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# REPORT ON BIODIVERSITY AND TROPICAL FORESTS IN PARAGUAY

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Front Cover: Lapacho (*Tabebuia* spp) trees in bloom in the Chaco of Paraguay
Credit: Oscar Rodas

# Report on Biodiversity and Tropical Forests in Paraguay

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# Acronyms

| | |
|---|---|
| AOP | Annual Operating Plans |
| ARP | Association of Rural Paraguay |
| CETEMACH | Technological Center of the Wood from the Chaco |
| CITES | International Convention of Trade in Endangered Species |
| CONAM | National Environmental Council |
| DFPCB | Directorate for Forest Protection and Conservation of Biodiversity |
| FAA | Foreign Assistance Act |
| FAO | Food and Agriculture Organization of the United Nations |
| FEPAMA | Paraguay Federation of Wood Industries |
| GEAM | Environmental Management for Sustainable Development |
| GOP | Government of Paraguay |
| IBA | Important Bird Areas |
| IDEA | Environmental Law and Economics Institute |
| IEE | Initial Environmental Examination |
| INDERT | National Institute for Land and Rural Development |
| INFONA | National Forestry Institute |
| IAN | National Agronomic Institute |
| MAG | Ministry of Agriculture and Livestock |
| NGO | Non-governmental organization |
| PROCOSARA | NGO for the Conservation of the San Rafael Ridge |
| RCAR | Regional Center for Agricultural Research |
| RED | Paraguay Network for Environmental Conservation on Private Lands |
| SEAM | Secretariat for the Environment |
| SINAVISI | National Strategy for the Protection and Conservation of Wildlife |
| SINASIP | National System of Protected Natural Areas |
| SISNAM | National Environmental System |
| TNC | The Nature Conservancy |
| UPAF | Upper Parana Atlantic Forest |
| USAID | United States Agency for International Development |
| WWF | World Wide Fund for Nature |

# EXECUTIVE SUMMARY

## Purpose of the Report

Sections 118 and 119 of the Foreign Assistance Act require that each USAID Country Development Strategy include an analysis of the actions necessary in that country to achieve conservation and sustainable management of biological diversity and tropical forests and of the extent to which the actions proposed for support by USAID meet these needs. This report provides USAID/Paraguay with this analysis.

## Methodology

A four-person team, consisting of the team leader, a forester, a biologist and a specialist in geographic information systems prepared this report between November 2009 and July 2010 over a period of approximately 30 working days each.

In the interest of clarity and brevity, the term "conservation" was defined for the purposes of this report as covering both "preservation" and "sustainable use" of biodiversity and forests. Implicit in the term "sustainable use" is that biodiversity and forests will be preserved, not destroyed or degraded. Similarly, "sustainable use" is often required in order to "preserve" biodiversity and forests. It therefore would have been unnecessarily redundant to repeat both terms throughout the report.

The team identified ten categories of conservation actions as being required to conserve Paraguay's forests and biodiversity: (1) conservation within protected areas; (2) conservation outside of protected areas; (3) establishment of conservation policies, strategies, laws and regulations; (4) research related to conservation; (5) education of conservation professionals; (6) strengthening of conservation institutions; (7) regulation of land use; (8) building public support for conservation; (9) providing financial incentives for conservation; and (10) financing for conservation actions.

Based on prior USAID reports and scientific literature (Appendix 1), interviews (Appendix 4) and field observations (Appendix 9), the team collected data to establish the current situation in Paraguay of each of these conservation actions. Various maps were also consulted and adapted for inclusion in the body of the report and in Appendix 11.

Thirty-four Paraguayan conservation professionals participated in a workshop (Appendix 3), in which the team presented its preliminary conclusions and recommendations. These conclusions and recommendations were discussed extensively and many of the comments and observations of the participants in the workshop were incorporated into the report.

## USAID/Paraguay Country Strategy

USAID/Paraguay does not plan to prepare a new Country Strategy but will continue to operate under the Country Strategy for 2005 to 2010, while preparing an Operational Plan for each year. Thus over the next few years, USAID/Paraguay intends to continue to finance similar types of activities as it has financed over the past few years. These activities fall under three Strategic Objectives: (1) Health; (2) Democracy and Governance; and (3) Economic Growth. The environmental and conservation activities that USAID/Paraguay finances are considered part of its Strategic Objective of Economic Growth.

