WWF-Vida Silvestre Atlantic Forest Ecoregional Programme. It was active until 1999.

1999

Creation of Vida Silvestre's Atlantic Forest Programme in Argentina, with a staff of three.

WWF-Brazil, WWF staff in Paraguay and Vida Silvestre conduct the first shared planning effort in the Atlantic Forest, marking the beginning of the ecoregional programme.

2000

Creation of WWF Atlantic Forest Project Office in Paraguay, with a staff of two. First conservation projects ongoing in Argentina and Paraguay, focusing on ecoregionally based conservation, research and habitat protection.

Start of the development of the Biodiversity Vision for the Upper Paraná Atlantic Forest, in partnership with governments, civil society organizations and universities.

2002

Creation of the first Steering Committee of the Atlantic Forest Ecoregion with staff from Vida Silvestre, WWF-Brazil, WWF-Paraguay, WWF-UK, and WWF-US.

2003

Publication of the Biodiversity Vision for the Upper Parana Atlantic Forest Ecoregion, led by WWF and Vida Silvestre, with more than 70 expert collaborators.

2006

Starts the development of the Biodiversity Vision for the Serra do Mar Atlantic Forest Ecoregion, led by WWF-Brazil and with the collaboration of more than 20 institutions.

2007

The Ecoregional Programme starts to adopt the Open Standards for the Practice of Conservation for design, management and monitoring of programme and projects.

2009

First tri-national Ecoregional Action Plan, a shared planning of conservation actions for the 2010-2013 period. Vida Silvestre purchases office for Atlantic Forest Programme.

2011

Publication of the Serra do Mar Atlantic Forest Biodiversity Vision.

2012

First external ecoregional evaluation conducted.

2013

Second tri-national planning of conservation actions, the 2014–2018 Ecoregional Action Plan.

2014

WWF Annual Conference held in Foz do Iguaçu (Brazil). Signing of the Atlantic Forest Programme Implementation Agreement (PIA) by the Steering Committee (integrated by Vida Silvestre, WWF-Brazil, WWF-Paraguay and four WWF contributing offices: LAC, Switzerland, Netherlands and Germany).

2015

Projects executed along the programme´s span: Argentina: 24 projects on conservation and socio-environmental issues + 9 projects on applied research; Paraguay: 32 conservation projects + 10 environmental studies conducted; Brazil: 30 social and environmental projects implemented + 6 research studies conducted.

Marine Programme of WWF-Brazil is launched and integrated within the Atlantic Forest Programme.

Campaña de comunicación WWF Paraguay

Social Pact and Zero Deforestation Law

Location:
All Atlantic Forest in Paraguay.

A public campaign resulting in the creation of legislation that has achieved an 82% decrease in deforestation.

Photo: Juan Mitos

Conformance with Forest Law

Location: Ñacunday, Pirapo, Jejui watersheds.

A project that helps landholders voluntarily comply with forest legislation though education regarding the available mechanisms for implementing sustainable practices.

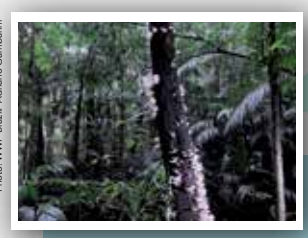


Photo: WWF-Brazil/ Adriano Gambarini

Private Protected Areas in Atlantic Forest: 21 new private protected areas created (1250 ha) and supported effective management by the implementation of PES (Payment for Ecosystem Services) of 2.656,76 ha / R$ 2.780.606,01 in the state of São Paulo

Photo: Desirée Weir

Paraguay Land-Use (ParLU)

Location: Lomas Valentinas, Tavapy, Koe Tuvy, Raul Peña, Punto Jovai, Mariscal Estigarribia, Dolores (Alto Paraná, Itapúa, and Canindeyu).

A four-year initiative that seeks to integrate human activities and forest conservation within the REDD+ mechanism

Photo: Andrea Ferreira

Support of Private Protected Areas

Location:
All Atlantic Forest in Paraguay.

Continuous support in the creation and maintenance of private protected areas, through the distribution of resources, organization of trainings, and collaboration with other organizations.

Photo: WWF

Conservation and Valuation of Biodiversity and Ecosystem Services (BES) in the Atlantic Forest Tri-National Corridor of Iguaçu National Park: strengthening of transboundary management and development of business partnership benefiting approximately 400 families of local producers, and also promoting the value of rural youth.

Photo: PROCOSARA

PARAGUAY

San Rafael Reserve Support

Location: San Rafael Reserve.

Over 10 years of funding and administrative support of the San Rafael Reserve, training staff and providing resources.

ARGENTINA

(Photo FVSA / Emiliano Salvador)

Forest rehabilitation to protect water sources

Location: Andresito Municipality.

Forest recovering in more than 120 hectares along stream banks.

(Photo FVSA / Lara Calleeiil)

Environmental education in primary schools

Location:
Misiones Province.

390 teachers trained, and 10 % of the school children participated in special classes about the nature of the Atlantic Forest.

(Photo FVSA /Emiliano Salvador)

Protecting the jaguar population in crisis

Location:
Priority Landscape for Jaguar Protectio.

Increasing the chances for jaguar survival through planning, awareness, education and law enforcement.

(Photo: Emilio White)

Forest protection in private lands

Location: several locations in Misiones Province.

16 private protected areas created or managed with FVSA support

(Photo FVSA / Veronica Galerendi)

Agricultural production in harmony with nature

Location:
Misiones Province.

250 small-scale farmers and technicians trained in Better Management Practices for food production.

Photo: WWF-Brazil / Eduardo Aigner

Watershed Restoration and Best Management Practices: Cancã-Moinho (81,000 seedlings were planted, 321 ha of forest fragments were conserved, 41 small scale farmers were benefited by PES and more than 9 milllion people were impacted directly and indirectly) and Tiete-Jacaré watershed (more than 450,000 seedlings were planted, 64 producers were benefited directly and 465 indirectly, 311 ha of restoration of Atlantic Forest with low cost and more than 1 million people were impacted directly and indirectly)

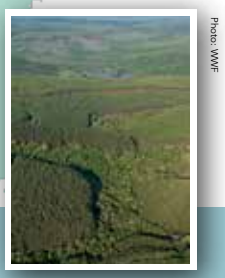


Photo: WWF

Small Landowner Certification in Brazil: FSC standards developed adapted for small-scale and low-intensity forest producers, more than 40,000 hectares reached FSC certification, including areas of native forest with high conservation value.

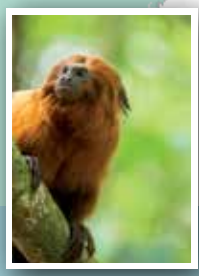


Photo: WWF-Brazil / Marcela Beltrão

Golden Lion Tamarin Conservation in São João River Basin (RJ): creation of public and private reserves (500 ha), forest restoration, environmental education and rehabilitation of species population: 3200 individuals, 16 times the population existing 30 years ago.

Photo: WWF-Brazil/ Ernesto Castro

Atlantic Forest Path / Borandá Social Movement: long-term and innovative project that seeks the creation of a mass movement, encompassing more than 160 stakeholders in five states, along a route that covers more than 2,000 km, and approximately 70 public and private protected areas.

Photo: WWF-Brazil / Adriana Mattoso

BRAZIL

Bertioga Restinga State Park: public mobilization and mass campaign to support 9,300 ha of restinga ecosystems protected in Serra do Mar.

Photo: WWF

Conservation, restoration and landscape management integrated with forest management practices: cooperation with Tanagro and Suzano Pulp and Paper.

WWF AND VIDA SILVESTRE´S MOST RELEVANT FIELD PROJECTS IN THE ATLANTIC FOREST

HABITAT AND SPECIES PROTECTION OR RECOVERY

Recovering our forests and freshwater systems

Our shared goal is to forge a path away from deforestation, working to restore and rehabilitate forests in sensitive watersheds where they were lost.

THE SCENARIO AT A GLOBAL SCALE:

While the world's forests continue to recede, FAO's worldwide forests assessment released in 2015 reveals a trend in global efforts to recover lost forests through restoration or natural regeneration. Between 2010 and 2015 there was an annual gain of 2.2 million hectares of natural forests; these gains of forestlands reduced global loss from 8.8 million to a net figure of 6.6 million hectares during the period (FAO, 2015).

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WWF´S GLOBAL STRATEGY TO COUNTERBALANCE DEFORESTATION

Since 2009, WWF advocates a global target of Zero Net Deforestation and Degradation by 2020. This target enables some flexibility, as it admits some natural forest losses if forest gains are achieved through forest restoration in key locations, like biological corridors (Wolosin & Ashley-Cantello, 2015). Forest restoration is a central conservation approach to attain this goal, especially in ecoregions where deforestation has taken a heavy toll on natural forests.

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THE CHALLENGE AT AN ECOREGIONAL SCALE: THE SCENARIO IN THE ATLANTIC FOREST

The massive loss of forests in the ecoregion and the appalling fragmentation of the remaining ones require a combination of approaches to maintain and restore the goods and services provided by forests. Stopping deforestation is not enough, and active recovery of forested areas is a necessary condition to bring back connectivity among fragments and biodiversity, as well as to ensure ecosystem services (Calmon et al., 2011).

COUNTRIES' COMMITMENTS TO REFOREST THE ATLANTIC FOREST

The three countries that share the Atlantic Forest have made ambitious commitments to reduce deforestation through different legal instruments. At the same time, in order to get forests back in critical areas where they were already losts, governments and NGOs have committed funding for forest restoration and rehabilitation, mainly in the Atlantic Forest of Brazil and Paraguay.

In more recent years, mainly as a result of national contributions to fight climate change through conservation and recovery of native forests, an increasing interest and encouraging pledges for financial resources have been made towards the reforestation efforts in the ecoregion (See Box: Reforestation commitments for the Atlantic Forest).

Reforestation commitments for the Atlantic Forest

ARGENTINA:

1 M ha (for the entire country, no specific commitment for Atlantic Forest) - 20x20 Initiative [28]

BRAZIL:

300,000 ha (in São Paulo State) - 20x20 Initiative
15 M ha by 2050 - Atlantic Forest Pact/Pacto da Mata Atlântica
12 M ha by 2030 (for the entire country) - Nationally Determined Contribution, 2015 Paris Agreement

PARAGUAY:

US$40 million commitment to reforestation (for the entire country) - Secretariat of Environment (SEAM)
900,000 ha (includes 30,000 hectares of reforestation with native species, Better Management Practices, enrichment and confinement) - Itaipú Binational, a public energy corporation
2,060 ha of restoration and 409 hectares of natural regeneration (US$11.5 million) - Itaipú Binational

TOOLS FOR CHANGE IN THE ATLANTIC FOREST ECOREGION: GAINING FORESTS THROUGH ECOLOGICAL RESTORATION AND FOREST REHABILITATION

Forest restoration and rehabilitation are prime conservation strategies deployed in the Atlantic Forest ecoregion. There are several approaches to reach the objective of bringing back lost forest cover. They differ greatly in their cost-benefit output. The objectives sought by a project and a careful weighing of each situation will define how to proceed. Two basic approaches are common:

Forest Ecological Restoration: re-establishing the structure, productivity and species diversity of the original forest. Over time, ecological processes and functions will match those of the original forest (Lamb & Gilmour, 2013).
Forest Rehabilitation: re-establishing the productivity and some, but not necessarily all, of the plant and animal species originally present. For ecological or economic reasons, the new forest may include species not originally present. Over time, the original forest's protective function and ecological services may be re-established (Lamb & Gilmour, 2013).

28 The Initiative 20x20 is a country-driven effort to attain 20 million hectares of forests restored in Latin America and the Caribbean by 2020. The initiative supports the Bonn Challenge – a global commitment to restore 150 million hectares worldwide by 2020 – and the New York Declaration on Forest – that seeks to restore 350 million hectares by 2030.

Forest restoration and rehabilitation are effective tools to reconnect isolated forest patches. If the connection between isolated forests can be established along a watercourse, the achievement is doubled, as freshwater habitats are also improved. Additionally, local people involved in the work of recovering forests are committed to maintain the new forest in their properties, benefiting from increased environmental quality within the farms and becoming supporters of forest conservation.

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ACHIEVEMENTS: LOST FORESTS ARE RETURNING TO THE ECOREGION

ADDING ALL INITIATIVES IN THE THREE COUNTRIES, MORE THAN 95,000 HECTARES HAVE BEEN RESTORED IN THE ATLANTIC FOREST ECOREGION OVER THE LAST FIVE YEARS

Multi-stakeholder large-scale forest restoration initiatives are under development in the three countries that share the Atlantic Forest. Even though there are differences in scale and resources in each country, combined they represent one ambitious initiative, which has the perspective of future increases as recent government policies are aimed at promoting reforestation. Forest recovery at a large scale has been primarily the accomplishment of private-public partnerships, with active intervention of conservation organizations and private landowners.

In Brazil, the Atlantic Forest Restoration Pact initiative, a joint endeavor of more than 160 organizations – NGOs, government, researchers, landowners and companies – has set the ambitious goal of restoring 15 million hectares of forests by 2050 in the 17 Brazilian states with Atlantic Forest (Calmon et al., 2011). WWF-Brazil is part of this initiative, which represents the largest forest

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restoration initiative currently being implemented in Latin America (Pinto et al., 2014), and one of the world´s largest of its kind. Five years after its launching, the Pact has achieved 86,300 hectares under restoration (Melo et al., 2013; "Pacto pela Restauraçâo da Mata Atlântica," 2016).

In Paraguay, A Todo Pulmón Paraguay Respira (ATP) is an NGO which first started as an environmental educational campaign, aimed at reforesting the Paraguayan Atlantic Forest. ATP's main goal is to reforest about 14,000 hectares with 14 million seedlings, seeking to reconnect isolated forest blocks. WWF-Paraguay gave critical support to create the NGO, taking the same name of the WWF's initiative from which it was born. ATP has already rehabilitated 7,300 hectares. The Tropical Forest Conservation Fund, created in Paraguay in 2007 for the connection and conservation of several protected areas in the Paraguayan Southern Corridor of the Atlantic Forest, has restored and enriched more than 320 hectares of biological corridors. WWF-Paraguay promoted the creation of this fund and is part of its management board.

© WWF PARAGUAY.

In Argentina, the National Fund for the Enrichment and Conservation of Native Forests is a public financing tool which partially funds restoration conducted in private lands. Vida Silvestre has promoted the creation of the Fund. A total area of 1,670 hectares was rehabilitated between 2011 and 2014. Another large-scale initiative is conducted by the largest forestry company in Argentina, [29] located in the Atlantic Forest, which has confined 3,000 hectares of deforested lands to manage the natural regeneration of native vegetation.

WWF AND VIDA SILVESTRE INITIATIVES: OUR CONTRIBUTION TO FOREST RECOVERY

THE CONTRIBUTION OF WWF AND VIDA SILVESTRE FOCUSES ON RECONNECTING FOREST PATCHES AND RECOVERING FORESTS ALONG WATERCOURSES

WWF and Vida Silvestre's forest rehabilitation and restoration work is focused on eight watersheds located in the three countries that share the Atlantic Forest. Since its beginning, in 2006, approximately 5,300 hectares of deforested or heavily degraded lands started the long process of recovering their forest habitats, ecological processes and services. The following map (Figure 21) shows the location and extension of the areas restored or rehabilitated by projects carried out directly by WWF and Vida Silvestre.

