# A BIODIVERSITY VISION FOR THE UPPER PARANÁ ATLANTIC FOREST ECOREGION:

## DESIGNING A BIODIVERSITY CONSERVATION LANDSCAPE AND SETTING PRIORITIES FOR CONSERVATION ACTION

# EXECUTIVE SUMMARY

## Ecoregion Conservation

In recent years the conservation community has been promoting the design and implementation of biodiversity conservation actions at larger scales. WWF has embraced this approach, focusing conservation planning and action on ecoregions — relatively large units of land or water that contain a distinct assemblage of natural communities that share a large majority of species, dynamics, and environmental conditions. Since most ecological and evolutionary processes that sustain biodiversity occur at these larger scales, WWF has determined that ecoregions are the best units to design and implement biodiversity conservation actions.

One of the key elements needed to implement ecoregion conservation is a ***Biodiversity Vision***. A Biodiversity Vision is a planning tool, usually in the form of a document like this, aimed at guiding biodiversity conservation activities in the ecoregion. A Biodiversity Vision sets a number of biodiversity conservation goals based on widely-accepted principles of conservation biology, and identifies critical areas to be either conserved, managed, or restored in order to meet those goals. These areas are identified through a science-based process that relies on the best available biodiversity data and socioeconomic information. Through this process, we developed a Biodiversity Conservation Landscape that is represented in a map illustrating how the ecoregion would look in 50-100 years if we are successful in conserving biodiversity. This Biodiversity Conservation Landscape is a central piece of the Biodiversity Vision, and its representation in a map helps to focus conservation activities on those areas and to set specific targets that would render the best results for biodiversity conservation.

## The Upper Paraná Atlantic Forest—a critically endangered ecoregion

In a worldwide ranking based on a comparative analysis of biodiversity data, WWF has identified the Global 200—the most outstanding ecoregions representing the full range of the Earth's diverse terrestrial, freshwater, and marine habitats. The Atlantic Forests, a Global 200 ecoregion, is actually a complex of 15 terrestrial ecoregions[1] that span the Atlantic coast of Brazil, extending westward into eastern Paraguay and northeastern Argentina. The Atlantic Forests are among the most endangered rainforests on earth, with only 7.4% of their original forest cover remaining, and this is in a highly fragmented landscape. They have been ranked as one of the most biologically diverse forests of the world. The southwestern portion of the Atlantic Forest constitutes the Upper Paraná Atlantic Forest ecoregion and is the focus of this Biodiversity Vision.

The original[2] area of the Upper Paraná Atlantic Forest ecoregion is the largest (471,204 $km^2$) of the 15 ecoregions of the Atlantic Forests Ecoregion Complex,

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[1] The Atlantic Forests Global 200 Ecoregion is actually not one Ecoregion but a set of 15 terrestrial ecoregions characterized by tropical or subtropical forests. These 15 ecoregions form continuous tropical and subtropical forests that share a common biogeographic history and have many species in common, and for this reason WWF has considered them together as one Global 200 ecoregion.

[2] Original (or originally) refers to the time when the area was mostly covered by pristine native forest vegetation. That time roughly corresponds to the late 15$^{th}$ and early 16$^{th}$ centuries, coinciding with the

extending from the western slopes of the Serra do Mar in Brazil to eastern Paraguay and the Misiones Province in Argentina. All this area was originally covered by a continuous subtropical semi-deciduous forest with a high diversity of plant species that formed different forest communities[3]. This ecoregion has the largest remaining forest blocks, still containing the original set of large vertebrates, including top predators such as harpy eagles, crested eagles, jaguars, pumas, and ocelots, and large herbivores, such as tapirs, two species of brocket deer, and two species of peccaries. While these blocks represent an important conservation opportunity, they present the special challenge of crossing the borders of three countries with different cultures and different languages, a complex socio-economic and cultural diversity, and have experienced recent economic and social crises.