## Geography of Paraguay

The Paraguay River divides Paraguay into Eastern Paraguay and Western Paraguay, which is also called the Chaco. Eastern Paraguay has an area of 159.827 km², 40% of the country, while Western Paraguay has an area of 246,925 km², 60% of the country. Most of Paraguay is flat, or rolling. Its only mountains of any height are located in Eastern Paraguay. Sixty-five percent of the soils of Eastern Paraguay are fertile and well-drained and thus excellent for agriculture and pasture, while the soils of Western Paraguay are mostly infertile and poorly drained and generally make low quality pasture and crop land. Rainfall, which mostly falls in the wet season from November to April, decreases from an average per year in the southeast of 1,800 mm to less than 400 mm per year in the northwest. Paraguay's three largest rivers are the Parana, the Paraguay and the Pilcomayo.

In Eastern Paraguay, the single largest land use is high pasture. Agriculture and low pasture are the second and third largest land uses. About 13% of Eastern Paraguay is covered by forest. There are 916,468 ha of high forest and 1,171,515 ha of degraded forest, for a total forest area of 2,087,983 ha. In 2009, forest covered 49.5% of Western Paraguay, or 11,876.078 ha, and other natural types of ecosystems, including water bodies and protected areas, covered 32.3% or 7,730,144 ha. .

In 2009, the population of Paraguay was estimated to be 6,995,655, with 60% of its people in urban areas and 40% in rural areas. The rate of population increase was 2.36% per year. Ninety-seven percent of the population lived in Eastern Paraguay and only 3%, or about 135,000 people in Western Paraguay. The census of 2002 identified 20 indigenous groups with a total population of 87,009.

In 2008, agriculture contributed 15%, livestock 8% and forestry 2.5% of Paraguay's Gross Internal Product. These three economic activities generated about 90% of Paraguay's exports and gave employment to 43% of its labor force.

Paraguay has a democratic, representative government, with legislative, judicial and executive branches. Municipalities have more autonomy than departments and control some important environmental functions, including land use planning and regulation.

## Biodiversity in Paraguay

Paraguay has five terrestrial ecoregions. The largest ecoregion is the Dry Chaco which includes 17,269,795 ha and occurs only in Western Paraguay. The second largest ecoregion is the Humid Chaco, which occurs on 12,856,674 ha in the center of the country, on both the east and west sides of the Paraguay River. The Upper Parana Atlantic Forest ecoregion occupies 8,661,796 ha, all of them in the eastern half of Eastern Paraguay. The Pantanal ecoregion, with 187,778 ha, is located on the border with Brazil along the Paraguay River and the Cerrado ecoregion, with 819,596 ha, occurs in Eastern Paraguay, also along the border with Brazil.

No ecosystem classification exists for Paraguay's aquatic ecosystems, but they consist of large rivers (Parana, Paraguay and Pilcomayo), smaller rivers, streams, creeks, lakes, ponds and reservoirs. The characteristics of these water bodies vary depending on their size, geographic location, seasonal changes in water flow, and the infrastructure projects, especially dams, which have modified their ecological characteristics.

The biodiversity of Paraguay has been most studied at the species levels and in the plant and animal groups. There are from 6,500 to 7,000 plant species in the country. The most diverse flora of Paraguay occurs in the Upper Parana Atlantic Forest, which has one of the most diverse floras in the world. In the animal group, there are from 230 to 250 fish species,

63 to 75 amphibian species, 132 to 150 reptile species, 708 bird species and 165 to 167 mammal species. There at least 100,000 invertebrate species. There are tens of thousands of species in the fungi, algae and monera kingdoms, although most of the species in these groups have not been identified.

Genetic biodiversity in Paraguay occurs in wild and domestic plants and animals. There are no data on how much the extensive conversion of forest land to crop land and pasture has reduced the genetic diversity of plant and animal species. Many genetic varieties of cultivated plants probably originated in Paraguay, including varieties of peanut, hot pepper, pineapple, corn, cassava, *ka'a or yerba and ka'a he'e*., the last of which is considered in danger of extinction.