29 Arauco Argentina S.A.

SAN FRANCISCO AND DESEADO (ARGENTINA):
125 HA
CANÇA AND MOINHO (BRAZIL):
389 HA
LENÇÓIS PAULISTA (BRAZIL):
312 HA
PIRAPÓ (PARAGUAY):
267 ha
ÑACUNDAY (PARAGUAY):
4,015 ha
MONDAY (PARAGUAY):
169 ha

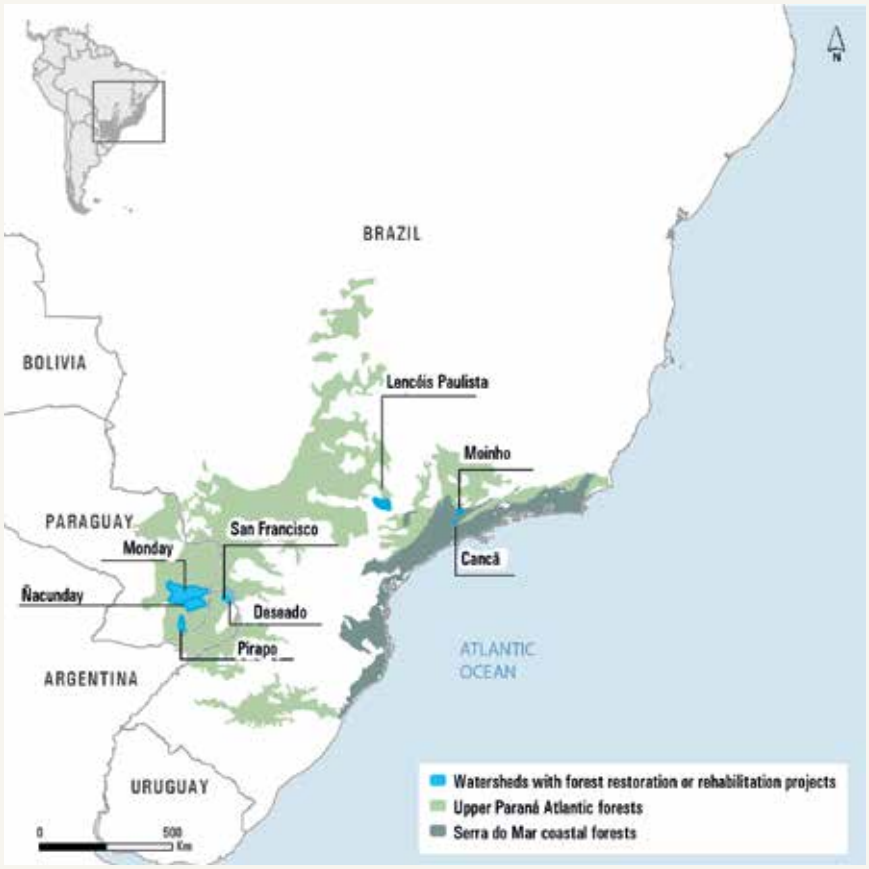
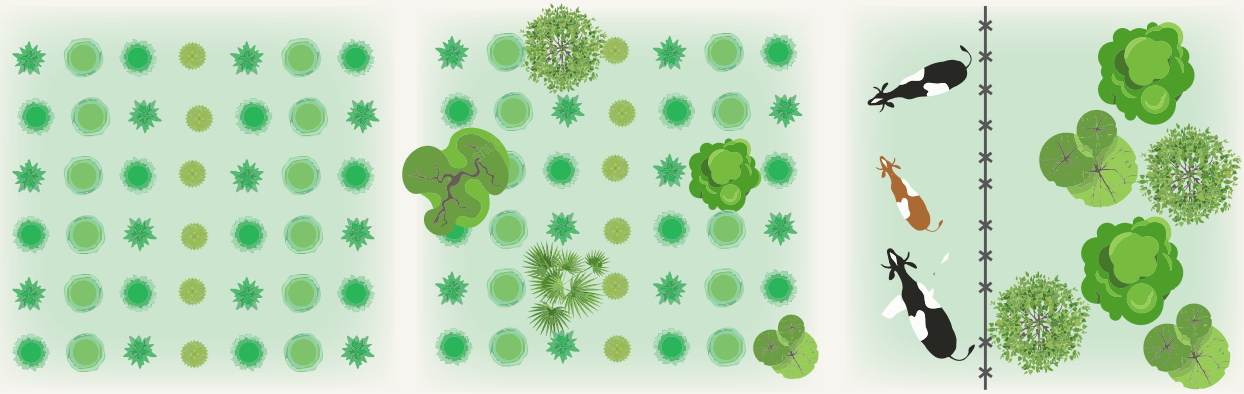


Figure 21. *Watersheds where restoration or rehabilitation work is conducted by WWF and Vida Silvestre*

OF WATERSHEDS: 8
OF HECTARES: 5,300

Three basic methods are used by WWF and Vida Silvestre to carry out forest restoration and rehabilitation (mainly with native tree species):



REFORESTATION
with native tree seedlings in deforested areas

ENRICHMENT
with native tree seedlings in heavily degraded forest

CONFINEMENT
of degraded areas to allow natural regeneration or forest regrowth

CONTRIBUTIONS OF WWF - VIDA SILVESTRE PROJECTS:

NATIVE SEEDLINGS PRODUCED:
1.05 MILLION

TREE NURSERIES ESTABLISHED:
9

PEOPLE TRAINED:
450

CO_2 SEQUESTERED:
171,000 Tons
(DURING THE FIRST 20 YEARS OF RESTORATION PLOTS)

The WWF offices in the ecoregion have not enough resources and capabilities to conduct restoration at the necessary scale to comply with national or global goals. Therefore, our strategy lies in conducting this work in areas that, despite their relatively small size, can have an important impact by creating or strengthening biological corridors -identified in the Biodiversity Vision- or rescuing very critical areas (Di Bitetti et al., 2003). Each seedling was planted in places where reestablishing connectivity was fundamental in order to overcome barriers posed by fragmentation or where watercourse protection forests were lost. In addition, as shown at the beginning of this chapter, alliances with other organizations allowed the Ecoregional Programme to promote the scaling up of these efforts.

Environmental and social gains of WWF's and VIDA SILVESTRE´s restoration and rehabilitation projects:

AT SITE-LEVEL:

Improved environmental conditions in farms: soil, water, biodiversity, resilience to extreme climate events.

Landholders complying with the law + landholders trained in forestry.

AT LANDSCAPE LEVEL:

Recovered habitat for fauna + biodiversity, corridors rehabilitated.

AT BASIN AND GLOBAL LEVELS:

Improved water security and governance.

Contributed with carbon sequestration and storage, linked to mitigation of climate change impacts.

THE TECHNICAL EDGE:

Improved locally adapted technical and operational methodologies for forest restoration and rehabilitation.

Properties with forest restoration plots provide background experience for demonstration and replication.

Freshwater conservation

In 2010, WWF-Paraguay and The Coca-Cola Company launched a communication campaign called "Opá" or "All gone" in Guaraní, to highlight the importance of protecting water resources in the Paraguayan Atlantic Forest.

This project built the commitment to water stewardship within Paraguayan society. Water is often treated as if there were an unending supply available, and this unsustainable mind frame endangers this precious resource. The Earth's fresh water supplies are dwindling, and are subject to uncontrolled contamination. Around the world, millions of people face a lack of potable water – water for drinking, cooking and basic sanitation. This project focused on the conservation and sustainable use of the Guarani Aquifer, one of the largest aquifers on Earth, which lies under the Atlantic Forest Ecoregion. The ecological relationship between the aquifer and the forest is threatened, espe-

cially in light of the fact that the Atlantic Forest is a highly endangered ecoregion and there are very important recharge areas within it. A countrywide communication campaign helped in raising awareness about water stewardship. This campaign was a total success because it caught the attention of civil society in general. In addition, an educational programme about water conservation and the Guarani Aquifer was conducted in seven rural communities and two indigenous communities within five municipalities located in the southern block of the Atlantic Forest Ecoregion. These communities are all located within the recharge area of the Guarani Aquifer.

Guardians of the jungle

The Mbya Guarani people inhabit the Atlantic Forest in Argentina, Brazil and Paraguay. With the expansion of the agricultural frontier, the Guarani population was reduced at the same time as the forest area, and the communities were displaced to small forest remnants. The Guarani people are considered the true guardians of the forest, because their presence is today a barrier to deforestation. However, the lands on which they currently live are not always suitable for their food production and often lack access to essential resources such as water. Due to displacement and loss of forest, Guarani communities had to change their cultural habits, and find access to food and to water.

For several communities, access to safe drinking water represented one of the main challenges. Therefore, Vida Silvestre sought support and brought solutions to five indigenous communities within the Argentine Atlantic Forest: Guabirá Poty, Arroyo Isla, Pya Guachu, Alecrín and Caramelito. From 2009 to 2011, Vida Silvestre shared with members of these communities the Tatachiná Project – which means "spirit of the forest" in the native language -, which dealt with improving the systems of water supply and distribution in these villages.

Thanks to the Tatachiná project, new water wells were installed in two of the communities and natural springs were protected in the other three. Eight large water tanks and modest water distribution systems were installed bringing water to crucial places within each community, such as schools, group of houses and vegetable gardens.

Wells installed, improved natural springs and over two kilometers of pipes installed represented a solution to safe water provision for these five communities. With this work, the risk of waterborne gastrointestinal diseases was reduced and the effort of manually transporting water from springs or streams to consumer sites was alleviated, directly benefiting about 350 men, women and children of the Mbya Guarani people in Misiones.

Today, five years after the project's conclusion, systems work successfully in four communities, while Arroyo Isla suffered an exodus of its inhabitants to other areas of Misiones.

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Creating and supporting protected areas

Our shared goal is to increase forest area under legal protection status and support the effective management of public and privately owned protected areas.

THE SCENARIO AT A GLOBAL SCALE:

Despite the widely recognized importance of protected areas for biodiversity and people, the current global coverage of terrestrial protected areas is still far from meeting global targets – 17 per cent coverage of ecologically representative areas - outlined in the 2020 Aichi targets of the Convention on Biological Diversity (CBD, 2010). With over 155,000 protected areas worldwide, [30] 12.5 per cent of the terrestrial realm of the planet is covered today by protected areas (Watson et al., 2014).

WWF'S GLOBAL STRATEGY TO STRENGTHEN THE PROTECTION OF NATURAL ECOSYSTEMS

Protected areas are crucial to delivering WWF's goals. To achieve robust protected area systems, WWF focuses on strong and diverse partnerships, creating networks, better management, development of local people, sustainable financing, smarter regulations, and building capacities and expertise in a landscape scale. The challenge is to ensure the protected area networks' integration, development and contribution to livelihoods.

© JAZMINE ROSSI.

THE CHALLENGE AT AN ECOREGIONAL SCALE: THE SCENARIO IN THE ATLANTIC FOREST

The Atlantic Forest ecoregional complex has a low coverage of protected areas, especially with regards to strict conservation areas. The terrestrial ecosystems in the Atlantic Forest are still far from reaching the 17 per cent protection goal set by the Aichi Biodiversity Targets, and even below the 12.5 per cent current global protection achievement.

Part 1 of this report described the increase in area under legal protection status recorded in the period between 2000 and 2015. The total protected land size

30 This figure only considers nationally designated areas.

increased by almost 2.4 million hectares, from 8.6 to about 11 million hectares. This achievement resulted from both public and private conservation efforts.

TOOLS FOR CHANGE IN THE ATLANTIC FOREST ECOREGION: PROMOTING THE CREATION OF NEW PROTECTED AREAS AND IMPROVING THE MANAGEMENT OF THE EXISTING ONES

Recognizing that protected areas are core to the conservation of biodiversity in the Atlantic Forest, one conservation strategy put forth by WWF and Vida Silvestre was to increase and strengthen the existing protected area systems in the three countries that share the ecoregion.

Three lines of work within this strategy have encompassed most actions carried out by the Atlantic Forest Ecoregional Programme during this period:

a) Creating new protected areas
b) Improving the impact of existing parks and reserves through better management and building capacities
c) Networking and financing for private protected areas

ACHIEVEMENTS: MORE AND IMPROVED PARKS AND RESERVES

Governments, NGOs – WWF and Vida Silvestre among them - companies and individuals have made impressive advances in the protection of forests and other ecosystems in the Atlantic Forest throughout the 15 years of conservation work that this report is summarizing.

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The following pages present the impacts of the WWF and Vida Silvestre Atlantic Forest Ecoregional Programme, evidencing the type, variety and scale of the contributions made by the programme in the field of forest protection, rethinking the protected areas as tools to promote sustainable development of the territory:

ECOREGION PROTECTION: WHERE WE ARE

AICHI TARGET 11 BY 2020:

17%

SCIENTIFIC RECOMMENDATION GOAL:

NOT AVAILABLE FOR ATLANTIC FOREST; A PENDING CHALLENGE

WE ARE NOW:

8.2%

Fifteen years of achievements expanding and strengthening the protection of forests and other ecosystems:

MORE FORESTS PROTECTED:

ARG

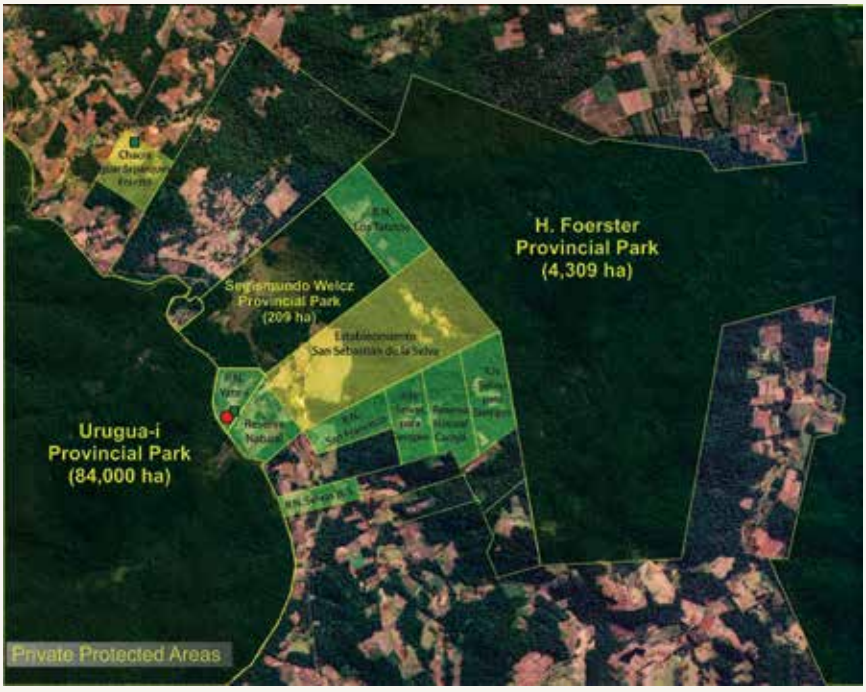
- Biodiversity Corridor Foerster-Urugua-í established by purchase of land and successive addition of small private reserves. The connection between two large provincial parks was secured.
- 5 wildlife refuges created and managed with technical support of Vida Silvestre, totalizing about 2,000 hectares.

PY

- Creation of 5 private nature reserves with support of WWF-PY (Maharishi, Tabucai, Ykua Pora, Arroyo Blanco and Capiibary).

BRA

- Creation of 9,300-hectare Bertioga Restinga State Park after public mobilization.
- 8 new Private Reserves of Natural Heritage (RPPN) created in Paraná state, covering more than 4,000 hectares and 4 new private reserves in São Paulo state.



Satellite view of the Biodiversity Corridor Foerster - Urugua-í, connecting the two provincial parks that give its name. The corridor is composed of nine small private protected areas (shown in light green) and one new provincial park (S. Welcz Provincial Park).

PROTECTED AREAS IMPROVED:

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ARG

- First evaluation of management effectiveness at system level for 16 private protected areas. Management weaknesses detected: knowledge and management of biological values, financial sustainability, and integration with stakeholders.
- Improved staff capacities for managing public and private protected areas: 80 park rangers trained in different topics, 24 managers of protected areas trained for planning and monitoring, 110 people trained in public use and visitation, 100 managers trained in sustainable financing.
- Management plans for 4 protected areas (Urugua-í Wildlife Reserve, Yaguaroundi, Ariraí and Caá Porá wildlife refuges) and 3 indigenous territories.

PY

- Strenghtening the conservation status of 70,000-hectare San Rafael Reserve, protecting one of the largest forest blocks in the Atlantic Forest in Paraguay. Improvement of its management by monitoring deforestation, assessment of conservation values, building infrastructure, fire-fighting, land purchasing, and conducting environmental awareness and education
- Legal formalization (title and deed) of two protected areas (Caazapá and Ybycuí National Parks).
- Support the building of new infrastructure, training park rangers and environmental education within 4 protected areas (Caazapá, Ybycuí and Cerro Corá National Parks, and Tapyta Private Reserve).
- Two areas subjected to High Conservation Value Area (HCVA) assessments (San Rafael Reserve and Ypetí Private Reserve) both resulting as very high valued.
- Better agriculture practices in Yvyturusu Resources Management Reserve.
- Capacity building of two NGOs to protect San Rafael.

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BRA

- Creation of the Atlantic Forest Path Initiative, triggering a social movement to engage people with parks, along 60 protected areas and 5 states in Serra do Mar ecoregion.
- Approval of a bill that reshapes the ecological Tax on Distribution of Goods and Services (ICMS).
- Evaluation of effective management in a Rio de Janeiro mosaic of protected areas, finding that the Atlantic Forest´s mosaics are the second most effective systems, even more than in the Amazon.
- Business plans developed for the promotion of three biodiversity and ecosystem services based activities among local communities in the Iguaçu National Park buffer zone: fruit production, vegetable production and carbon sequestration by restoring a biological corridor.

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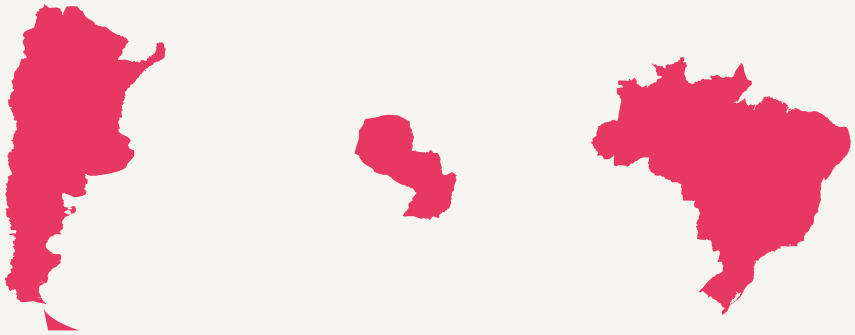
NETWORKING AND FINANCING MECHANISMS FOR PROTECTED AREAS:



ARGENTINA

- Creation of one network of private protected areas with 18 conservation units, the Atlantic Forest Node of the Argentine Network of Natural Protected Areas.

PARAGUAY

- Creation of the Network for Conservation on Private Land, with WWF support.

BRAZIL

- Strengthening of one existing network, the Federation of Private Ecological Reserves of São Paulo State (FREPESP).

ARGENTINA AND BRAZIL:

- Transboundary cooperation initiated between Iguaçu (Brazil) and Iguazú (Argentina) National Parks to use common bi-national park management benchmarks.
- 11 protected areas in Brazil and 22 in Argentina included into Payments for Environmental Services schemes.

Looking ahead: the Borandá Social Movement.

WWF-Brazil is building Borandá Social Movement, a strategy for the appreciation of protected areas by generating employment and income for local communities related to protected areas in four Brazilian states, as well as through the support and engagement of civil society regarding public use and recreation in national and state parks, and private reserves. The project is building a twenty-first century social movement for the long-term survival of the Atlantic Forest, "bringing the forest into the lives of people and people to the heart of the forest". Borandá is a neologism created from the popular phrase "bora", a contraction from a Portuguese word, meaning "let's go do something", with the idea of walking (andar in Portuguese). It will focus on two issues, which were chosen after a process of strategic planning based on a participatory methodology, always aiming in the engagement of stakeholders:

a. Stimulate outdoor culture
b. Added value to the society
The project is centered on a long distance trail named "Atlantic Forest Path", a route that covers an area of more than 2,500 km, passing through the states of Santa Catarina, Paraná, São Paulo and Rio de Janeiro, and approximately 70 public and private protected areas. The main objective is to reconcile conservation and development in the Serra do Mar region, which is in the heart of the Brazilian Atlantic Forest.