The largest threat to biodiversity in the Upper Paraná Atlantic Forest ecoregion is the extreme degree of forest fragmentation and degradation, where the main proximate cause is the expansion of agriculture, both large- and small-scale. Other causes include squatting by landless people, the construction of infrastructure (dams, roads, etc.), illegal hunting of wildlife, and unsustainable exploitation of the native forest. Despite the high degree of forest fragmentation, there are still good opportunities for the conservation of the remaining large forest fragments in the ecoregion. By protecting these large areas we will be able to conserve the ecological processes that sustain biological diversity.

## Setting biodiversity conservation goals

We have set four basic goals for this *Biodiversity Vision* to achieve conservation results in the Upper Paraná Atlantic Forest ecoregion. The four goals are based on conservation biology principles, and include:

1. The conservation of blocks of natural forest large enough to be **resilient** to short-term and long-term environmental changes
2. The maintenance of **viable populations** of all native species in their natural patterns of abundance and distribution, and with the genetic diversity necessary to meet environmental challenges
3. The maintenance of **healthy ecological processes** and selective factors such as disturbance regimes, hydrological processes, nutrient cycles, and biotic interactions, including predation
4. The **representation** of all native biological communities and seral stages across their natural range of variation within a Biodiversity Conservation Landscape.

## Crafting the Vision

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arrival of the first European immigrants and the beginning of the rapid process of transformation of the forest into agricultural land. Prior to this time, native people likely impacted the ecoregion as a whole to a relatively small or medium degree.

[3] Individual plant communities of the Upper Paraná Atlantic Forest ecoregion are characterized by different soil types and the dominant tree species. In the Upper Paraná Atlantic Forest, some of the typical communities include: palmito (*Euterpe edulis*) and palo rosa (*Aspidosperma polyneuron*) forests, bamboo forests (four species of bamboo are common in the ecoregion and are the dominant species in some areas), laurel forests (several species of trees within the genus *Nectandra* and *Ocotea* are common in this forest type). However, no detailed vegetation map exists for the entire ecoregion and there is not complete agreement on the nomenclature used for the different forest communities.

Underlying the Biodiversity Vision is a series of complex analyses aimed at designing a Biodiversity Conservation Landscape that will accomplish the conservation goals described above. During the past three years, WWF has led a tri-national participatory process involving more than 30 local organizations representing multiple sectors and disciplines. Many of these organizations[4] provided information and data critical to produce this Biodiversity Vision for the time frame and geographic scale necessary to conserve the Upper Paraná Atlantic Forest Ecoregion's biodiversity.

For the analyses we used various overlays of maps representing the distribution of the different biological and socio-economic variables. A Geographic Information System provided a critical tool for conducting the analyses and visually describing different layers of information in various maps. Three separate but interdependent analyses were critical to arrive at the final Biodiversity Conservation Landscape:

The first step involved the **identification of individual landscape units**[5]. Given the lack of complete or sufficient biological information available to define and map all ecological communities, we used climatic, altitude, and topographic information as proxies for developing a biological model. Using these three layers of information, we identified 18 separate landscape units.

The second step involved the identification of native forest fragments with the highest potential for achieving conservation goals. For this **fragmentation analysis,** we used a map of forest fragments obtained from satellite images. We ranked forest fragments according to a Fragment Importance Index developed to indicate the relative contribution of forest fragments to biodiversity conservation. The index was based on four variables: fragment size, fragment size after excluding a buffer zone[6] of 500 m (an indirect measure of edge effects, see Box 4), distance to nearest fragment, and altitudinal range within the forest fragment.

The third step was a **threats and opportunities analysis**, where the objective was to map areas that represent critical threats and important opportunities for biodiversity conservation. Land use information provided a critical basis for assessing conservation opportunities and threats. The threat variables used in our analysis included: distance to cities, agriculture, cattle raising, and rural population density. Opportunity variables that were used included: the distance from a strictly protected area, the proximity to a river (assuming that rivers in this ecoregion constitute potential biological corridors), and zones of planned conservation. Variables were weighted according to their relative impact on biodiversity conservation.