## The Forests of Paraguay

In Eastern Paraguay, forest originally covered about nine million hectares. As of 2008 approximately 2.2 million hectares remained. Of the various forest types, the High Forest is the most commercially important. Other principal forest types are the Riverside Forest, the Low Forest, and the Savannah Forest. In 2002, there were about 39,278 ha of forest tree plantations in Eastern Paraguay, mostly consisting of eucalyptus species.

In Western Paraguay between 11.8 and 13 million ha of forest remained in 2009. Its forest types are the High Forest, Low Forest, the Riverside Forest, and the Semi-Arid Forest. There are no commercial tree plantations in Western Paraguay.

Timber was once an important product of Paraguay's Atlantic Forest of Upper Paraguay. The removal and degradation of most of this forest type has reduced the economic importance of Paraguay's forest industry. Most of Eastern Paraguay's forest now can produce little more than poles and firewood. Many years of protection and silvicultural treatments would be required to re-establish its economic value for the production of high-value timber. In the informal economy, however, forest products still remain important to rural people and economies. Firewood, for example, provides 22% of Paraguay's energy for domestic and industrial use. Forests, even when severely degraded, also provide economically important environmental services, such as the regulation of water flows, shade for cattle and protection of soils.

Western Paraguay's forest is producing small quantities of wood from about eight different species of trees. Typical volumes per hectare in the forests of Western Paraguay range from as low as 23 cubic meters to as high as 43 cubic meters per hectares. On some sites, it may be possible to manage forest units for commercial forest products.

## Threats to Paraguay's Biodiversity and Forests

The principal direct threat to the biodiversity and forests of Paraguay is the elimination, fragmentation and degradation of its forests. In Western Paraguay, forest land is being converted to pasture at a rate of about 260,000 ha per year. By 2009, only about 13% of Eastern Paraguay still had forest cover. Although currently the deforestation rate in Eastern Paraguay is only about 8,000 ha per year, when the Law of Zero Deforestation expires at the end of 2013 the rate of deforestation in Eastern Paraguay will almost certainly rise rapidly, since no effective measures have been taken to reduce the rate of deforestation after that date.

Other direct threats to Paraguay's biodiversity are the over-exploitation of some species of plants and animals, the contamination of water bodies with industrial, domestic and

agricultural chemicals and the competition of aggressive exotic and invasive species with native species of plants and animals. No specific data indicate that changes in the global climate have become a threat to Paraguay's forests or biodiversity.

National policies currently are the principal indirect threat to Paraguay's forests and biodiversity. For many decades, government policies have encouraged or condoned the conversion of forest to pasture and crop land, and most of these policies continue to be implemented. The risk still exists, for example, that the government will expropriate "unproductive forested land", and government agencies continue to provide subsidized credit for the expansion of pasture and crop land at the expense of forest land. In addition, in its budgets, the government regularly chooses to fund conservation institutions, such as the Secretariat for the Environment (SEAM) at levels far below those they require to carry out effectively their conservation functions.

## Paraguay's System of National Protected Areas

As of early 2010, Paraguay's National System of Natural Protected Areas (SINASIP) consisted of 58 areas with a total of 2,613,000 ha. There were 31 Public Protected Areas with a total of 2,276,481 ha, 18 Private Protected Areas with 287,054 ha and seven Protected Areas under Special Management, with 50,464 ha. That most of the Public Protected Areas have been super-imposed on private land has severely complicated their management. In addition, SINASIP does not include some areas of Paraguay that are important for the conservation of certain species and ecosystems.

## Conclusions and Recommendations

The report makes the following eight principal conclusions and recommendations:

(1) Since Paraguay is an extremely important country for the conservation of globally significant biodiversity and for preventing and mitigating global warming, all of the forest that remains in Eastern Paraguay and large areas of the forest in Western Paraguay should be conserved.

(2) Deforestation is the most severe threat to Paraguay's forests and biodiversity and, therefore, Paraguay should reorient its policies so as to diminish the rate of deforestation and augment reforestation and forest management.

(3) Given that most of Paraguay's forest land is privately owned and that many of its public protected areas have been super-imposed on private land, the future of the country's forests and biodiversity depends largely on the decision of these private land owners. Measures should be implemented that will give incentives to the owners of private lands to conserve rather than destroy their forests.

(4) The implementation of the 30 priority conservation actions that are listed in the following table would significantly promote the conservation of Paraguay's biodiversity and forests.