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CONSERVATION ON PRIVATE LANDS: THE IMPORTANCE OF VOLUNTARY PROTECTION OF NATURAL AREAS IN THE ATLANTIC FOREST

WWF and Vida Silvestre give considerable support for the creation and management of private protected areas in the Atlantic Forest. Around 80 per cent of the remaining non-protected forest fragments in the Atlantic Forest are in private lands. Thus, strong socio-environmental initiatives and economic incentives are required to ensure their conservation (Cunha et al. 2013).

The analysis of protected areas created in privately owned lands during the 2000–2015 period shows there was a significant increase in their total area. In Brazil, it increased twenty times; in Paraguay there was an 88.5 per cent increase above the 1999 baseline; and this increase was 9.4 per cent in Argentina. [31] Private protected

31 These numbers are an underestimation of the total protected area owned by privates, as there are many cases of conservation areas, with acceptable standards of management, which are not formally registered in the public record system. In Argentina, this group would add almost 10 per cent to the privately owned protected area.

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areas make up significant fractions of the systems in the Atlantic Forest of Argentina and Paraguay. In Paraguay, almost half of the protected areas are privately owned (41 per cent), while in Argentina they constitute 8.3 per cent of all area under protection. On the other hand, in Brazil the fraction is less than 2 per cent (Figure 22).

	PRIVATE PROTECTED AREAS existing before 2000 (number and area)	NEW PRIVATE PROTECTED AREAS created between 2000 – 2015 (number and area)	HOW MUCH OF THE PROTECTED AREA IS TODAY ON PRIVATE LANDS?
ARGENTINA	11 PAs 37,448 ha First created in 1988	17 PAs 3,521 ha	8.3 %
BRAZIL	8 PAs[6] 2,051 ha First created in 1994	860 PAs[6] 176,000 ha	< 2 %
PARAGUAY	1 PA 64,405 ha First created in 1991	12 PAs 57,028 ha	41.13 %

Figure 22: *Changes in private lands protection between 2000 and 2015.*
Sources: Argentina: Ministry of Ecology and Natural Renewable Resources of Misiones (MEyRNR) and Fundación Vida Silvestre´s protected area database; Brazil: National Census of Conservation Units, Ministry of Environment, and Fundação SOS Mata Atlântica (https://www.sosma.org.br); Paraguay: National System of Protected Areas (SINASIP).

Conservation on private lands: what is the role of small private protected areas?

With the exception of the privately owned protectes areas in Paraguay (where a private protected area averages 10,000 hectares), these areas are generally small: an average of 200 ha in Brazil and 553 ha in Argentina (excluding two areas over 10,000 ha). In Argentina and in Brazil the highest concentration of private protected areas occur in the Atlantic Forest ecoregion; they represent 25 per cent of private reserves' total area [32] in Brazil.

Protected area owners started in recent years to mobilize as a social collective and to articulate their needs of support. In Brazil, 18 regional associations were created and a National Confederation of RPPNs [33] was established. In 2014, the first Network of Private Natural Protected Areas was created in Argentina, with a substantial representation of Atlantic Forest areas (18 out of 58). In Paraguay WWF worked with the Network for Conservation on Private Lands, which mobilized the creation and strengthening of numerous protected areas on privately owned lands.

Even small private protected areas, less relevant in terms of area, perform extremely valuable functions, both social and ecological. If strategically located, they can improve the inadequate design of large public areas or may constitute corridors or stepping-stones between larger pristine areas. They have a role engaging the public in supporting protected areas and creating opportunities for income generation, as they give qualified jobs for technicians, park rangers, tourist guides, and/or employ and train local residents.

32 Only the Private Reserves of Natural Heritage or RPPNs are considered. RPPNs are the category of private protected areas recognized by the environmental authority ICMBio (Chico Mendes Institute for Biodiversity).

33 Private Reserves of Natural Heritage (RPPN) is the category of private protected areas recognized by the Brazilian environmental authority ICMBio (Chico Mendes Institute for Biodiversity).

Improving the outlook for flagship species

Our shared goal is to secure the long-term survival of the flagship species for the Atlantic Forest, the jaguar, through science-based conservation planning, management and public awareness.

THE SCENARIO AT A GLOBAL SCALE:

Species are threatened in every habitat on every continent. One of the characteristics of the current extinction of life on Earth is the loss of larger-bodied animals in general, and of top predators in particular (Ray et al., 2005; Woodroffe, 1998). They are more vulnerable to human impact, mainly because they require large territories. Research suggests that losing these animals can produce major negative changes in the ecosystems, with far-reaching effects on processes as diverse as the dynamics of diseases, wildfires, carbon sequestration and invasive species (Estes et al., 2011).

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WWF'S GLOBAL STRATEGY TO PREVENT ENDANGERED SPECIES LOSS

WWF works to stabilize and increase populations of WWF's priority species and, at the same time, deliver broader conservation goals as well as social equity and improved livelihoods for the rural poor. WWF focuses efforts on a select group of priority species [34] – several of them top predators - that are especially important, either as flagship species [35] or footprint-impacted species. [36]

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THE CHALLENGE AT AN ECOREGIONAL SCALE: THE SCENARIO IN THE ATLANTIC FOREST

The jaguar (*Panthera onca*) is the largest wild cat and the top terrestrial predator of the Neotropics. Although jaguars are considered near threatened (NT) in the global assessment of the IUCN Red List of Threatened Species (Caso et al., 2008), wildlife researchers estimate only about 200 jaguars left in the entire Atlantic Forest ecoregional complex, distributed in seven isolated populations (Paviolo et al., 2016). The same research suggests that the Atlantic Forest may soon be the first tropical biome to loose its largest top predator if effective protection is not put into action (Galetti et al., 2013). The largest of the existing jaguar populations in the Atlantic Forest, one of the only two with more than 50 jaguars, lives in one of the main remaining forest blocks, across Argentina, Brazil and Paraguay in the Upper Paraná Atlantic Forest.

34 The jaguar is not part of WWF's global priority species list, however it has been chosen by WWF and Vida Silvestre Atlantic Forest Ecoregional Programme as an ecoregional priority species.

35 Flagship species: iconic animals that provide a focus for raising awareness and stimulating action and funding for broader conservation efforts.

36 Footprint-impacted species: species whose populations are primarily threatened because of unsustainable hunting, logging or fishing.

LESS THAN
51
JAGUARS
WERE LIVING IN THE LARGEST CONTINUOUS BLOCK OF UPPER PARANÁ ATLANTIC FOREST IN THE EARLY 2000S.

© EMILIO WHITE.

In order to determine the status of the Upper Paraná jaguar population, and, by proxy, the appropriateness of the Biodiversity Conservation Landscape design, as well as the ecoregion's status, monitoring surveys were conducted in Argentina, Brazil and Paraguay in partnership with research institutions, in 2003 and 2004. These first studies revealed a population in deep crisis. The remaining jaguars were cornered by habitat loss, poaching, forest defaunation and conflicts with livestock farmers (Paviolo et al., 2008). A jaguar population crash in this part of the Atlantic Forest had occurred not long ago, around the late 1990s, when the density of jaguars decreased from an estimated 3.7 to less than 1 individual/100 km^2 (Crawshaw, 1995; Paviolo et al., 2008). The best-known and most intensely monitored population has been the one in Argentina, followed since 2004 until present day.

THE TOP 3 THREATS TO JAGUARS IN THE ATLANTIC FOREST

(data from Argentina, Schiaffino et al., 2011)

A. POACHING: at least 40 jaguars poached between 1995 and 2009 (3 per year).

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© MINISTERIO DE ECOLOGÍA Y RECURSOS NATURALES RENOVABLES DE MISIONES.

B. HABITAT LOSS: more than 50 per cent of native forests were already lost, transformed for human use

C. LOW PREY AVAILABILITY: defaunation of large mammals in some parts of the jaguar landscape, due to massive poaching.

Source: territoriodigital.com

TOOLS FOR CHANGE IN THE ATLANTIC FOREST ECOREGION: GATHERING EFFORTS FROM MULTIPLE INSTITUTIONS TO PROTECT JAGUARS

WWF and Vida Silvestre initiated an intense effort in 2003 aimed at securing the survival of the jaguar population in crisis, through a participatory strategy involving all concerned institutions of the region. Two action groups were born, in Argentina and Paraguay. The project was established in Argentina in 2006, and it united six main public, academic and civil society stakeholder groups, which together developed a regional management plan for the species, implementing its programmes and activities. Since 2008, WWF-Paraguay supported the Jaguar Alliance, a group of organizations, researchers, landowners and decision makers

concerned about the jaguar situation. This alliance created an institutional framework and supported a long-term strategy for jaguar conservation in the corridor between Mbaracayu Forest Reserve and Morombi Private Reserve.

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The jaguar conservation actions revolved around three main points: monitoring and planning for conservation, uniting inter-institutional efforts and creating public awareness. Other relevant issues essential for jaguar survival - mainly anti-poaching patrolling and legal prosecution of poachers - are the scope of government institutions and were not addressed directly by WWF and Vida Silvestre Atlantic Forest Ecoregional Programme.

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ACHIEVEMENTS: THE JAGUAR POPULATION IS RECOVERING IN THE UPPER PARANÁ ATLANTIC FOREST

As a result of the effort of the mentioned action groups, a set of technical, institutional and social tools were developed, all necessary to further build a context for the survival of jaguars in the ecoregion:

Scientific achievements (led by academic research groups):

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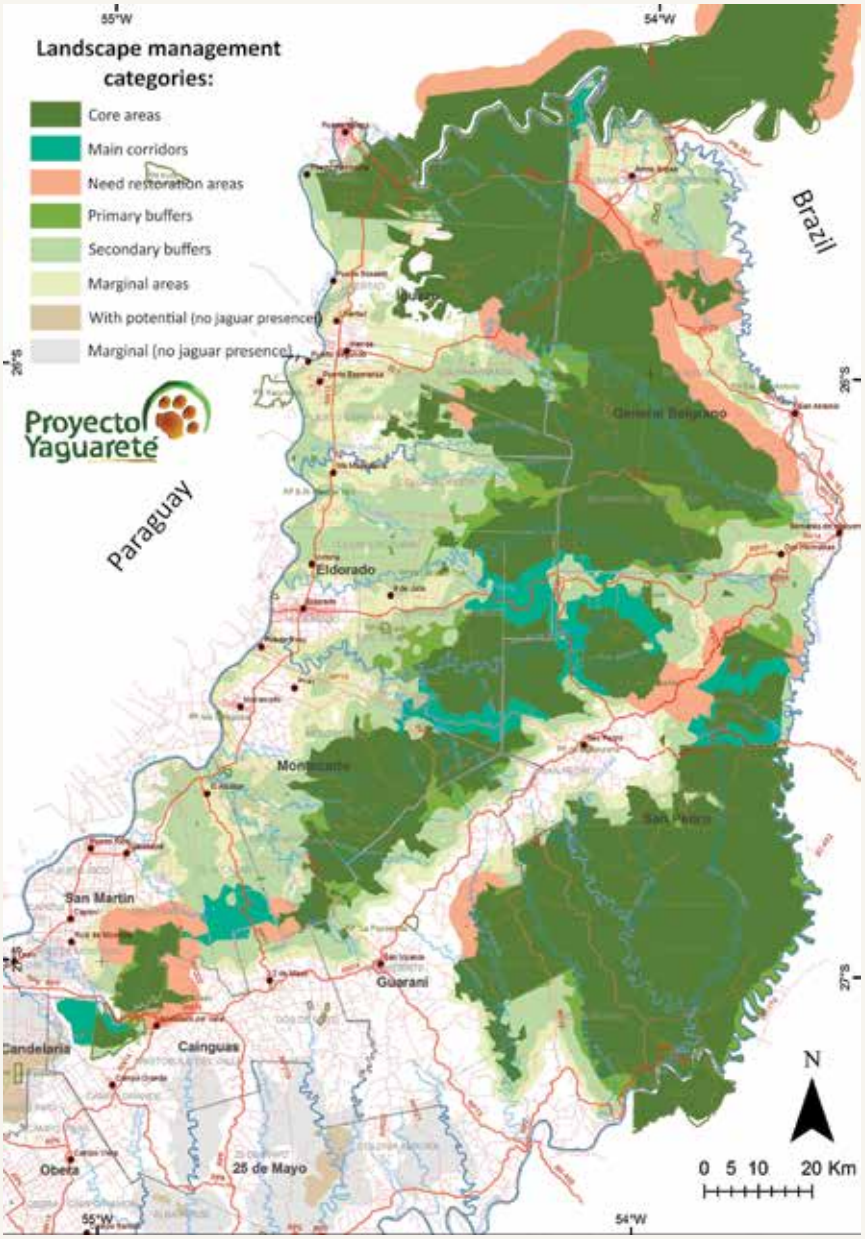
- **THE STATUS OF THE POPULATION WAS DETERMINED** in the early 2000s, indicating a population crash.
- **EVALUATION OF THE REAL JAGUAR DISTRIBUTION** in the Upper Parana Atlantic Forest.
- **REGULAR MONITORING** of jaguar population (every 2 years) in Argentina and Brazil.
- The importance of main threats was evaluated by conducting a **POPULATION VIABILITY ANALYSIS.**
- New **KNOWLEDGE ABOUT THREATS** affecting jaguars and their habitat, by GPS tracking 3 jaguars in Argentina, 3 in Brazil and 3 in Paraguay.
- A **PRIORITY LANDSCAPE FOR JAGUAR PROTECTION** was designated.
- The **CRITICAL CORRIDORS WITHIN THE JAGUAR DISTRIBUTION AREA WERE IDENTIFIED,** and fine-scale planning proposed for their use and conservation.



Map of the priority landscape for jaguar protection in the Atlantic Forest of Argentina and neighbouring Brazilian protected areas. This landscape management tool is part of the Jaguar Conservation Action Plan.

Institutional achievements (led by the Atlantic Forest Commission for Jaguar Conservation in Argentina and the Jaguar Alliance in Paraguay):

- A **SCIENCE-BASED JAGUAR CONSERVATION ACTION PLAN** was developed, which was approved by national and provincial authorities in Argentina.
- The **JAGUAR LANDSCAPE** was recognized by environmental authorities as a tool to restrict some productive activities in Argentina.
- Passage of **LAW ON *PANTHERA ONCA* CONSERVATION** in 2014, which calls for a long-term strategy for the conservation of jaguars in Paraguay, including an awareness campaign and detailing punishment for poachers.

Social achievements (led by WWF and Vida Silvestre):

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- **PUBLIC AND CIVIL SOCIETY STAKEHOLDERS** were brought together around jaguar conservation.
- **FOUR AWARENESS RAISING COMMUNICATION CAMPAIGNS** on the jaguar crisis were developed in Argentina.
- A **200+ MEMBER VOLUNTEER NETWORK** was created to monitor the jaguar presence in every fragment of the Atlantic Forest in Argentina and Paraguay (see Box: Union is strength).
- **75% OF THE CITIZENS IN MISIONES PROVINCE**, Argentina, support jaguar conservation efforts, assigning high value to the species (Latam Research Group, 2014).

The last field survey conducted in 2014 in the Upper Parana Atlantic Forest of Argentina and Brazil recorded an increase in density and total number of jaguars. The largest survey ever conducted on jaguars (see Box: The largest survey ever conducted on jaguars) estimates that between 51 and 85 jaguars individuals (mean = 68) still remain in a landscape of 13,430 km^2 (Paviolo et al., 2016). The population estimate increased slightly, from the 33–54 (mean = 43) adult jaguars in 2004, to a population size of 51–85 animals in 2014 (mean = 68) (Figure 23).

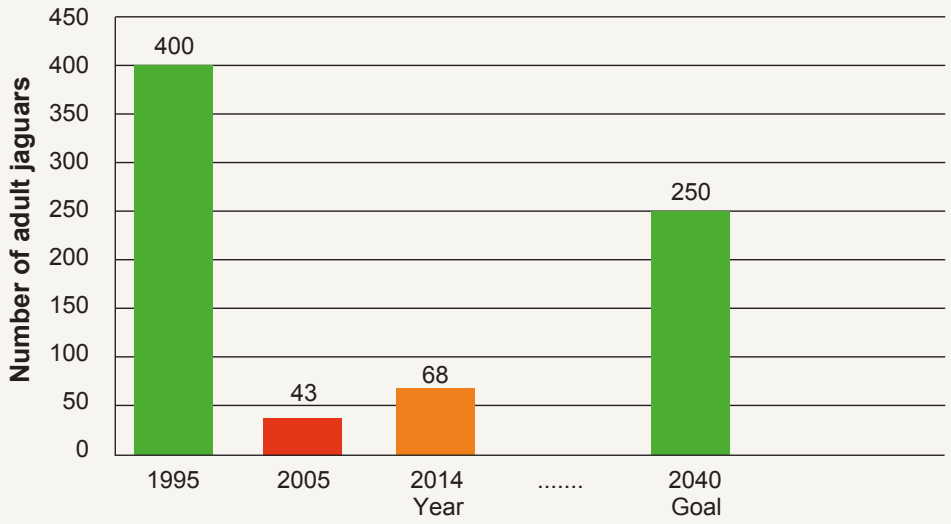

Figure 23: *Number of jaguars estimated in one population of the Upper Paraná Atlantic Forest, between 1995 and 2014. The column in the far right represents the number of jaguars expected in the long term as result of the Jaguar Conservation Action Plan, and corresponds to the carrying capacity of the remaining jaguar habitat.*

The largest survey ever conducted on jaguars

A systematic camera trap survey to obtain updated jaguar density and population size estimations was conducted in early 2014, in the Upper Paraná ecoregion between Argentina and Brazil. The survey covered an area of 321,221 hectares and was carried out on for almost 6 months, totaling 5,397 camera-trap days, and set at 122 field locations. This was the largest study conducted so far on the species. The survey obtained a total of 170,000 photographs, 1,299 of them recording jaguars - and resulted in an estimated jaguar population of 68 individuals (51-85). (Paviolo et al., 2016)

Although it is difficult to demonstrate a direct causality between the improvements in this small jaguar population and the actions conducted, there were a series of favourable conditions, in part produced by WWF and Vida Silvestre interventions that may be linked to the recorded population increase. These include: a) a possible reduction of jaguar and its prey's mortality by poachers and farmers, b) a strengthening of the forestry regulatory framework that diminished the loss of jaguar habitat, and c) a permanent communication across the jaguar landscape demanding local residents (urban and rural) to commit to supporting jaguar survival.