We analyzed the current status of forest cover and representation of the different landscape units within the protected area system using the landscape units map in

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[4] See Acknowledgements.

[5] A landscape unit is a parcel of land of any size that is fairly uniform in certain characteristics (e.g., soil type, vegetation, land use, etc.) and differs from other such portions of land. In this particular analysis, we identified different landscape units based on abiotic characteristics (altitude, topography, rainfall, and seasonality) considered to be important determinants of biodiversity distribution. See Landscape Units Analysis in Chapter 4 for details on how we identified landscape units.

[6] The term buffer zone is used in this document with two different meanings. Sometimes, as is used here and in GIS analyses, a buffer zone is an area of arbitrary size that surrounds any focal area: a city, a forest fragment, or an ecoregion. In other cases, we will use the term buffer zone as it is typically used in conservation biology: a transitional area that ameliorates the negative effects of human impacts on surroundings of a natural ecosystem, usually a strictly protected area.

combination with the forest fragments map and the protected areas map. This gave us an idea of how well represented each landscape unit was in the actual landscape, and guided decisions on how to improve representation of those underrepresented landscape units in the final Biodiversity Conservation Landscape. Combining the fragment importance index map with the threats and opportunities map, we constructed a biodiversity conservation potential map that illustrates where the areas with the highest biodiversity conservation potential are located in the ecoregion. Using this biodiversity conservation potential map as the basic layer of information, we defined a ***Biodiversity Conservation Landscape***. Expert opinions and socio-political viability of certain decisions where also taken into account when outlining the Biodiversity Conservation Landscape. This process is summarized in Fig. 32.

Refining the final Biodiversity Conservation Landscape, involved a series of logical analyses and decisions that we explain in a simplified manner here. First, using the biodiversity conservation potential map as a guide, we identified large native forest blocks (>10,000 ha) to constitute Core Areas (see definition below). These are the forest fragments that may sustain the whole life cycle of a jaguar, which we used as our umbrella species[7]. Next we identified Main Corridors to connect Core Areas. Lastly, smaller areas of relatively high conservation value, surrounded by secondary corridors, were included to increase representation of landscape units and associated biodiversity within the final design of a biodiversity conservation landscape.

## Our Vision in a map

Our Biodiversity Vision is a Biodiversity Conservation Landscape that spans the three countries, with adequate space for wildlife set aside from human activities to ensure that critical biodiversity conservation goals are met. The implementation of this Vision will depend on the participation of many sectors and the coordination of activities across the borders of the three countries.

The resulting Biodiversity Conservation Landscape is composed of **three main types of areas:**

The **Core Areas** are the blocks of well-preserved native forest large enough to be resilient to threats that cause biodiversity loss. These are the most biologically important and strategic zones for conservation, either public or private. Each Core Area should be managed to maintain an area of continuous native forest large enough for the life cycle of wide ranging species such as jaguars and white-lipped peccaries. Core Areas should be managed under strict protection and human activities should be reduced to a minimum. Core Areas should be connected to other Core Areas through a network of corridors to meet our biodiversity conservation goals.

The **Biological Corridors** are relatively narrow areas of native forest, either natural or restored, that connect large forest patches, either Core Areas or Sustainable Use Areas. The Biological Corridors would allow the movement of the wildlife and sufficient genetic interchange among Core Areas to maintain viable populations.

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[7] Umbrella species are those with very large area requirements. These species can be used as target species for conservation planning under the assumption that if we are able to preserve viable populations of them, we will preserve enough habitat for many other species with smaller area requirements. For a critical review of the umbrella species concept see Noss et al. 1997.

The **Sustainable Use Areas** are large areas that function as buffers and connections surrounding the Core Areas, other critical conservation areas under strict protection, and the biological corridors. They maintain healthy ecological processes and environmental services in combination with environmentally friendly economic activities.

We have also identified areas that are important for the development of river basin management and conservation programs as well as areas where we need to develop finer-scale land use planning to appropriately create and implement critical Biological Corridors.