**PRIORITY CONSERVATION ACTIONS IN PARAGUAY**

| |
|---|
| **Conservation within protected areas** |
| 1. Clarify regulations of private land within public protected areas |
| 2. Prepare and implement management plans for protected areas |
| 3. Increase representativeness of SINASIP |
| 4. Increase number and area of private reserves |
| **Conservation outside of protected areas** |
| 5. Establish biological corridors |

| |
|---|
| 6. Promote large-scale reforestation |
| **Policies, Strategies, Laws & Regulations** |
| 7. Ensure security of forest land tenure |
| 8. Reformulate forests laws and regulations |
| 9. Simplify regulations for the approval of private protected areas |
| 10. Prepare for end of Zero Deforestation Law |
| **Conservation Research** |
| 11. Promote research on the silviculture of the forests of Western Paraguay |
| 12. Promote research on agro forestry and silvopastoral production |
| **Conservation Education** |
| 13. Survey and evaluate professional and technical programs |
| 14. Finance fund for theses in conservation fields |
| **Institutional capacity** |
| 15. Increase coordination between institutions |
| 16. Educate municipal officials in conservation actions |
| 17. Increase presence of the State in rural areas |
| 18. Increase the participation of business in the conservation actions |
| 19. Define the roles of conservation NGOs |
| **Land use planning & conflict resolution** |
| 20. Clarify role of land use planning in environmental impact assessments |
| 21. Train municipal government officials in land use planning |
| 22. Implement a national land cadastre |
| 23. Evaluate effect of land reform on forests |
| 24. Resolve super-position of protected areas on private and indigenous lands |
| **Public support for conservation** |
| 25. Implement an education campaign for private forest land owners |
| 26. Implement an education campaign for policy makers |
| **Financial incentives for conservation** |
| 27. Implement Law 3703/09 |
| 28. Implement Law for Payment of Environmental Services |
| **Financing for conservation institutions** |
| 29. Improve and rationalize financing for SEAM |
| 30. Subsidize creation of private reserves |

(5) Before any additional large conservation projects are financed in Paraguay an objective and complete evaluation should be prepared of the most significant prior conservation projects of the last two decades and this evaluation be used to design and implement future conservation actions.

(6) Although the activities USAID/Paraguay is planning to finance under its Strategic Objectives of “Health” and “Democracy” are unlikely to cause adverse effects on Paraguay’s biodiversity or tropical forests, some activities it may finance under its Strategic Objective of Economic Growth to promote agriculture and ranching could cause negative impacts on Paraguay’s biodiversity and tropical forests if they result in an increase in demand for agricultural or livestock products without a concomitant increase in the sustainable productivity per unit area of land. USAID/Paraguay should utilize the environmental review process to ensure that direct or indirect adverse environmental effects do not occur as a result of activities under this Strategic Objective.

(7) Large infrastructure projects in Paraguay could cause significant adverse impacts on biodiversity and forest. Infrastructure project should be accompanied by effective measures to avoid, mitigate or compensate for these negative impacts.

(8) The Government of Paraguay should coordinate conservation activities that are implemented by different public and private institutions.

# I. INTRODUCTION

## A. PURPOSE OF THE REPORT

Sections 118 and 119 of the Foreign Assistance Act require each USAID Country Development Strategy to include an analysis of the actions necessary in that country to achieve conservation and sustainable management of biological diversity and tropical forests and of the extent to which the actions proposed for support by USAID meet these needs. This report provides USAID/Paraguay with this analysis.

## B. STRUCTURE OF THE REPORT

The report is divided into the following sections:

- Section I identifies the purpose of the report, describes the methodology that was used in its preparation, notes the gaps in the available information and summarizes the types of activities that USAID/Paraguay is planning to finance during the period from 2010 to 2013.

- Section II summarizes the physical and social geography of Paraguay.

- Section III presents data about the biodiversity and forests of Paraguay. .

- Section IV describes and analyzes the direct and indirect threats to the forests and biodiversity of Paraguay.

- Section V identifies the principal issues related to the conservation of Paraguay's forests and biodiversity and the priority actions that are required to conserve them effectively on a significant scale over the long-term.

- Section VI provides the conclusions and recommendations of the report.