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In the Upper Parana Atlantic Forest of Paraguay, on the other hand, a very small population of jaguars has been recorded, consisting of about 15 individuals in two large reserves (Fariña, 2011). This small population is extremely vulnerable, due to forests fragmentation and degradation in Paraguay; therefore, WWF-Paraguay is focusing their efforts on connecting isolated forest blocks as a strategy for a sustainable landscape that could support a viable jaguar population in the long term.

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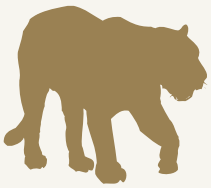
75%

OF THE PEOPLE THINK THAT IT IS WORTH PROTECTING THE SPECIES



67%

CONSIDERS THAT THE GOVERNMENT IS THE FIRST OR SECOND RESPONSIBLE FOR THE NECESSARY ACTIONS

Union is strength

The jaguar is the largest feline of the American continent; it is the animal that requires the largest area to live and it is also the most threatened one. In 2002, Fundación Vida Silvestre Argentina decided to allocate funds for research on the species to learn about the jaguar population status in the Upper Parana Atlantic Forest.

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Undoubtedly, due to the nature of the animal - low density and elusive behaviour - knowing how many Jaguars live in the Atlantic Forest represented an extremely difficult challenge. Consequently, following the saying "union is strength", Vida Silvestre decided to join efforts and create a large Network of Collaborators in order to collect evidence to confirm jaguar presence. Thus, individuals and volunteers, mainly those working in forest areas – park rangers, farmers and biologists, among others - began to nurture the network.

For the operation of the Network of Collaborators, lectures and a series of training courses were held for more than 300 people from Argentina, Brazil and Paraguay, who selflessly joined the team. A sample collection kit (known as the "Jaguar Kit") consisting of a handbag with basic elements to take footprints in plaster, collect faeces and record sightings or other types of evidence of the jaguars presence, was created. All the elements collected were sent by each collaborator to the coordinating team, which then analysed them in the laboratory to determine whether it was "the big cat".

Between 2002 and 2008, the Network of Collaborators worked in all its glory. Nearly 2,600 records were collected all over an area of about 90,000 km^2 of forest in Argentina, Paraguay and Brazil. As a result of this enormous work, it was possible to get the jaguar distribution map, which coupled with other complementary research methods, allowed to set the size of the jaguar population in the area.

After a period of very low activity, during which the monitoring of the jaguar population was restricted to camera-trap surveys, the Network of Collaborators was regrouped in 2014. In this new phase, it has added newly widespread technologies - GPS data, digital photos, social networks - taking advantage of collaborators´ smartphones. Nowadays, the group is active again and its main objectives are to continue registering jaguar presence throughout the geography of the Atlantic Forest in Argentina, to obtain valuable genetic information contained in faeces, and to create awareness to prevent poaching and thus the loss of this endangered population.

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The Golden Lion Tamarin, a species linked to the history of WWF 's work in the Atlantic Forest

The golden lion tamarin (*Leontopithecus rosalia*), is restricted to a reduced area in the Serra do Mar ecoregion of Brazil. It is not a cross-border species as the jaguar or so many other species. However, we briefly present WWF-Brazil´s work for the conservation of this emblematic species because it symbolized the long-term effort of our organization and partners in the pursuit of an ambitious conservation goal.

WWF began one of its first actions in the Atlantic Forest back in 1971, working to conserve the golden lion tamarin, one of the Atlantic Forest's most endangered species. There were only 200 wild tamarins, while a minimum population of 2,000 were necessary to remove the primate from the endangered species list. As a first step, the Golden Lion Tamarin Project, financially supported by WWF, helped to create two biological reserves - Poço das Antas and União - housing the largest remaining populations in nature.

Since the beginning, the main conservation strategy was to recover the tamarins' habitat, promoting the creation of protected areas, planting new forest corridors, connecting forest fragments, in order to provide enough habitat for the population to grow.

In 2001, WWF-Brazil and the Golden Lion Tamarin Association, along with 40 other partners, celebrated the birth of the 1,000th golden lion tamarin living free in nature. This remarkable fact also celebrated 30 years of WWF activities in the region. The Mico 1000 (Monkey 1000) campaing was launched by WWF-Brazil, engaging children to choose a name for the iconic newborn. Two years later the species was still threatened (EN), but not critically endangered (CR), the first case of recovery of a threatened species in Brazil.

The São João River Basin, in Rio de Janeiro state, contains the forest "islands" in which the tamarin lives, and was the focus of WWF work. It was declared an Environmental Protection Area (APA) in 2002, known as the Golden Lion Tamarin's APA; the creation of Private Reserves of Natural Heritage (RPPN, for its name in Portuguese) was increased, totaling 500 hectares. Moreover, agro-ecologic and agro-forestry practices were promoted among farmers in the surroundings of Poço das Antas and União Biological Reserves.

Today, the population of golden lion tamarins has succeeded in its recovery, with more than 3,200 individuals (Save the Golden Lion Tamarin, 2014). The biggest challenge for the future of the species continues to be the restoration of its habitat. The Golden Lion Tamarin Association maintains its goal of restoring 25,000 hectares of forests. The other important challenge for the species´ conservation is the engagement of society and local municipalities, being supported by WWF-Brazil.

SUSTAINABLE PRODUCTION

Fighting for sustainable production and consumption

Our shared goal is to mainstream sustainable food and commodity production in the Atlantic Forest as a way to integrate nature conservation with human consumption needs.

THE SCENARIO AT A GLOBAL SCALE:

The global human population is currently using the natural resources equivalent to 1.6 planets. Ecosystems and biodiversity are being seriously affected by such unsustainable demand and consumption of goods (Global Footprint Network, 2015). Globally, 40 per cent of the areas suitable for agriculture are used for production of commodities and 92 per cent of the freshwater used goes to agricultural production (WWF, 2014b). Around one third of global cropland is used to grow animal feed (FAO, 2014).

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WWF'S GLOBAL STRATEGY TO REDUCE THE IMPACT OF COMMODITY PRODUCTION

Through its global Market Transformation Initiative (MTI), [37] WWF worked to transform the production and markets of 15 commodities that have the greatest impacts on biodiversity, water and climate. In order to achieve a more sustainable commodity production, MTI recommended credible certification schemes that include:

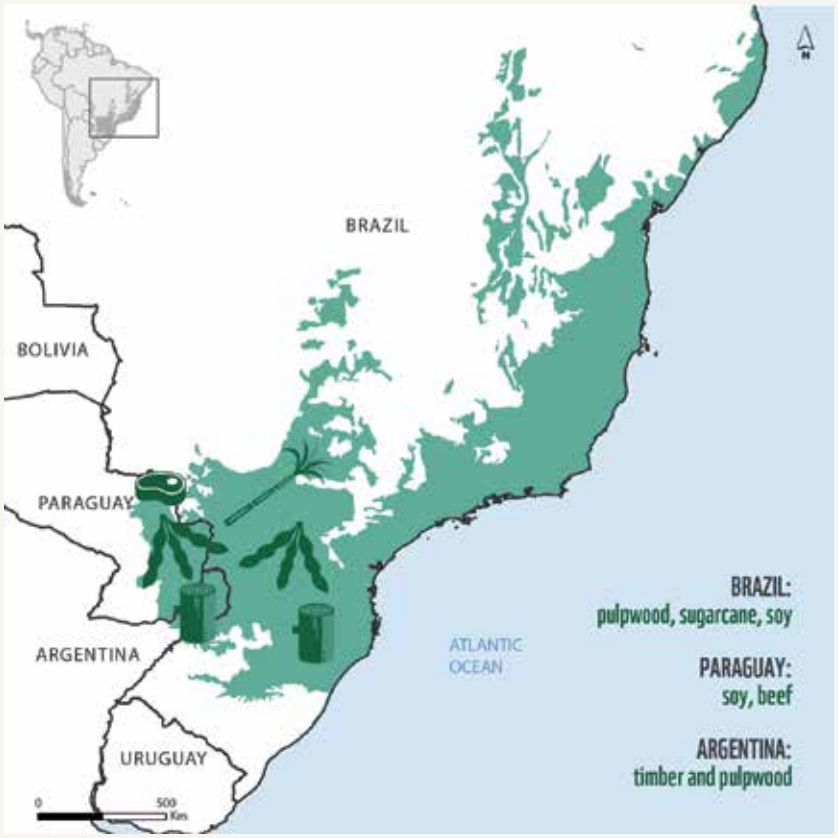
- Requiring better management practices in commodity production
- Contributing to biodiversity conservation and ecosystem restoration
- Setting higher standards on workers' conditions
- Recognizing the legal and customary rights of local and indigenous people
- Entailing that producers should have positive impacts on the local communities

37 In a process started in 2015, WWF is modifying its organizational structure, and the Market Transformation Initiative is no longer a standing programme; sustainable production of commodities is currently part of the Food Practice, which pursues the following Global Goal: "sustainable food systems conserve nature and maintain food security".

THE ATLANTIC FOREST SCENARIO: THE ADVANCE OF COMMODITIES OVER FORESTS

The Atlantic Forest ecoregion hosts the production of 5 out of the 15 commodities of WWF's concern: timber, pulp and paper, soy, sugarcane, and beef. Land transformation – for agriculture, livestock production, forestry and urban expansion - has replaced 69 per cent of the Atlantic Forest in Paraguay (WWF-Paraguay, 2011), while in Argentina's share of the ecoregion, more than 30 percent of the natural forest habitats gave way to such activities (Izquierdo et al., 2008). Brazil, the seventh largest economy in the world, has more than 145 million people living in this ecoregion, which produces 70 per cent of the Brazilian Gross Domestic Product (GDP) and contains one of the largest consumer markets in Latin America.

WWF's MTI and the Atlantic Forest Ecoregional Programme work to promote and establish ways to supply food and commodities while preserving the natural ecosystems, their goods and services.



Main commodities produced in the Atlantic Forest, by country.

TOOLS FOR CHANGE IN THE ATLANTIC FOREST ECOREGION: INTRODUCING AND EXPANDING VOLUNTARY CERTIFICATION FOR RESPONSIBLE COMMODITY PRODUCTION

TRANSFORMING TIMBER AND PULPWOOD PRODUCTION

Brazil and Argentina have the first and third largest areas of forest plantations in Latin America, respectively: 7.7 million hectares of exotic tree plantations in Brazil, and 1.2 million in Argentina (FAO 2014), with the largest fractions of these areas in the Atlantic Forest. Brazil leads the global ranking of industrial forest productivity with 39 cubic meters per hectare per year (Industria Brasileira de Árvores, 2015). Paraguay's forest plantations currently occupy well over 50,000 hectares almost exclusively in the Atlantic Forest ecoregion (Instituto Forestal Nacional, 2013). Globally, tree plantations are likely to expand to meet increasing demand for pulp, paper, cardboard, and energy. Brazil alone plans to double its forest plantation area by 2020 (Industria Brasileira de Árvores, 2015).

The Forest Stewardship Council (FSC) is an independent, non-governmental, nonprofit organization established to promote the responsible management of the world's forests (https://ic.fsc.org/en).

WWF-Brazil, WWF-Paraguay and Vida Silvestre have promoted the adoption of FSC certification in the Atlantic Forest. As plantations produce more wood on less land than natural forests, they can reduce the pressure to harvest remaining natural forests. Responsibly managed forest plantations can eventually result in an increased area of restored and regenerated native forests, when large forestry companies comply with restoration obligations. In all three countries, WWF and Vida Silvestre promoted the establishment of FSC initiatives and became part of their national organizational structures for environmental standards.

Since the creation of FSC-Brazil in 1996, large companies are committed to certifying their production and improving their performance in a landscape approach. There are currently 6.15 million hectares of FSC certified plantations in Brazil, the vast majority of which are located within the Atlantic Forest. Significant challenges and opportunities arise in working within the sector in mosaic landscapes, applying sustainable intensification perspective, forest restoration and multi-commodity approaches.

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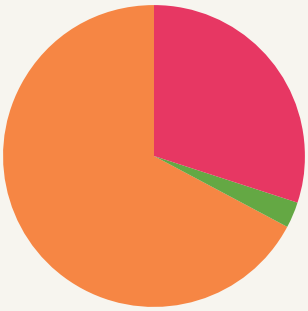
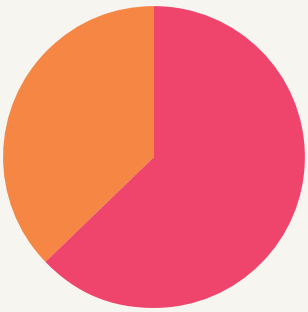
ARGENTINA



30% FSC CERTIFIED
67% NON-CERTIFIED
3% CERFOAR CERTIFIED
(DATA 2016)

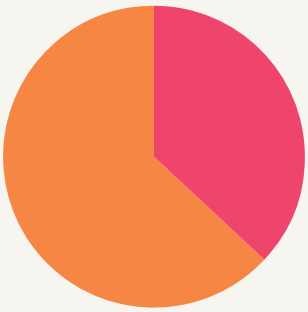
BRAZIL



63% CERTIFIED (88% BY FSC)
37% NON-CERTIFIED

(DATA 2014) - (IBÁ, 2015). FOR BRAZIL, DATA AVAILABLE ONLY AT COUNTRY-LEVEL. HOWEVER, MOST PART OF THE INDUSTRIAL TREE PLANTATIONS IS IN THE ATLANTIC FOREST.

PARAGUAY



37% FSC CERTIFIED
63% NON-CERTIFIED

(DATA 2013/2016). FOR PARAGUAY, DATA AVAILABLE ONLY AT COUNTRY-LEVEL. HOWEVER, MOST PART OF THE INDUSTRIAL TREE PLANTATIONS IS IN THE ATLANTIC FOREST.

FSC standards for all

For small-scale foresters, meeting FSC standards can be a challenge, so WWF-Brazil, FSC-Brazil, the Federal University of Viçosa and large companies, developed FSC standards adapted for small-scale and low-intensity forest producers, most of them located in the Atlantic Forest. The resulting new standard is simpler, more adequate and less costly for this kind of producer: outgrowers who supply wood for large companies. A two-year effort concluded with the approval of the FSC International Standard of Certification for Forest Management in Small and Low Intensity Scale (SLIMF). Since its approval, in 2013, more than 130,000 hectares in small and medium sized properties, integrated with large pulp and paper companies, reached FSC certification, including areas of native forest with high conservation values.

The Atlantic Forest Conservation Programme in Argentina has only very recently become involved with timber and pulpwood production issues. The adoption and spread of FSC certification in this part of the Atlantic Forest has been slow and challenging. Government and companies are prone to support and embrace weaker certification schemes, mainly PEFC . [38] Two companies are currently FSC certified in the Atlantic Forest region; one is the largest forestry company in the country, with a combined certified area of 192,790 hectares. The FSC certified plantations are one third of the total planted forests.

In addition, from a nearly complete absence of sustainable practices in tree-plantations in the Argentine Atlantic Forest just a few years ago, national and provincial government forestry agencies have started introducing sustainability con-

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38 Programme for the Endorsement of Forest Certification. The WWF Certification Assessment Tool (CAT) showed that PEFC meets 70% of the "Standard Strengths" indicators, which cover sustainable forest management related issues such as biodiversity, water and soil, worker's rights, and community relations.

cerns, materialized in four ongoing programmes [39] to foster better management practices in the sector. These programmes address, for the first time at the provincial scale, biodiversity conservation and social issues in forestry, ranging from small to large-scale operations. This recent change in public policies could facilitate further adoption of FSC certification in the years to come.

Paraguay's fledgling FSC-certified plantations occupy more than 19,000 hectares within the Atlantic Forest. Even though FSC certification only began five years ago in Paraguay, eight companies already hold valid certification licenses, with the number of certified plantations growing constantly. [40] Regarding FSC, WWF-Paraguay 's leading partner is Unique Wood Paraguay, a German-Paraguayan company that promotes sustainability within the forestry sector.

The Atlantic Forest's FSC certified companies, along with some government agencies and forestry companies from around the world, participate in the New Generation Plantations (NGP) platform, created by WWF in 2007. The NGP platform allows exchange, learning and influence about better plantation management among participants. They pursue model management practices with high environmental and social impacts: ecosystem integrity, protection of high conservation values, effective participation of all stakeholders, and jobs creation. Conservation and restoration of natural forests around plantations is frequent among NGP participant companies. Since its onset, the plantations in the Atlantic Forest have had a leading role in the platform:

- Six large companies in the Atlantic Forest (Suzano, Stora Enzo, Acre State, Arauco, Masisa and Fibria Celulose)
- Eight case studies of innovative and influential practices (carbon sequestration, tree nurseries, mosaics, corridors, social businesses, bioenergy, among others).
- Ten years of debate and exchange among the Forest Dialogue´s members about the impacts and best management practices in industrial forestry.