**Figure 36** depicts the resulting Biodiversity Conservation Landscape. Due to the lack of opportunities for biodiversity conservation and the lack of forest fragments with sufficient conservation value, some landscape units are not represented in the final Biodiversity Conservation Landscape. However, this Biodiversity Conservation Landscape will ensure the conservation of large and resilient blocks of native forests, where viable populations of umbrella species and healthy ecological processes, including predation by top predators, will be sustained. Both the Biodiversity Conservation Landscape and the Biodiversity Vision will continue to be refined over time as additional studies are undertaken and new information becomes available.

## From Vision to Action – implementing an Ecoregion Action Plan

The implementation of this Biodiversity Conservation Landscape will require a series of actions at different time and spatial scales. Since no one organization can achieve results at this scale, actions must be coordinated among governmental and non-governmental organizations of many sectors. Achieving this Vision will require governments to incorporate the principles, ideas, and designs into their regional development programs and policies. Maintaining intact forest in the Core Areas will require improved implementation of existing protected areas, both public and private, and new protected areas must also be established. The connections among Core Areas can most easily be secured through the establishment of forest corridors crossing landscapes of multiple use zones that provide services valuable for the human population. Design of these corridors and multiple use zones will require fine-scale land use planning. It is critical to include the participation of stakeholders[8] to develop their support for implementation. New environmentally-friendly and economically-viable production alternatives, as well as incentives for the protection of forest on private land (both large and small holdings), must also be developed. Perverse incentives that contribute to forest conversion must be eliminated. Large-scale education campaigns will be essential to increase public understanding of the value of protected forests and thus generate public support and involvement in conservation—including enforcement of existing forest laws and development of new, improved public policies where necessary. Capacity building is also essential for landowners, both public and private, to become effective stewards of forested areas. To implement many of these activities will require new basic and applied research in areas such as restoration of native forest communities, economic and biological sustainability of alternative land uses, needs assessments for communication

[8] Stakeholder—any person, group, or institution that affects or is affected by (either positively or negatively) a particular issue or outcome.

and education efforts, land use planning, and economic mechanisms to sustain conservation.

With this Biodiversity Vision as a guide, WWF and local partners need to transform short-term actions already underway to an ***Ecoregion Action Plan*** that lays out targets over the short-term (1-5 years) and medium-term (10-15 years). This Plan should clearly identify threat mitigation strategies, and focus on clear targets for conservation achievement as well as on the roles of partner institutions, long-term financing possibilities, structures for effective governance, communication and campaign activities, and capacity building. These clear targets are essential to guiding, focusing, and monitoring progress. Together with this inspiring Vision, the clear targets and transparent reporting of achievements are necessary to build the commitment and ownership by partners for continued and active engagement. Embedded in the crafting of an Ecoregion Action Plan is the need for flexibility. As more information is collected and actions are monitored, the Plan can be easily updated and allow for sound judgment when a change of course or tactic is necessary. In addition to helping the ecoregion action programs organize their strategic efforts in an ecoregion, the Plan has other benefits. The Ecoregion Action Plan can help openly articulate the biodiversity agenda, and can help leaders recognize the importance of this agenda among other national and international priorities. It is clear that appropriate institutional development of partners is necessary to strengthen advocacy on a variety of levels. Since Brazil, Argentina, and Paraguay are all (to varying degrees) recently emerging democracies, this capacity building overlaps significantly with the development of active participation in government and taking an active role as citizens.

Implementation may take place at levels below the ecoregional scale, or outside the ecoregion, depending on the issue involved. A threats analysis is an essential filter for determining at what scale and timeframe we should act. All conservation activities must be conceived and implemented in relation to the social and political realities in which they take place. In the Upper Paraná Atlantic Forest ecoregion, these realities are different in each of the three countries and even in different regions of the same country. Most of the actions will be implemented on a national or regional level within each country. However, strategic planning, monitoring of the threats and conservation results, and resulting adjustments must be conducted at an ecoregional scale.