## C. METHODOLOGY

This report is an update to the Report on Tropical Forests and Biodiversity in Paraguay that was prepared in 2004 (Catterson, Thomas. and F. Fragano, 2004) as part of the USAID/Paraguay Country Development Strategy for 2005 to 2009.

In the interest of clarity and brevity, the term "conservation" was defined for the purposes of this report as covering both "preservation" and "sustainable use" of biodiversity and forests. Implicit in the term "sustainable use" is that biodiversity and forests will be preserved, not destroyed or degraded. Similarly, "sustainable use" is often required in order to achieve the "preservation" of biodiversity and forests. Therefore it would have been redundant to repeat both terms throughout the report.

The team identified *a priori* the following ten categories of conservation actions as being required to conserve Paraguay's forests and biodiversity:

(1) Conservation within protected areas;
(2) Conservation outside of protected areas;
(3) Establishment of conservation policies, strategies, laws and regulations;
(4) Research on conservation;
(5) Educated conservation professionals;
(6) Strengthening of conservation institutions;
(7) Regulation of land use planning and conflict resolution;
(8) Building public support for conservation;
(9) Providing financial incentives for conservation; and
(10) Financing for conservation actions.

Data and information were obtained on the current status, principal issues and priority actions related to these actions from reports and scientific literature (Appendix 1), interviews (Appendix 3) and field observations (Appendix 4). A number of maps were consulted and adapted for inclusion in the text of the report and in Appendix 11.

Thirty-four Paraguayan professionals participated in a one-day workshop during which the preliminary conclusions and recommendations of the report were presented and discussed. Many of their comments and recommendations were incorporated into the report.

The report was prepared in approximately total of 120 working days between November 2009 and July 2010 (Appendix 9) by a team consisting of a team leader, a forester, a biologist and a GIS specialist (Appendix 10).

## D. GAPS IN THE AVAILABLE INFORMATION

Three principal gaps in information limited the detail and scope of this report.

- Few data were available about the current or past budgets for the Secretariat of Environment and the National Forestry Institute (INFONA), which are the principal national institutions responsible for conserving and managing Paraguay's biodiversity and forests. It was not possible, therefore, to determine with exactitude the fiscal situation of these institutions and the effect that situation is having on their ability to achieve the conservation of Paraguay's biodiversity and tropical forests.

- Many projects to assist Paraguay to conserve its biodiversity and forests have been designed and implemented. The evaluation team, however, could not locate any evaluations of these projects. It could not, therefore, draw on the experiences and lessons of past conservation projects in order to formulate the conclusions and recommendations in this report.

- Few data were available to the team about the current biological condition of Paraguay's protected areas. It was not possible, therefore, for the evaluation team to make a detailed evaluation of how well these protected areas are functioning as a means of protecting Paraguay's biodiversity and tropical forests.

The evaluation team nonetheless believes that sufficient data were available to support adequately the report's principal conclusions and recommendations.

# E. USAID/PARAGUAY'S COUNTRY STRATEGY

USAID/Paraguay continues to operate under a Country Development Strategy that was prepared for the period from 2005 to 2010. The Country Strategy is being updated each year through the preparation of an Annual Operating Plan. The Country Development Strategy has three Strategic Objectives: (1) Health; (2) Democracy and Governance; and (3) Economic Growth. USAID/Paraguay staff indicated to the evaluation team that the activities that the Mission finances are likely to remain similar to those of the last few years and that the conservation activities it finances will continue to be considered as part of the Economic Growth Strategic Objective. The following paragraphs summarize the activities that USAID/Paraguay financed during the period from 2005 to 2010.

### 1. Health

Under the Health Strategic Objective, USAID/Paraguay has assisted the GOP to prepare plans to improve health conditions in 28 communities, to establish approximately 200 community pharmacies, implement a system of health insurance in selected departments, finance family planning clinics and establish a system for organizing and accessing information about health.

### 2. Democracy and Governance

USAID/Paraguay's Democracy and Governance program has financed measures to increase the transparency of Paraguay's judicial system and local governments. It has provided support for increasing public participation in the preparation of government budgets and for the monitoring by citizens of publically financed infrastructure and education programs.

### 3. Economic Growth

The objective of USAID/Paraguay's economic growth program has been to generate income and employment in Eastern Paraguay. The program "Paraguay Sells" has supported the growth of local businesses through the identification of better markets for their products. The Development Credit Authority (DCA) Program has increased the availability of credit for small agricultural enterprises. The Improved Economic Opportunities for Paraguayans Project has increased the economic opportunities for small-scale farmers.