TRANSFORMING SUGAR PRODUCTION

As a water-intensive crop, sugarcane has a significant impact on environmentally sensitive ecoregions like the Atlantic Forest. Brazil is the largest sugarcane producer in the world, with sugarcane plantations covering 10.5 million hectares (which produced 739 million tons in 2013); the cultivation area is expected to reach 11.5 million hectares by 2020 (Ministério da Agricultura Pecuária e Abastecimento, 2011). More than half of the sugarcane is produced in the states of São Paulo and Minas Gerais, both in the Atlantic Forest. In the Atlantic Forest share of Argentina and Paraguay sugar production is not relevant.

The Bonsucro Standard is the first standard to measure the impact of surgarcane's sustainable production. Bonsucro is a collaboration among sugar retailers, investors, traders, producers and NGOs that are committed to sustainable sugar production by establishing principles and criteria applied in the sugarcane growing regions of the world (bonsucro.com).

39 Sustainable Management of Natural Resources: Sustainable Forest Plantations Programme, Biodiversity Conservation in Forestry Productive Landscapes Programme, Programme for Forestry Sustainability and Competitiveness of Renewable Firewood Programme.

40 FSC Public Certificate Search: http://info.fsc.org/certificate.php#result.

WWF is a founding member of Bonsucro, a certification standard for sugarcane growers, which is one of the greatest opportunities to provide sustainability to the sector. Certified sugar plantations adopt a wiser use of resources, sustainable techniques and better plantation management for higher quality and productivity. Ultimately, the environmental impact of sugar production is reduced and its profitability increases.

SUGARCANE PRODUCTION

In Brazil, current certification reaches 954,000 hectares at 46 mills, representing 8 per cent of total Brazilian sugarcane and 4 per cent of global production. [41] Legal compliance, including abiding by the Forest Code, is one of the sustainability pillars of Bonsucro, and WWF is working with other institutions to develop spatial maps of the Atlantic Forest's priority areas for Smart Compensation.

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WWF-Brazil established a partnership with the Bariri Sugarcane Suppliers Association (Assobari) to produce the most encompassing protocol for standards that currently exists, to comply with labour and environmental regulations. Bonsucro adopted this protocol to certify growers.

WWF, Bank of Brazil and other institutions are identifying and sharing best restoration practices with the sector (WWF, 2016). WWF-Brazil has recently trained 130 small-scale farmers in the adoption of the better agricultural practices required to achieve the certification. Five of these producers were also engaged to establish comprehensive demonstration units, through implementation of better management practices on their agriculture and pasture production activities, and restoring riverine areas. The experience is part of the Water Producer Project.

41 Bonsucro 2015. http://www.bonsucro.com/.

The Round Table on Responsible Soy (RTRS) is an international multi-stakeholder initiative founded in 2006 that promotes the use and growth of responsible soy production (www.responsiblesoy.org)

TRANSFORMING SOY PRODUCTION

Brazil, Argentina and Paraguay are the three largest soy producers in South America. With around 25 million hectares of soy plantations in Brazil, 19.3 million in Argentina and 3 million in Paraguay, this commodity is responsible for a steady forest conversion to agricultural land in the Atlantic Forest ecoregion (WWF, 2014a). Soy is grown extensively in the Atlantic Forest ecoregion in Brazil and Paraguay, but in the Argentine share of the ecoregion its actual cultivation is insignificant, though the impacts of soy grown elsewhere in Argentina reach the region by displacement of livestock and other activities from the Pampas and Chaco regions.

25 MILLION
HECTARES OF SOY PLANTATIONS IN BRAZIL,
19.3 MILLION
IN ARGENTINA AND
3 MILLION
IN PARAGUAY

Soy demand continues to grow and FAO projections indicate an increase from 270 tons produced globally in 2012 to 515 tons in 2050 (Bruinsma, 2009). In light of continuous pressure on the Atlantic Forest, WWF promotes better management practices in soy production through the voluntary RTRS certification, along with efforts to introduce land use planning and bring about legislation to stop forest conversion. This approach must be accompanied by efforts to introduce diet shifts in the countries with the highest demand of meat proteins produced with soy-based animal feed.

WWF-Paraguay and WWF-Brazil promote and participate in the Executive Council of the Round Table on Responsible Soy, understanding that soy certification is the best available instrument to guarantee sustainable production and halt soy-driven deforestation.

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SOY PRODUCTION

Brazilian National Interpretation of the RTRS standard was concluded in 2011. Brazil leads the RTRS certification worldwide, with 261,371 hectares certified in 2013.

On the other hand, the national interpretation of the RTRS standards for Paraguay is still in progress. The current certification of soy production under the RTRS scheme covers about 18,000 hectares, or 0.6 per cent of the total production area in Paraguay, which reflects the first successes of a process that it is still in development.

WWF-Paraguay provided technical support in the RTRS Mapping Project for Paraguay that differentiates areas suitable for soy production (degraded or low conservation value) from areas with high conservation value where agricultural development should be avoided ("go" and "no-go" areas).

TRANSFORMING BEEF PRODUCTION

Created in 2012, the Global Roundtable for Sustainable Beef (GRSB), of which WWF is a founding member, established its guiding principles and criteria in late 2014. Since then, the GRSB has also advanced in defining its governance structure, growing its membership and developing a strategic plan. Besides GRSB, a handful of other initiatives, platforms and organizations in Brazil are working on market tools to halt deforestation linked to cattle ranching. Best cattle ranching practices are promoted by the Brazilian Roundtable for Sustainable Beef, which was established prior to the GRSB inception and is engaged in it, and the Leather Working Group. For example, the government is holding the beef industry more accountable for unsustainable production practices through a new Conduct Adjustment Agreement; the tannery sector established an environmental auditing protocol; and the Brazilian association of supermarkets developed initiatives for sustainable purchasing. Large meatpackers have been working to ensure that their supply does not come from illegally deforested areas (WWF, 2016).

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Global Roundtable for Sustainable Beef

The Global Roundtable for Sustainable Beef (GRSB) is a multi-stakeholder initiative that recognizes and respects the important role that a sustainable beef supply chain plays in feeding the growing global population (www.grsbeef.org).

Shifting small-scale farming towards sustainability

THE ATLANTIC FOREST SCENARIO: SMALL-SCALE FARMING AMONG FOREST REMNANTS

THE SCENARIO AT A GLOBAL SCALE:

Family or small-scale farming is a relevant source of food production worldwide. Recent global estimations revealed that 53 per cent of the agricultural land is managed by family farms. Of all farms in the world, 98 per cent constitute family farms (Graeub et al., 2016). Many small holding farming systems in Africa, Asia and Latin America, which are the source of income and food for several billion people, are excluded from government rural development plans that protect farms from diverse causes of low productivity.

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In South America, while 18 per cent of the farm acreage is held by family-farms, they constitute 82 per cent of the total existing farms (Graeub et al., 2016)). The same pattern is found within the Atlantic Forest. Small–scale farms [42] occupy 20 percent of the total agricultural area in the Brazilian Atlantic Forest (Frickmann Young, 2003) and 24.3 per cent in Argentina. [43]

Small–scale farmers represent a large fraction of the landholders in the Atlantic Forest. In Brazil, while the territory along the Atlantic Forest is important for commodities, 70% of the country´s total food production comes from small-scale farms (de França, Del Grossi, & Marques, 2009; Fernandes, 2012). Although holding only a reduced part of the agricultural lands, in the Atlantic Forest of Argentina and Paraguay the traditional rural lifestyle is embodied, associated with diversified on-farm consumption farming. These small-scale farmers resist in a context of an ever-growing advance of large-scale commodity production. Good management of soil, nutrients, water and forest products in small properties is necessary to maintain their productivity, the livelihoods of rural families and to discourage conversion of the remaining fragments of natural areas.

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42 The parameters to define a small-scale farm differ across the three countries of the Atlantic Forest. In Argentina, there is not an official definition by farm size, but usually this category is composed by land properties up to 50 hectares. In Brazil, a family-scale property or minifundio equals to one fiscal module, and a small property measures up to 4 fiscal modules, which vary between 5 and 110 hectares according to each municipality. In Paraguayan Atlantic Forest, landholders with fewer than 20 hectares are considered small-scale farmers.

43 Censo Nacional Agropecuario 2002. Ministerio de Economía, Argentina. http://www.indec.gov.ar/index_agropecuario.asp

Although the Atlantic Forest Ecoregional Programme has sought to establish a variety of good farm practices across its priority areas, in each country there is a particular strategy to cope with each specific problem. In Paraguay, the focus is on crops diversification; in Brazil, on protection of soils, water and forest fragments, and in Argentina, on agro-forestry systems and pesticide-free production.

SUPPORTING CROP DIVERSIFICATION AND BUILDING RESILIENCE IN PARAGUAY

Many small-scale farmers in the Atlantic Forest of Paraguay, including indigenous communities, have not reached household food security. Furthermore, some of these communities of small landholders are cultivating soy or renting their lands to large landholders to produce soy. Food security and crop diversification are key for these vulnerable people.

WWF-Paraguay's strategy has been to provide support, training and technical assistance for these producers to adopt better agricultural practices and reach food security, while moving their farm management towards a diversified crop platform that increases the resilience of the productive systems facing climate impacts.

WWF-Paraguay promoted crop diversification – including Ilex paraguariensis (yerba mate), Passiflora edulis (passion fruit), medicinal herbs, among others – and production of native and exotic tree seedlings for the market. It also introduced agro-forestry systems, combining native traditional yerba mate trees with agriculture plots.

Overall, more than 700 family-scale farmers in Paraguay received training for better agricultural practices, including diversification of agricultural production, soil management and conservation, integrated pest management, and tree seedling production in nurseries that supplied restoration of riverine forests.

Resilience against the odds

When a middle-aged woman named Ña Leli saw her community, Tavapy II, changing before her eyes, she took action. Living in one of the most soy-dominated areas of the Paraguayan Atlantic Forest, in the department of Alto Parana, Ña Leli watched as the forest disappeared around her. Neighbors abandoned their traditional agricultural lifestyles and sold their lands for soy cultivation over the course of many years. Instead of surrendering to the mounting pressures to do the same, Ña Leli and her few remaining neighbours formed a committee that sought solutions to generate income so that they could remain on their land. With the support of WWF-Paraguay, the committee began diversifying crop production; they grew gargantuan watermelons that won prizes at local fairs, identified an organic method for growing the national tea-like infusion yerba mate, and started cultivating organic saffron and chamomile using agroforestry techniques. The committee secured funds for an industrial-grade tea drier, one of very few in the country that dries yerba mate leaves for packaging and sale. Most astounding of all is the committee's tree nursery, which produces thousands of saplings of yerba mate as well as native forest species that support WWF-Paraguay's reforestation efforts in the region. The successes of Ña Leli and her committee of hard-working men and women in Tavapy II prove that traditional communities with a strong sense of environmental stewardship remain relevant in an era of mechanized agriculture. The innovative resilience of Tavapy II serves as a model for other communities facing mounting pressures to abandon their lands to monocrops.

SUPPORTING SMALL FARMERS AS WATER PRODUCERS IN BRAZIL

The farmers of Cancã, Moinho and Tietê-Jacaré watersheds in Sao Paulo state, in Brazil, started to introduce good agricultural practices as part of the larger and far reaching Water Brazil Programme created by WWF-Brazil, Bank of Brazil and three large public and private partners to preserve water and rivers across the country.

In Cancã-Moinho Watershed, one of the most important microwatershed of Cantareira system, the one that supplies the city of São Paulo, the largest of Latin America, more than 81,000 seedlings were planted and 321 ha of forests fragments were conserved. Moreover, 41 small-scale farmers were benefited by Payment for Enviromental Services (PES) and more than nine milllion people were impacted directly and indirectly. The best management practices included sustainable management of pasture (Voisin system), organic agriculture, soil conservation, forest restoration and payments for environmental services related to water.

In Tiete-Jacaré watershed more than 450,000 seedlings were planted, 64 producers were benefited directly and 465 indirectly, 311 ha of Atlantic Forest were restored with low cost and more than one million people were impacted directly and indirectly. The best management practices included sugar cane plantations, Bonsucro certification and forest restoration.

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ADOPTING AGRO-ECOLOGICAL PRACTICES IN ARGENTINE SMALL-SCALE FARMS

Vida Silvestre in Argentina launched its work with farmers soon after the programme was established, concentrating most efforts on training and providing technical support to farmers' families for the adoption of agro-ecological practices, in order to protect soil, water and biodiversity resources present in their small farms. As result of the programme actions in the Argentine Atlantic Forest, a total of 218 small-scale farmers and 28 technicians were trained in a variety of environmentally adequate farming techniques and innovative productions, and 41 farms received direct support.

The Andresito Municipality, a 90,300-hectare jurisdiction surrounded by four large protected areas, is an essential buffer zone as well as an area of connectivity among the conserved forests. It is thus one of the most critical areas regarding the ecological integrity of the ecoregion. The programme's work has been more intense in this municipality.

In Andresito, Vida Silvestre first developed a forest landscape planning effort at municipal level, through a participatory process involving all the community's stakeholders. The land use plan has, since then, become a tool to support decision-making in the area, regarding where and what kind of productive activities to promote.

Agro-ecological food production was also promoted in this area, by providing training and technical assistance to 19 farms in the area, which are producing and marketing vegetables grown under good practices, such as organic pest control, mixed crops, biodynamic calendar, soil protection and wise use of water. The programme helps this group of farmers to take advantage of the market offered by the numerous hotels and restaurants in the world-renowned Iguazu Falls area.

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PUBLIC POLICIES AND FINANCIAL MECHANISMS TO SECURE FOREST PROTECTION

Fighting deforestation with public policy

Our shared goal is to decrease deforestation rates through legal limitations to forest conversion (in Argentina and Paraguay); and organize society´s control over the implementation of new legislation that weakens forest protection (in Brazil).

THE SCENARIO AT A GLOBAL SCALE:

Forests are lost globally at an alarming pace. Between 2000 and 2010, 13 million hectares were deforested each year worldwide (FAO, 2010). Forest loss threatens over 80 per cent of Earth's biodiversity, accounts for at least 15 per cent of global greenhouse gas emissions and endangers the livelihoods of millions of people who rely on forests (Pan et al., 2011; Sunderlin et al., 2005). In many countries, government policies, or the lack thereof, lie behind the loss of forest resources; thus, introducing improved public policies can strengthen forest conservation, maintaining valuable forest services for society.

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WWF'S GLOBAL STRATEGY TO RESTRAIN DEFORESTATION

The scale and likely effects of deforestation and forest degradation led WWF, in 2008, to advocate for an ambitious conservation target of Zero Net Deforestation and Forest Degradation by 2020. In order to effectively focus the conservation efforts in places where threats are greater, WWF subsequently identified eleven Deforestation Fronts where most deforestation is likely to happen between 2010 and 2030 (WWF, 2015). The Atlantic Forest-Gran Chaco is among the four fronts found in South America in which there is a projected loss of 10 million hectares of forests – most of it in the Gran Chaco - if no interventions are deployed to prevent it (WWF, 2015).

THE ATLANTIC FOREST SCENARIO: THE QUEST FOR EFFECTIVE PUBLIC POLICIES

The turn of the 21st century found Paraguay holding the first place in deforestation rates in South America and the second place in the world (WWF, 2006). Despite the standing legislation at the time, namely the Forestry Law, the Environmental Protection Decree, the Environmental Crime Law and the Penal Code, [44] an average of about 120,000 hectares were lost annually in the Paraguayan share of the Atlantic Forest ecoregion (Huang et al., 2007).

In Argentina, the first national native forest inventory, completed in 2005, revealed that the country had lost about 70 per cent of its native forests, and about 44.25 per cent of the original Atlantic Forest (Secretaría de Ambiente y Desarrollo Sustentable, 2005). The average annual area deforested in the Argentine Atlantic Forest, between 1998 and 2002, had been 16,808 hectares. [45] The provincial law [46] regulating the use of these forests had been passed in 1977, when native forest resources still seemed limitless.

Both in Argentina and Paraguay, old laws were in place to limit forest conversion, but they were far from stopping or seriously combatting the rapid and intensified loss of native forest (Figure 24).

In the Brazilian Atlantic Forest , the bulk of deforestation had occurred gradually since colonial times, having lost more than 92 per cent of its original area by the turn of the century (Hirota, 2003). Brazil had a long-standing Forest Code, which since 1965 regulated the protection of legal reserves [47] and permanent protection areas [48] of native forests in every private property. This national law

44 Forestry Law 422/73; Environmental Protection Decree 18,831/86, Environmental Crime Law 716/96.

45 Ministerio de Ambiente y Desarrollo Sustentable de la Nación. Mapa Forestal Provincia de Misiones Actualización 2002. Unpublished Report. 24 pp. http://www2.medioambiente.gov.ar/bosques/umsef/cartografia/mapa.asp?mapa=misiones

46 Misiones Provincial Law 854/77.

47 A legal reserve is a proportion of rural land that should be maintained permanently as forest in each property. In the Atlantic Forest ecoregion the mandatory legal reserve represents 20% of every property.

48 Permanent Protection Areas are sensitive lands - such as water heads, river margins, forests in slopes and high altitudes above 1800m - where the clearing of vegetation is prohibited.

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allowed almost no further legal deforestation in the ecoregion. However, pushed by agribusiness and big landholdings' interests since the late 1990s, the Forest Code was altered in 2012, [49] introducing a relaxation of criteria to define areas of reserves and protection, as well as an amnesty for illegal deforestation carried out before 2008. Land use change projections made for the Brazilian Atlantic Forest indicated that more than 7 million hectares or about 45 per cent of the existing legal reserve area at the time of the debate might be legally lost with the new code (Instituto de Pesquisa Econômica Aplicada, 2011).

	ARGENTINA	PARAGUAY	BRAZIL
ORIGINAL ATLANTIC FOREST AREA (in hectares)	2.7 million	8.6 million	123.2 million
FOREST LOSS PER YEAR (in hectares)	16,808 (average for 1998–2002 period)	65,175 (average for 2000–2005 period)	34,966 (average for 2000–2005 period)
WHICH PORTION OF THE REMAINING FORESTS REPRESENTED THE ANNUAL LOSS?	1.26 %	3.7 %	0.35 %
WHICH PORTION OF THE ORIGINAL FORESTS REPRESENTED THE ANNUAL LOSS?	0.62 %	0.75 %	0.026 %

Figure 24: *Forest loss in the Atlantic Forest around year 2000*
Sources: Argentina: SADS 2005b; Paraguay: UN-REDD Programme 2015 and WWF-Paraguay GIS Lab; Brasil: SOS Mata Atlantica and INPE 2014, Hirota 2003.

49 Federal Law 12,651/12

TOOLS FOR CHANGE IN THE ATLANTIC FOREST ECOREGION: DEVISING NEW LEGAL INSTRUMENTS

WWF and Vida Silvestre joined forces with other environmental organizations, community leaders, government representatives and society, to push for new regulations that would stop or set much harsher criteria to allow native forest conversion in the Atlantic Forest.

New laws to restrain forest loss:

PARAGUAY (2004):
Forest Conversion Moratorium or Zero Deforestation Law: NO Atlantic Forest conversion until 2018

ARGENTINA (2007):
National Law for Native Forests Protection: NO Atlantic Forest conversion on 73% of the remaining forests ("Red" or "Yellow" forest categories)

New strategies to counter deforestation enabled by the new forest code:

BRAZIL (2013):
"Forest Code Watch" Initiative: permanent social watch on the impacts of the Forest Code

PARAGUAY

WWF Paraguay celebrated a milestone achievement when the National Senate passed the Zero Deforestation Law in the Eastern Region of Paraguay in 2004. [50] The law establishes a temporary moratorium of native forest conversion to any other land use. Mandating an initial two-year ban on conversion, the law was later extended on three occasions - 2006, 2008 and 2013 - to be upheld until the end of 2018, thanks to the efforts of awareness campaigns organized by WWF Paraguay and widespread public support.

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Core contents of the law:

- Prohibits the transformation or conversion of lands with forest cover for agricultural use or the construction of human settlements.
- Establishes the Secretariat of Environment (SEAM) and the National Forestry Institute (INFONA) as the responsible parties for creating a baseline inventory of existing native forests.
- Calls for an independent audit to georeference and review land use plans
- Recognizes that those not complying with the law will be sanctioned.

ARGENTINA

In Argentina, in 2006, the National Congress drafted a regulation restricting forest conversion nationwide, but it was soon blocked by legislators from the northern forested provinces who resisted its debate and approval. Vida Silvestre along with the main Argentine environmental organizations launched a national campaign to reach the required one million signatures that obligated the Congress to debate the dormant bill. In late 2007, the National Law for Native Forests Protection [51] was passed, starting a new period in the use of native forest in the country.

50 National Law 2,524/2004 - Zero Deforestation Law in the Eastern Region of Paraguay.

51 National Law 26,331/2007 - National Law for Native Forests Protection. Its provincial correlate is Misiones Provincial Law XVI-105 (2010)

ARGENTINA

Core contents of the law:

- It obligates the provincial environmental authoriy to develop a forest land zoning plan (in all provinces with native forests).
- Requires an assessment of the conservation value and ecological role of all remaining native forests, and their assignment to one of three categories: red, yellow (both banning conversion) or green (conversion permitted).
- Prohibits conversion on red and yellow categories forests.
- Establishes a fund to provide incentives and compensate forest landowners affected by the ban on forest conversion or use.

BRAZIL

The change in legislation that protected the Brazilian share of the Atlantic Forest, unlike the changes that occurred in Argentina and Paraguay, was detrimental. More forests were habilitated for deforestation after the 2012 reform of the Brazilian Forest Code, compared to its 1965 version. WWF-Brazil was part of the Brazilian Committee in Defense of the Forests and Sustainable Development, a coalition of 200 environmental and civil society organizations that coordinated a resistance to the passing of the reform bill.

While the previous Forest Code was widely unenforced, the procedures contained in the reformed code are said by its defenders to enable greater transparency and improve enforcement, in spite of lessened regulations. After the adverse passing of this detrimental reform in legislation, WWF-Brazil

CITIZEN INVOLVEMENT WAS ESSENTIAL TO BRING CHANGES IN PUBLIC POLICIES

ARGENTINA:

1.5 MILLION

signatures demanding congressional debate of the Forest Protection bill

BRAZIL:

MORE THAN 2 MILLION

signatures against the reform of 1965 Forest Code

1.4 MILLION

signatures for Zero Deforestation bill

PARAGUAY:

20 K SIGNATURES

asking for the extension of the Zero Deforestation Law (2013)

BRAZIL

along with seven socio-environmental organizations devised and created the "Forest Code Watch". The initiative seeks to follow up the enforcement and regulation of the new Forest Code in a critical way and with technical background. Its web platform provides information, studies and analysis to back the progress of the new code's implementation.[52]

Core contents of the initiative:

- Uses strict control mechanisms to mitigate negative aspects of the new Forest Code and avoid further backwards steps.
- Assesses the performance of federal and state governments in the enforcement of the code.
- Monitors the Programme of Environmental Regularisation created by the code's reform. [53]
- Generates and disseminates data on the law's implementation.

ACHIEVEMENTS: NEW REGULATIONS ARE DECREASING DEFORESTATION

Paraguay: An impressive 82 per cent reduction in the annual forest loss was recorded in the Atlantic Forest of Paraguay 10 years after enacting the Zero Deforestation Law, which resulted from the Social Pact partnership led by WWF-Paraguay (Figure 25). Not free from shortcomings, particularly in the intensity of its enforcement, the results of this regulation have set a new scenario for the future of these forests.

WWF-Paraguay promoted and led two complementary mechanisms to help achieve a real implementation of the initial Moratorium and compliance with the Zero Deforestation Law:

52 http://www.observatorioflorestal.org.br.

53 http://www.mma.gov.br/informma/item/10107-decreto-regulamenta-programa-de-regulariza%C3%A7%C3%A3o-ambiental

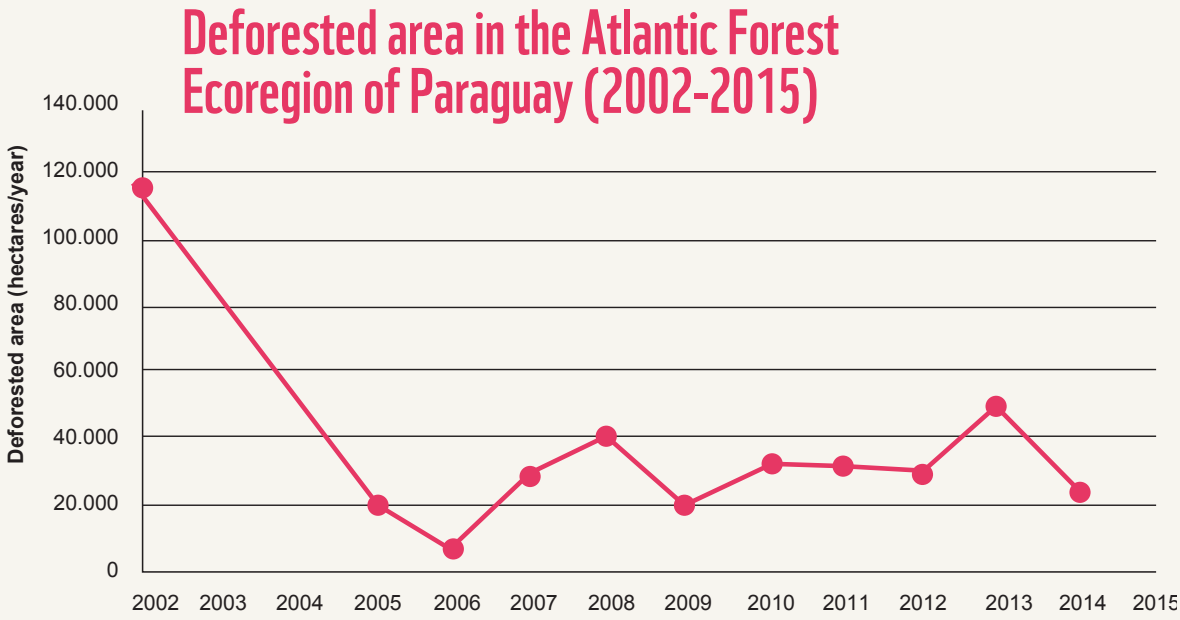


Figure 25: *Changes in annual forest loss in the Atlantic Forest of Paraguay from 2002 to 2015.* (Sources: FCA-UNA/WWF-Paraguay [Years 2002-2004]; Guyra Paraguay and WWF-Paraguay [Years 2005-2006]; WWF-Paraguay [Years 2007-2015]. 54

- The Social Pact for the Atlantic Forest's Conservation in 2005, a multi-sector dialogue integrated by 139 organizations holding a diversity of interests, and aimed at building support for the implementation of the moratorium.
- The Conformance with Forest Law (CFL) Programme, an initiative to support landowners to abide by Paraguay's forest law beginning in 2005. The CFL programme worked to ensure that landowners: (a) acquire the mandatory environmental license required for any productive activity, (b) reforest or offset their forest cover deficits when deforestation surpassed the 25 per cent of mandatory legal reserve of forest in the property, and (c) where noncompliance was verified, legal actions were pursued. The ultimate goal of the programme was to make sure that once the moratorium is lifted there is adequate governance in place to restore the Atlantic Forest.

Initial implementation of the Conformance with Forest Law Programme began with 164 property owners in the Pirapó and Ñacunday watersheds, starting the process to comply with the Forestry Law and the Environmental Impact Law. [55] Of the area with legal forest deficit within the scope of this programme, 68 per cent was reforested or confined for forest restoration (WWF, 2011). In the case of noncompliance, the appropriate authorities took legal actions.

An indirect outcome of the CFL Programme was the enactment of a new forest regulation in 2010, the Law on Restoration of Watercourse Protective Forests within the National Territory [56] reinforcing the mandate to restore forests protecting water resources in medium and large-scale properties.

54 Data compiled and generated by the WWF-Paraguay GIS Monitoring Laboratory: http://www.wwf.org.py/que_hacemos/sig2/monitoreo_de_la_deforestacion

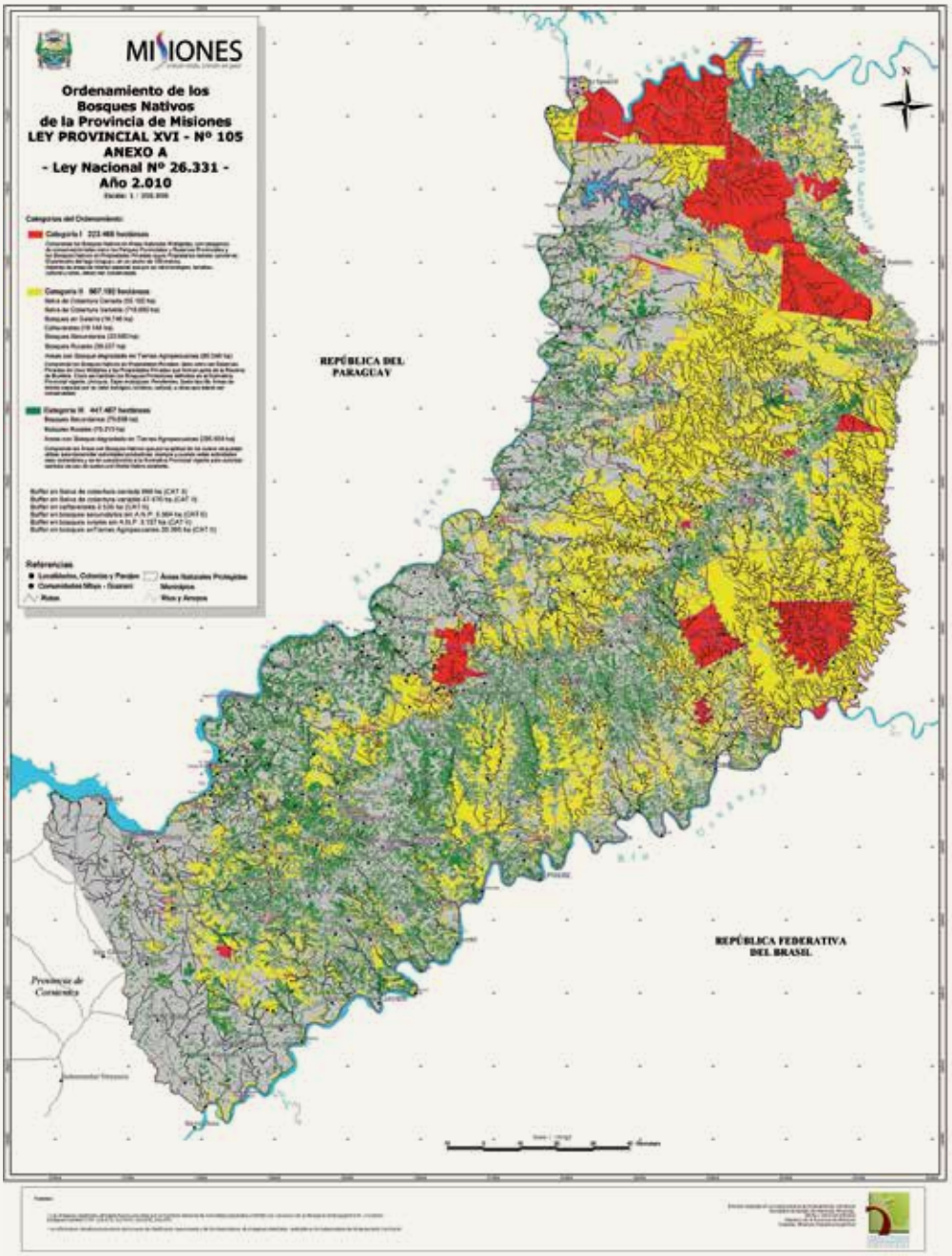
55 National Laws: 422/73 - Forestry and 294/93 – Environmental Impact

56 National Law 4241/2010 - Restoration of Watercourse Protective Forests within the National Territory

Protecting Pirapó

The Conformance with Forest Law (CFL) project had particular success in the Japanese colony of Pirapó, in the department of Itapúa, southeastern of the Atlantic Forest in Paraguay. Pirapó, founded in 1960, is an agricultural community with small, medium and large-scale producers. In the early 2000s, many of the large-scale producers had removed more forest over the years than the legally permitted 75 per cent. Adding severity to the problem, the Pirapó River, which flows into the Paraná River, was at particular risk because riverine forests were also being illegally removed at a rapid pace. In order to promote compliance with forestry legislation, WWF-Paraguay began work in the area, taking a full three years to gain the trust necessary to be taken seriously by the community. There was an agreement established between those with forest deficit and the district attorney to negotiate a solution to the non-compliance. Instead of establishing a price for a fine, those with forest deficit sought neighbours with a forest surplus, and they would come to an agreement that allowed for compliance with the laws. WWF-Paraguay worked landowner to landowner using this method that resulted not only in more law conformance, but liberated lawbreakers from pressures to pay bribes to legal authorities. The success of CFL in Pirapó led to a better understanding of forest legislation, better trained municipal staff who were equipped with geographic information systems (GIS) technology, and a model that could be replicated in other communities with forest deficits.

Argentina: Under the forestland zoning that was concluded in 2010, 73 per cent of the remaining native forests in the Atlantic Forest ecoregion of Argentina, including all large forest blocks, were designated as non-conversion areas. The rest, 447,487 hectares, were habilitated for conversion.



Official map of the Misiones Province – which hosts the totality of the Atlantic Forest in Argentina – reflecting the zoning of native forests. The areas in red and yellow are banned for conversion and the green areas can be transformed to other land uses given prior authorization.

After the National Law for Native Forests Protection was passed in 2007, and enforced in Misiones in 2010, a remarkable reduction in the average annual forest loss was observed. Data obtained from surveys conducted from 1998 to 2014 show that the annual area deforested was about eight times smaller for the 2011-2014 period than at the beginning of the 2000s (Figure 26).