Activities related to the environment have been incorporated into the Economic Growth Strategic Objective. In support of the conservation of Paraguay's tropical forests and biodiversity, between 2006 and 2009 USAID/Paraguay has financed actions in support of the National System of Wildlife Protected Areas (SINASIP), has provided assistance to various Paraguayan environmental NGOs to implement conservation actions in the Atlantic Forest and Chaco Regions of Paraguay, and has supported the formulation and implementation of environmental policies and projects with several municipal and departmental governments. It also financed the NGO Foundation for the Sustainable Development of the Chaco to prepare a Land Use Plan for the departments of Boqueron and Alto Paraguay. A considerable proportion of its funding has been used to finance various actions that were intended to increase the protection of the San Rafael Forest, the largest remaining contiguous area of forest left in Eastern Paraguay.

# II. THE GEOGRAPHY OF PARAGUAY

## A. PHYSICAL GEOGRAPHY

### 1. Location and Size

Paraguay is located in the center of South America and shares boundaries with Argentina, Brazil, and Bolivia. Its total area is 406, 752 km², of which 397,302 km² are land and 9,450 km² are water. The Paraguay River divides the country into Eastern Paraguay and Western Paraguay, commonly referred to as the Chaco. Eastern Paraguay has an area of 159.827 km², 40% of the country. Western Paraguay has an area of 246,925 km², 60% of the country.

### 2. Geology and Topography

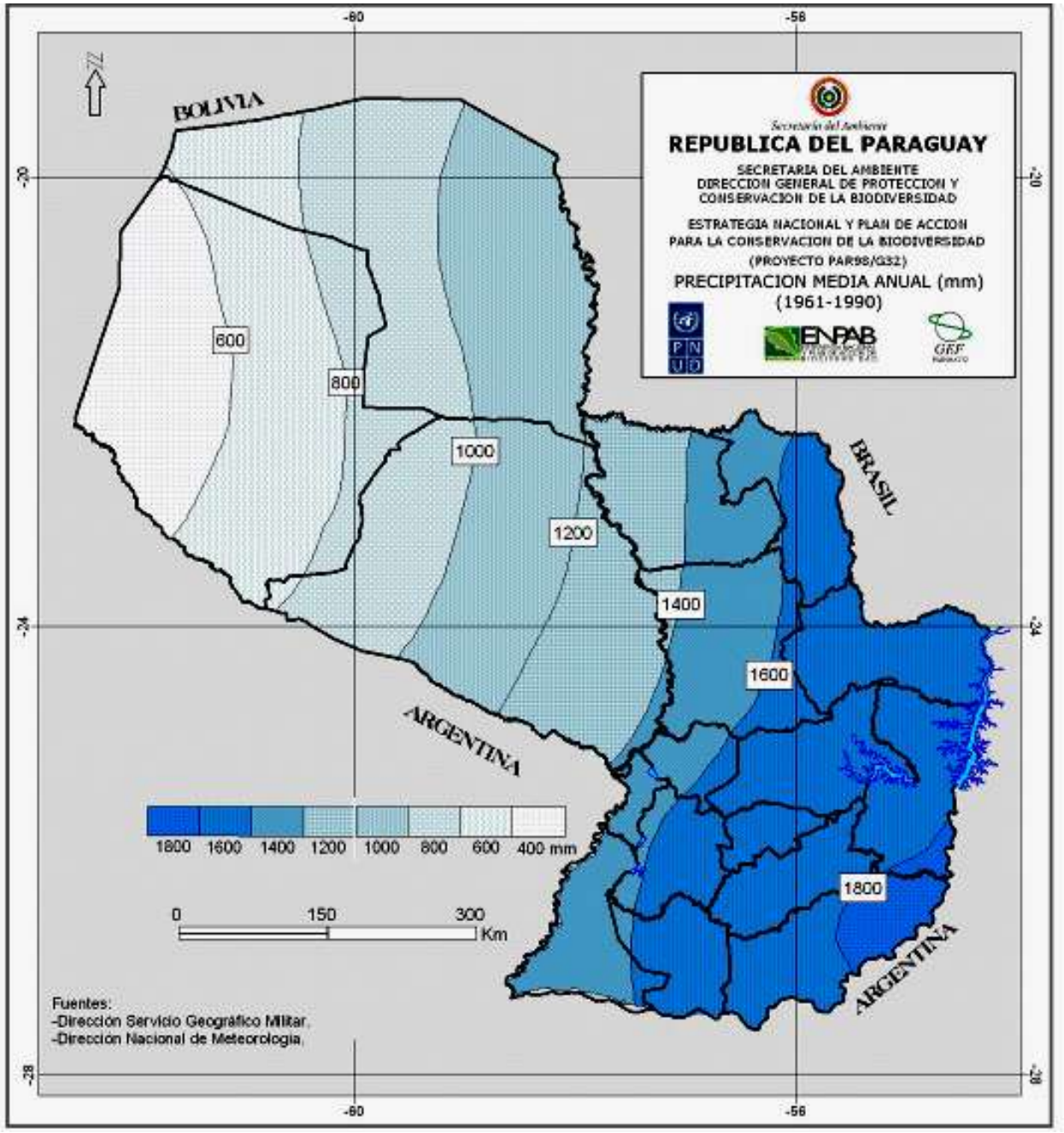
Eastern Paraguay's topography is mostly flat or gently rolling, but it has four ranges of hills, the Cordilleras of Amambay, Mbaracayú, Ybytyruzú and Caaguazú, whose highest elevation is 842 meters above sea level. Western Paraguay, by contrast, is almost entirely a plain that slopes east towards the Paraguay River. The highest elevation in Western Paraguay is 380 meters above sea level. The Brazilian Shield underlies most of Eastern Paraguay while the Andean Depression underlies most of Western Paraguay (ENPAB, 2003).