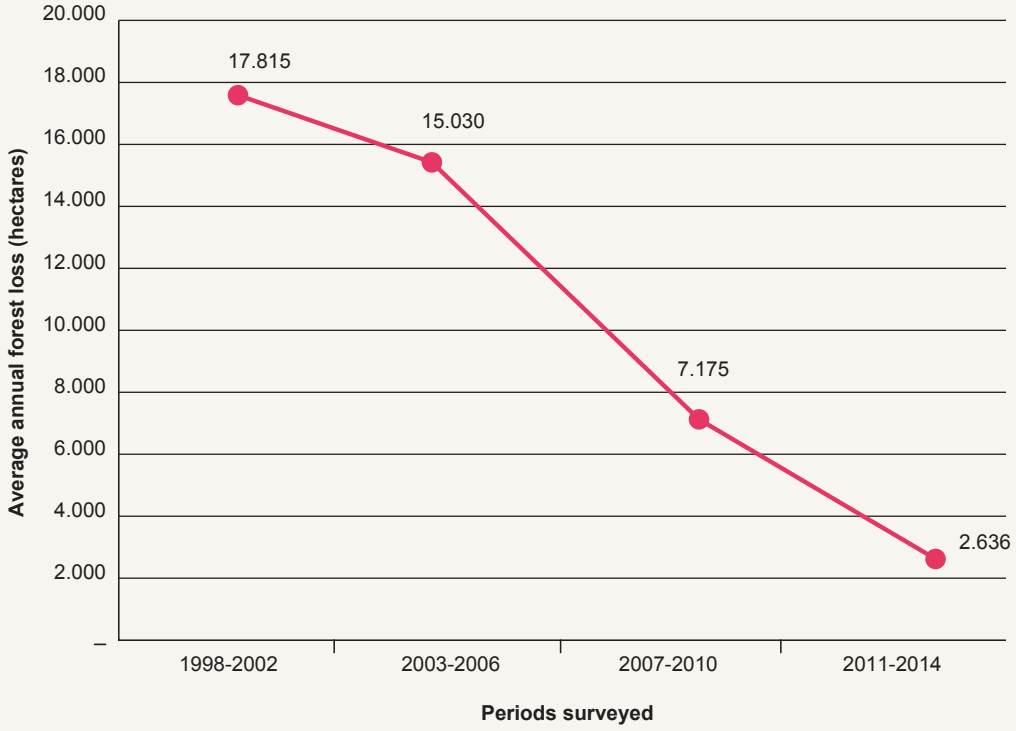


Figure 26: *Changes in average annual forest loss in the Atlantic Forest of Argentina since 1998 to date.* (Source: National System of Native Forests Monitoring: http://snmb.ambiente.gob.ar/portal/)

In addition, since 2011 the National Fund for the Enrichment and Conservation of Native Forests [57] was set in motion. Forest owners can access compensation funds by submitting a Forest Conservation Plan or a Sustainable Forest Management Plan. A total of US$7.77 million ($Ars43.5 million) was disbursed to implement the law and an area of 326,154 hectares has received compensation funds to date. As the local environmental authority was provided with legal, monetary and technical resources to require harsher environmental compliance from landholders, there was also a positive change in the quality of the enforcement.

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57 The National Fund for the Enrichment and Conservation of Native Forests is constituted with 0.3% of the national budget plus 2% of agricultural export taxes.

Brazil: In August 2015, a large network of more than 120 environmental NGOs including WWF-Brazil – The Atlantic Forest NGO Network – initiated a new stage in the defense of older and stricter forest regulations. They are demanding the Brazilian Supreme Court of Justice, under the figure called the Direct Actions of Unconstitutionality, to annul some components of the new forest code. Broad scientific data demonstrating the importance of the native forests' ecosystem services for human populations (Soares-Filho 2014) serve as a basis to support this action. The Atlantic Forest NGO Network argues that the new code stimulates deforestation and neglects forest restoration in watersheds and river margins, with further negative effects on the energy and water crisis in the Atlantic Forest southeastern states.

WWF-Brazil along with other organizations are backing a bill for a National Zero Deforestation Law. A recent campaign gathered 1.4 million signatures to support the presentation of the bill, whose goal is both feasible and necessary and will avoid large social and economic impacts in the future.

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Identifying financial mechanisms for change

Our shared goal Support the establishment of Payments for Ecosystem Services and the REDD+ mechanism to reduce current threats to nature and people posed by unsustainable forest use and to produce a shift towards climate resilience.

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THE REDD+ MECHANISM

Native forests in the Atlantic Forest ecoregional complex are the target of deforestation and forest degradation and, as such, plausible areas to change the incentives that drive such processes, achieving decreasing levels of greenhouse gas emissions. The REDD+ mechanism is an extraordinary opportunity to build sustainable financing mechanisms to protect some of the most important forest habitats, as well as the security and sustainability of local livelihoods.

WWF´s Forest and Climate Programme works for REDD+ to be defined and adopted both globally, and at the national and local levels. To define and implement REDD+ at the local level, WWF works along with local and indigenous communities, who are directly affected by its implementation. To reach REDD+ goals, local communities are building capacity in REDD+ projects in order to reach real and verifiable reductions in carbon emissions, have positive impacts on biodiversity and improve the well-being of forest-dependent communities.

PAYMENTS FOR ECOSYSTEM SERVICES

New information about forests' multiple benefits, new policies and new economic incentives have the potential to change domestic economies away from the busi-

ness as usual trajectory (CIFOR, 2009). Payments for Ecosystem Services (PES) is an approach to conservation that provides financial reward to landowners in exchange for the services landscapes naturally produce. Natural resources play a crucial role in the provision of services like water, biodiversity, carbon sequestration and landscape beauty. Awarding payments for the benefits provided by forests and other natural ecosystems is a way of recognizing their value and ensuring their future maintenance and conservation. Many PES mechanisms have emerged as potential sources of sustainable financing for conservation, and there is also evidence that such mechanisms improve development options and livelihoods in rural areas.

What is REDD+?

REDD+ refers to the initiatives and financial mechanisms to promote the Reduction of Emissions from Deforestation and Forest Degradation in developing countries. The United Nations Framework Convention on Climate Change (UNFCCC) recognizes the reduction of deforestation and forest degradation as a valid mechanism to fight climate change. In addition to the reduction in deforestation and forest degradation, REDD+ integrates efforts to conserve forests, increase forest carbon stocks and sustainable forest management, as activities that contribute to the mitigation of climate change. Under the REDD+ mechanism, developing countries are rewarded financially for the emission reductions achieved associated with a decrease in the conversion of forests to alternate land uses.

Five REDD+ principles:

Principle 1:

CLIMATE REDD+ demonstrably contributes to greenhouse gas emission reductions with national goals working toward a global objective.

Principle 2:

BIODIVERSITY REDD+ maintains and/or enhances forest biodiversity and ecosystem services.

Principle 3:

LIVELIHOODS REDD+ contributes to sustainable and equitable development by strengthening the livelihoods of forest-dependent communities.

Principle 4:

RIGHTS REDD+ recognizes and respects the rights of indigenous peoples and local communities.

Principle 5:

FAIR and EFFECTIVE FUNDING REDD+ mobilizes immediate, adequate and predictable resources for action in priority forest areas in an equitable, transparent, participatory and coordinated manner.

TOOLS FOR CHANGE IN THE ATLANTIC FOREST ECOREGION: PREPARING THE ATLANTIC FOREST COUNTRIES FOR INNOVATIVE FINANCING

Seeking to reduce the loss and degradation of their forests, the governments of Argentina, Brazil and Paraguay are developing the basic UN-REDD Programme requirements to become ready for REDD+:

a) build a National Forest Inventory, which serves as the baseline of carbon stocks;
b) develop a REDD+ national strategy, including adequate channels for the participation of local and indigenous people and civil society organizations;
c) establish a national system of measurement, reporting and verification, to monitor deforestation and forest degradation, and carbon emissions from these sources;
d) produce a carbon map;
e) build capacities and strengthen national authorities responsible for REDD+.

Argentina and Paraguay are partner countries of the UN-REDD Programme.

ACHIEVEMENTS: ADVANCES IN ESTABLISHING REDD+ AND PES MECHANISMS

Paraguay: advances in REDD+

PY

The Government of Paraguay, in collaboration with WWF, has been working to prepare the country for REDD+ since the concept was first proposed within the UNFCCC in 2005. The preparatory phase for REDD+ involves the Secretariat of Environment (SEAM) and the National Forestry Institute (INFONA), which have received support from UN-REDD, the Government of Japan and the Forest Carbon Partnership Facility (FCPF). The preparatory REDD+ phase was concluded in September 2016, with Paraguay moving towards REDD+ readiness.

In order to make REDD+ implementation a reality in Paraguay, WWF-Paraguay intended to mainstream REDD+ activities in the forest sector by fostering linkages with potential investments in sustainable forest management. Research about the feasibility of forest management practices was conducted to feed into policy, communication and capacity building measures to support information dissemination. Between 2012 and 2014, WWF-Paraguay and partners WWF-Germany, Deutsche Investitions und Entwicklungsgesellschaft mbH (DEG), and UNIQUE Forestry and Land Use, conducted the project “Development of business models for the restoration of forests and REDD+ in Paraguay”. Diverse and innovative business models for forest restoration were analysed from different perspectives and presented in five publications:

- REDD+ mechanism and the finance of carbon
- Lessons learned through the involvement of rural and indigenous communities
- Catalogue of forestry production models for small producers
- Catalogue of forestry production models for medium and large producers
- Forestry investments options compatible with REDD+

In addition, a REDD+ policy project called Paraguay Land Use (ParLu) was implemented by WWF-Paraguay, supported by the German government, [58] and was coordinated in the Atlantic Forest (one of two focal regions of operation).

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The project integrated the sub-national approach to the Paraguayan national REDD+ framework and has developed bottom-up REDD+ packages that can provide the expertise needed for decision making in the national UN-REDD Programme. [59] In the field, this expertise was gathered from the development of five pilot projects in the Atlantic Forest, which are testing and demonstrating several REDD+ instruments, working closely with rural and indigenous communities interested in improving their capacities in REDD+.

With regards to governance, WWF-Paraguay served as an advisory member to the National Commission on Climate Change, supporting the national positions and Intended Nationally Determined Contributions (INDCs) at the COP20 and COP21.

At the end of 2014, the framework for a national climate change law was submitted with the support of WWF-Paraguay. This framework has the following objectives:

a) Ensure compliance with the constitutional provisions on the development and implementation of public policies for adaptation to climate change and mitigation of greenhouse gas emissions.
b) Regulate greenhouse gas emissions according to the UNFCCC.
c) Regulate actions for mitigation and adaptation to climate change.
d) Reduce the vulnerability of the adverse effects of climate change and strengthen national resilience and response to the phenomenon.

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58 The German government´s support involves the German Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) through its International Climate Initiative (IKI).

59 http://www.parlu.org.

e) Promote education, research, development and technological innovation on climate change adaptation and mitigation.
f) Promote the development of a competitive sustainable low carbon economy.

Paraguay: development of PES

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The perceived economic benefits of agricultural production in Paraguay far outweigh the ones of conservation. For that reason, the passage of the Law 3,001/2006 on Payment for Ecosystem Services in Paraguay was an important step in supporting the mechanisms that reward conservation. Further support of the mechanism, in defining nominal value per hectare depending on the ecosystem, has enhanced buyers' understanding of the price negotiation process. With the support of NGOs such as the Institute of Environmental Law and Economics (IDEA), Guyra Paraguay, Network for Conservation on Private Lands, and Fundacion Moises Bertoni, together with environmentally conscious companies and the public sector, the PES market in Paraguay although new, is growing. Like in many growing markets, the largest obstacle Paraguay has faced is finding buyers for environmental certificates.

DEVELOPING PES IN PARAGUAY

2004 The Attorney General's Office in Paraguay approached WWF Paraguay with the idea of initiating a Tradable Development Rights Mechanism.

2005 With the support of Guyra Paraguay, discussions surrounding the Clean Development Mechanism created a foundation for emissions trading, financial markets and incentives in Paraguay.

2006 — Law N° 3,001/2006 was passed, accounting for the "valuation and payment for environmental services."

2007 — WWF-Paraguay coordinated the design of three types of funds to be used for PES and other mechanisms: a) a public fund; b) a private fund; and c) a public-private fund.

2010 — One voluntary carbon market in the Atlantic Forest was first validated, conducted by the local NGO Guyra Paraguay in the San Rafael Reserve area. The "La Amistad" community of farmers is being paid for the maintenance and recovery of their forests (US$170 / hectare / year).

2013 — The nominal value of ecosystem services per hectare was established for each ecoregion of Paraguay. First eight ecosystem services certificates were issued, including protection of more than 13,000 hectares of Atlantic Forest.

2014 — WWF began supporting Aché indigenous communities in Puerto Barra and Ko'eTuvy to provide information about the PES mechanism. It was initiated the process to obtain certification of their forests, still ongoing.

2015 — Paraguay's Ministry of Public Works and Communications (MOPC) committed to the purchase of nearly US$1 million worth of ecosystem services certificates as compensation for environmental impacts caused by infrastructure projects.

PAYCO (Paraguay Agricultural Corporation) and NGO Naturaleza Pura were the first companies to receive payments for ecosystem services in the Paraguayan Atlantic Forest.

Valuing the Forest Ecosystem Services in Paraguay

According to the current regulations, private landowners, including indigenous communities, can certify their forest reserves for Payments for Ecosystem Services (PES). The nominal value of ecosystem services per hectare was established for each of the eleven ecoregions of Paraguay, with the support of Paraguay's Ministry of Treasury, the National Forestry Institute, the Institute of Environmental Law and Economy and the Secretariat of Environment. The latter manages the PES protocol and certification in Paraguay. WWF-Paraguay supported the simplification of the PES protocol under these streamlined steps:

- **Step 1.** Prove possession of the lot intended for certification
- **Step 2:** Report on forest existence and satellite imagery, prior examination by technicians of the competent environmental authority.
- **Step 3:** Presentation of the Environmental Impact Assessment (EIA), if applicable
- **Step 4:** Filing an affidavit proving there will be no effect on indigenous communities

- **Step 5:** Proof of solvency of associated costs
- **Step 6:** Plan for fire prevention and control
- **Step 7:** Plan of biological monitoring

The following graphic details the maximum price per hectare for buying and selling certificates, though the process is based on negotiation.

ARG

Argentina: Advances in REDD+

In Argentina, REDD+ is in an early development stage. The Argentine Secretariat of Environment and Sustainable Development – SAyDS (holding the status of Ministry since December 2015) led the preparation for the future implementation of a REDD+ programme. In 2002, the SAyDS was designated as the country's focal point for the Intergovernmental Panel on Climate Change (IPCC), and Argentina became a partner country of the UN-REDD Programme in 2009. Since then, the government has been advancing a REDD+ readiness process. In 2010, a Readiness Preparation Proposal (R-PP) was presented to the World Bank's Forest Carbon Partnership Facility (FCPF), to set guidelines and a basis for the process.

The preparation of an Argentine REDD+ National Programme has been underway since 2013. In order to gather background information on the country´s needs, all ecoregions of Argentina were reached by a nationwide participatory consultation process, which included 40 workshops, almost 1,000 participants and 100 civil society organizations. The risks and benefits in all regions were evaluated, particularly the REDD+ impacts on indigenous peoples and forest dependent communities.

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The Argentine Law on Minimum Standards for the Protection of Native Forests will become the main existing mechanism to be integrated in the REDD+ strategy, along with other complementary national initiatives on ecosystem services, forest communities, biodiversity sustainable use and a biodiversity observatory. Argentina has established a roadmap towards its National Programme; this roadmap is planned to contribute with all UN-REDD Programme requirements to become ready for REDD+.

Until now, the roadmap has led to several achievements, for example, the development and launching of a National Forest Monitoring System with web-GIS access [60] and the development of a tailored consultation protocol for indigenous peoples' safeguards. An immense opportunity opens to Argentina's Atlantic Forest, as it is one of the ecoregions targeted to deploy REDD+ projects. Vida Silvestre has been working to enter the governance structure as a member of the REDD+ Advisory Committee, which will be integrated, among other social actors, by civil society organizations.

Argentina: Development of PES

In Argentina, the economic benefits of primary sector production – agriculture, cattle and forestry – have overwhelmingly overshadowed the economic benefits of the services provided by natural ecosystems. Knowledge gaps and lack of information have hidden the value of the ecosystem services from the public and the authorities, delaying the advancement of payment schemes for these services. Thus, PES schemes are incipient, but showing a growing trend. One national law – Law 26,331 – beginning in 2007 sets the legal and financial framework to implement PES in all provinces with native forests. In the Atlantic Forest ecoregion, the government-funded PES mechanism has the largest geographical impact. Having reached its fifth year of operation, the payments are

60 http://snmb.ambiente.gob.ar/portal/

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ongoing. Two pilot municipal-scale mechanisms, involving NGOs, government agencies, cooperatives, and businesses, are still in an embryonic stage, not yet legally recognised, but embody the opportunity to demonstrate their potential as decentralized initiatives. The issue of valuing the services and putting a genuine price for them remains a challenge, and the mechanisms are operating as monetary incentives decoupled from the strict economic value of the services of nature.