### 3. Soils

About 65% of the soils of Eastern Paraguay are fertile and well drained and thus excellent for agriculture and pasture. Western Paraguay's soils, by contrast, are predominately infertile and sandy and frequently become saline when they are cultivated or irrigated (ENPAB, 2003).

### 4. Climate

Warm winds from the north and cold winds from the south are the main factors that influence Paraguay's climate. Cold fronts are most common from May to September and warm fronts from October through April. The average temperatures vary from 21 degrees C in the southeast to 25 degrees centigrade in the northwest. Average annual rainfall in the more humid southeast may reach 1,800 mm per year, while in the drier northwest rainfall in many years is less than 400 mm. The rainy season is from October through April. Map 1 indicates the average annual rainfall across Paraguay between 1961 and 1990 (ENPAB, 2003).




**Map 1. Annual mean precipitation (mm) in Paraguay 1961-1990**

## 5. Hydrology

All of Paraguay is located in the basin of the La Platte River. Its three large rivers are the Parana, along the eastern border with Brazil, the Paraguay through the middle of the country, and the Pilcomayo, along its southern border with Argentina. Eastern Paraguay has an abundance of superficial and subterranean water, especially in the Guarani Aquifer, which extends beyond Paraguay into Brazil. Western Paraguay, by contrast, largely lacks reliable sources of superficial or subterranean water, and much of the available water is saline or salubrious.

# B. SOCIAL GEOGRAPHY

## 1. Land Use

Table 1, which is based on the most up-to-date study available for this report, indicates the land uses in Western Paraguay as of 2009.

**Table 1. Land use in Western Paraguay in 2009**

| Land Use | Area(ha) | % |
|---|---|---|
| Dry Forest & Quebracho | 11,876.087 | 49.5 |
| Matorral | 671,127 | 2.8 |
| Cerrado | 300.532 | 1.3 |
| Natural Pasture and Tree Savanna | 4,578.299 | 19.1 |
| Planted Pasture | 3,489,636 | 14.5 |
| Aquatic Vegetation | 118,569 | 0.5 |
| Water Bodies | 18,918 | 0.1 |
| Protected Areas | 2,042,699 | 8.5 |
| Indigenous Reserves | 899,188 | 3.8 |
| Urban Areas | 4,958 | 0.02 |
| **TOTAL** | **24,002.0133** | **100** |

Source: Asociación Rural de Paraguay. 2009

Table 1 indicates that in 2009 forest covered 49.5% of Western Paraguay or 11,876,078 ha, and other natural ecosystems, including the categories of indigenous reserves, water bodies, natural pasture, tree savannahs and protected areas, covered 36.2% or 8,629,323 ha. The total area of natural ecosystems in Western Paraguay, therefore, is approximately 85% or 20,505,401 ha. Planted pasture covered 14.5 % or 3,489,636 ha. Urban areas covered only 0.02% of Western Paraguay or 4,958 ha.