DEVELOPING PES IN ARGENTINA

There are three ongoing mechanisms of PES in the Atlantic Forest of Argentina:

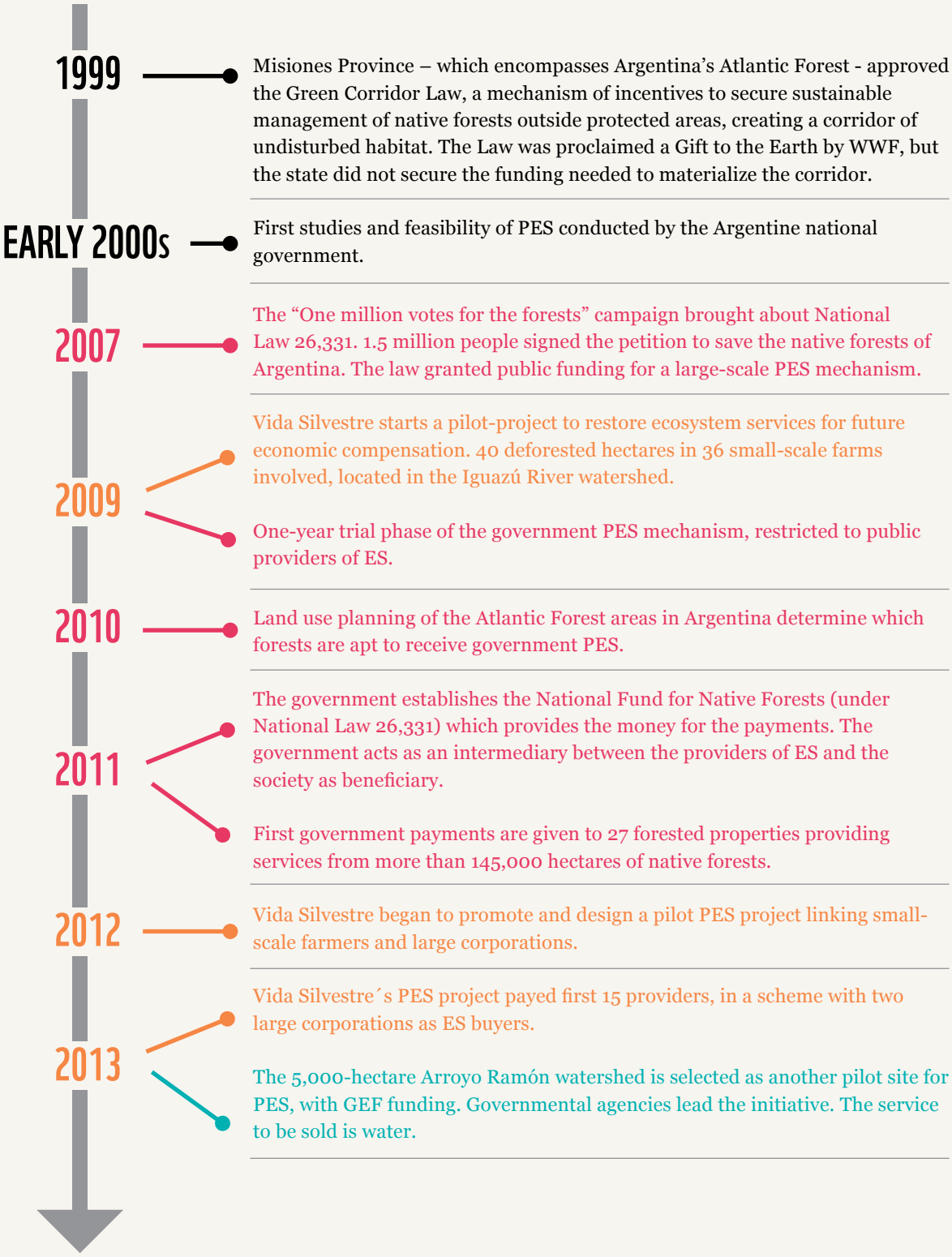
PES AT AN ECOREGIONAL-SCALE FUNDED BY NATIONAL GOVERNMENT

How it works: Forestland owners who are not allowed to deforest due to restrictions set by the provincial forestland zoning are compensated for all the services provided by the forests in their properties. Under this scheme, the government is the intermediary buyer of services and the forest services' beneficiary is the society at large.

PILOT PES LED BY VIDA SILVESTRE AT A WATERSHED-SCALE FUNDED BY CORPORATIONS

How it works: Environmental services (ES) providers are small-scale farmers in the San Francisco and Deseado watersheds, who restore forests along streams. Recovering forest cover improves water provision, which is the first service sold. Buyers are large corporations seeking to enhance their environmental performance. Its legal basis is under development.

PILOT PES LED BY THE LOCAL GOVERNMENT AT A WATERSHED-SCALE
How it works: ES providers will be small-scale farmers in the San Ramón watershed, who conduct farm and forest management practices, which improve water provision for the community of Oberá. Buyers will be the local utilities cooperative and other public agencies. Its legal basis is under development.



2014

Work begins in the Arroyo Ramón area. First steps: sanitary cleaning of the river, community outreach, environmental education and biodiversity baselines. Governance and operability are built.

5 family-scale farmers initiate restoration of forests and their services in 10 hectares of deforested lands, to enter PES scheme as providers in coming years.

2015

5th cycle of government-funded PES accomplished. Since the inception of the mechanism, 112 providers have received PES.

BRA

Brazil: Advances in REDD+

In 2010, Brazil's Ministry of the Environment initiated discussion regarding Brazil's National REDD+ Strategy, and eight meetings were subsequently held in 2011 for discussions within a working group consisting of various government entities (REDD+, 2016). In 2012 and 2013, the effort expanded to include partners outside of the government's realm, and, after some hurdles, the strategy was established by Ordinance from the Ministry of the Environment (MMA) No. 370 on 2 December 2015 and published in 2016. In addition to federal instruments, there are laws and programmes developed autonomously by federal entities in order to promote REDD+ actions at the subnational level. The great challenge of the Brazilian government is the coordination of the various public policies, federal and state programmes and initiatives, public and private entities that contribute to mitigating emissions in the changing land-use and forest sector in order to achieve the commitments established by the country. [61]

© CARLOS BOTELHO.

61 http://redd.mma.gov.br/images/Publicacoes/enredd_final_pt_WEB.pdf

The National Commission for REDD+, established by Decree No. 8,576 / 2015, is responsible for coordinating, monitoring and implementing the National REDD+ Strategy and it consists of eight ministries, two representatives of state governments, a representative of municipalities and two representatives of civil society. The Ministry of the Environment presides over the National Commission, which also serves the role of Executive Secretariat, and acts as a focal point for REDD+ to the UNFCCC in Brazil. This commission's composition has been questioned by organizations for not having a balance between the different stakeholders (Observatório do Clima, 2015, 2016). In Brazil, the uptake of results for payments of funds will be made according to the guidelines, rules and criteria established by the National Commission for REDD+ with inputs provided by a Thematic Advisory Board established for this purpose.

Brazil: development of PES

Since proposing the PES law to Congress, PES projects have been rapidly multiplying in Brazil, funded by the government and other sectors. PES as an economic tool has shown its dynamism and potential for conservation in Brazil, involving 848 environmental service providers and 40 PES water projects in the Atlantic Forest that encompass a total area of approximately 40,000 hectares.

DEVELOPING PES IN BRAZIL

2003	The National Water Resources Council was established.
2007	The National Policy and Federal Programme on PES involving discussion about the bill PL 792/2007 began.
2009	The Certified Emission Reductions and Forest Degradation Bill, a REDD+ instrument, was written.
2010	The Santa Catarina state* PES Programme and Fund was established.
2011	The PES Programme in Rio de Janeiro state* was established, accounting for water and forest resources.
2011-2012	The São Paulo state* Climate Change Law was passed, including changes in the State Fund to Fight and Control Pollution to enable non-refundable payments to landowners and PES.
2012	Mechanisms accounting for biocredit and PES in Paraná state* were established.
2014	11 Private Natural Heritage Reserves amounting to 1,884.74 hectares received PES in Sao Paulo state.*

(*all states mentioned are within Serra do Mar and Alto Paraná ecoregions)

Next Steps of the Atlantic Forest Ecoregional Programme: We, the people of the Atlantic Forest, decide its future

The Atlantic Forest is an ecoregional complex with a fast territorial dynamics and more than 148 million people living in connection with the forest, or what remains of it. This diversity of people, activities, and landscapes creates a complex backdrop for conservation initiatives as well as multiple opportunities for innovation led by the WWF network, its partners and collaborators.

Most of Brazil's GDP[1] – 70 per cent – and in a lesser extent the economies of Paraguay and Argentina rely on the Atlantic Forest territory, including the production of major global commodities with advanced certification status like soy, pulpwood, sugarcane, and beef. The ecoregion also holds one of Latin America´s most important consumer markets. As the world's population grows, challenges arise in the search for intensified but sustainable land use. The Atlantic Forest presents an ideal setting for the development of initiatives that reconcile conservation and production, in a "mosaic of landscapes," seeking public-private alliances for solutions to local challenges at a global scale.

The results obtained in the last annual meetings of the United Nations Framework Convention on Climate Change, represent an excellent opportunity to highlight the importance of the Atlantic Forest in order to strengthen compliance with the targets set for forest restoration and the role of landscapes in emissions reduction, improving adaptation to climate change, and implementing nature-based solutions. The Atlantic Forest is home to one of the world's largest forest restoration programs, but in addition to restoration opportunities, there are also great challenges, such as the need to strengthen governance, promote strategic advocacy, influence public policy and build new funding models for lasting conservation.

In the last 15 years, coordinated trinational actions have generated many lessons learned with regards to species conservation, protected areas, and better management practices, but we need to rethink our outreach strategy to engage even more civil society actors and younger generations, transforming WWF into an agent for collaborative solutions that bring together multiple stakeholders, including the private sector, to conserve our Atlantic Forest.

WHERE ARE WE HEADED?

The last decade has witnessed a slowdown in the pace of deforestation in the Atlantic Forest, and many new and creative conservation tools are being used in an effort to protect what is left of the natural forest and to recover it over deforested lands. These two facts give hope that we might be reaching a turning point, from

1 GDP: Gross Domestic Product.

where protection and recovery can start to outpace loss and degradation. However, to reach this point, action is urgent, and the time to act is now.

Four paths are essential to secure the future of the Atlantic Forest, and to ensure a lasting provision of ecosystem services:

Protect the large forest blocks that remain, because they represent the only opportunity to preserve the most threatened populations of flora and fauna over the long term, as well as the ecological and evolutionary processes that sustain biodiversity.

Conserve and integrate smaller forest fragments as elements of functional mosaics, and/or enhance connectivity among the larger fragments.

Recover forests on degraded lands and re-establish lost connections between forest blocks to increase the populations of species that have been isolated and cornered in scarce wilderness.

Build sustainable and resilient landscapes that integrate large forest blocks, smaller forest fragments, recovery areas and productive lands, providing connectivity, buffering, and proper management of threatened species and the whole biota of the ecoregion. Such arrangements will also improve the provision of forest ecosystem services, increasing the wellbeing for the inhabitants of the ecoregion.

HOW TO ADDRESS OUR CHALLENGES?

DESIGNING

territorial strategies that strongly link natural ecosystems, their environmental services and the people that use them, in order to increase the engagement of organizations and institutions and foster collaborative work to conserve the Atlantic Forest. Our strategies have to be rooted in commonalities among the three countries, while at the same time recognizing and making the most of their particular features.

BUILDING

strong alliances with key sectors of society that live in, and make decisions about the Atlantic Forest: local governments, private sector, indigenous peoples, grassroots groups; promoting their empowerment, as an emerging social fabric engaged in the sustainable development of the territory.

UPDATING

the Atlantic Forest Ecoregional Programme strategies, within the new WWF network global strategy, and strengthening the work on multi-sectorial integrated governance, markets oriented towards sustainable goods and services, and environmentally sustainable businesses and finances.

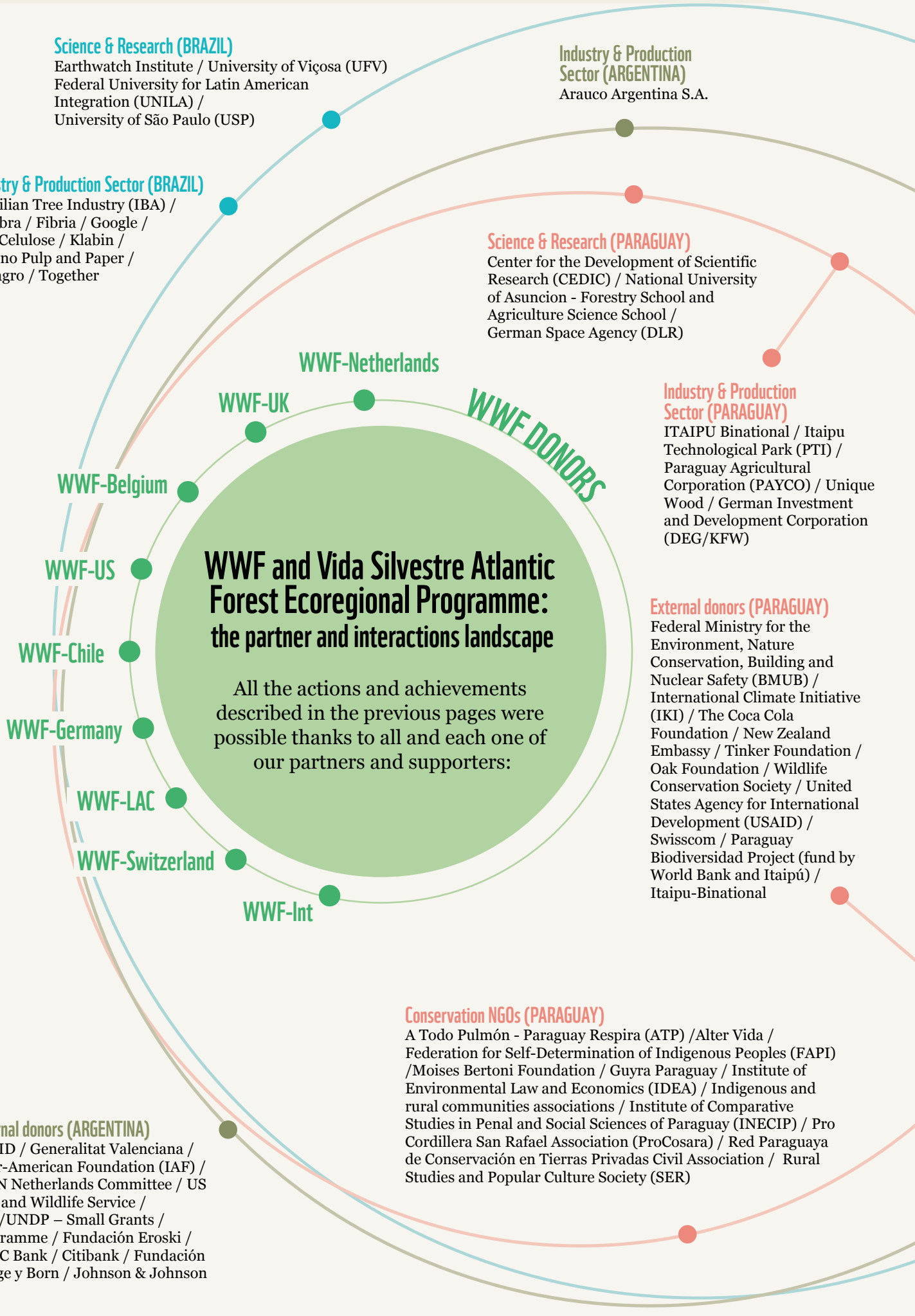
CONSOLIDATING

a network of partners and allies, both within and outside the WWF network, that support technically and financially the implementation of the trinational programme's priority strategies.

VENTURING

into a program management perspective that includes more innovation and flexibility, making the most of the opportunities of a changing context, coordinating with more diverse stakeholders and closer to the private sector.

The Atlantic Forest's people and the global community will have to be actively engaged in building this cross-sectorial consensus and positive change to help conserve and restore the Atlantic Forest for present and future generations.



WWF and Vida Silvestre Atlantic Forest Ecoregional Programme: the partner and interactions landscape

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Arauco Argentina S.A.

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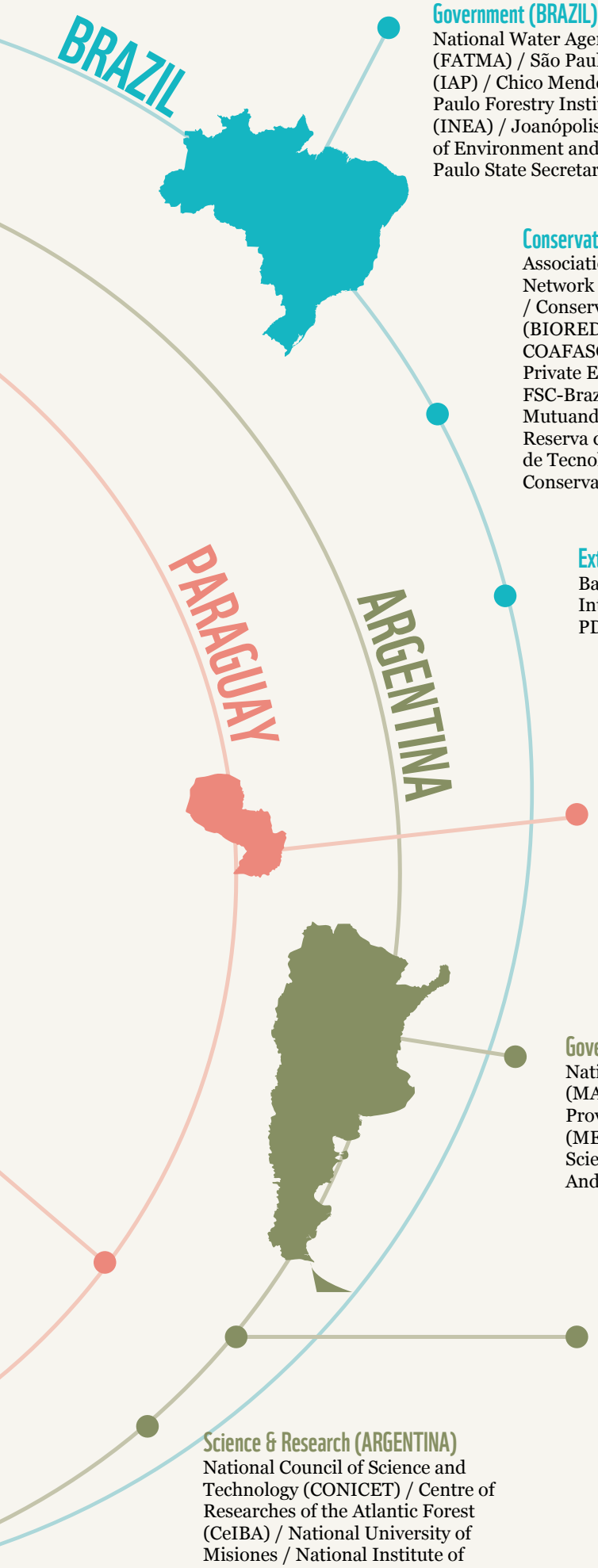

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Conservation NGOs (ARGENTINA)

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