The data in Table 1 raise four questions. First, the table indicates no agricultural land in Western Paraguay, although field observations indicated that some of the Mennonites who live there do practice agriculture. Second, the term “natural pasture and tree savanna” mixes a land use with a type of vegetation, thereby leaving unclear the extent of these uses within the 4,578,299 ha. Third, the category of “indigenous reservation” is a category of land ownership, not land use, although presumably the land under indigenous control mostly still retains most of its natural vegetation. Finally, the category of “protected areas” does not refer to a land use, although, again, natural vegetation probably does predominate in the protected areas of Western Paraguay.

Table 2 indicates an estimate of the land uses in Eastern Paraguay as of 2008 and 2009. The table presents data that were prepared for this report by Guyra Paraguay. Data from 2009 for the area of high forest and degraded forest were combined with data from UGP (2008) for other land uses. For this study, high forest was assumed to occur only in blocks of more than 1,000 ha. Blocks of forest with less than 1,000 ha were assumed to contain only degraded forest.

**Table 2. Land use in Eastern Paraguay 2008 - 2009**

| Land Use | Description | Area (ha) | % |
|---|---|---|---|
| High forest | Larger blocks of forest, less segmented, more than 1000 ha. | 916,468 | 6 |
| Degraded forest | Blocks of forest more segmented, | 1,171,515 | 8 |

| Land Use | Description | Area (ha) | % |
|---|---|---|---|
| | less than 1000 ha. | | |
| Mechanized Industrial Agriculture | Soya, corn, rice | 2,389,577 | 15 |
| Mechanized Small-Scale Agriculture | Soya, corn | 386,342 | 2 |
| Non-Mechanized Agriculture | Horticultural crops, tree crops | 2,145,787 | 13 |
| High pasture | Natural pastures not subject to flooding | 6,208,646 | 40 |
| Low pasture | Natural pastures subject to flooding | 2,122,486 | 14 |
| Water Bodies | Rivers, lakes wetlands | 127,973 | 1 |
| Urban Areas | Land with constructions | 119,391 | 1 |
| **TOTAL** | | **15,588.185** | **100** |

Source: UGP (2008) and forest areas estimated by Guyra in 2009

Table 2 indicates that as of 2009 in Eastern Paraguay there were approximately 916,468 ha of high forest and 1,171,515 ha of degraded forest. The total forest area in Eastern Paraguay, therefore is approximately 2,087,983 ha, or about 13% of its total area.

Table 2 indicates that the single largest land use in Eastern Paraguay is high pasture, which covers 40%, or 6,208,646 ha. The second largest area of land use is industrial mechanized agriculture, which covers 15% or 2,389,577 ha. The third largest land use is low pasture, covering 14% or 2,122,486 ha. Non-mechanized agriculture occupies 13% of Western Paraguay, or 2,145,787 ha. [1]

## 2. Demography

In 2009, the population of Paraguay was approximately 6,995,655. Sixty percent of Paraguayans live in urban and 40% in rural areas. The rate of population increase is 2.36% per year. Ninety-seven percent of the population lives in Eastern Paraguay and only 3%, or about 135,000 people, in Western Paraguay (BID, 2008). Ninety-five percent of the population is *mestizo*, or people of both indigenous and non-indigenous descent, and 5% is pure indigenous. Ninety percent of the population is Catholic (CIA, 2009).

The census of 2002 identified 20 groups of indigenous peoples with a total population of 87,009. The indigenous population in the Eastern Region was 44,135 and in the Chaco was 42,964. More than 90% of the indigenous peoples live in rural areas. Five indigenous groups (Maka, Maskoy, Guarani Occidental, Nivaclé y Enlhet Norte), however, also have relatively large urban populations. The largest indigenous groups are the Ava Guarani, Pai Tavytera, Mbya, Nivaclé, Enlhet, and Enset Sur. Indigenous women have a fecundity rate of 6.3 compared to the Paraguay's average of only 3.9.

## 3. Economy

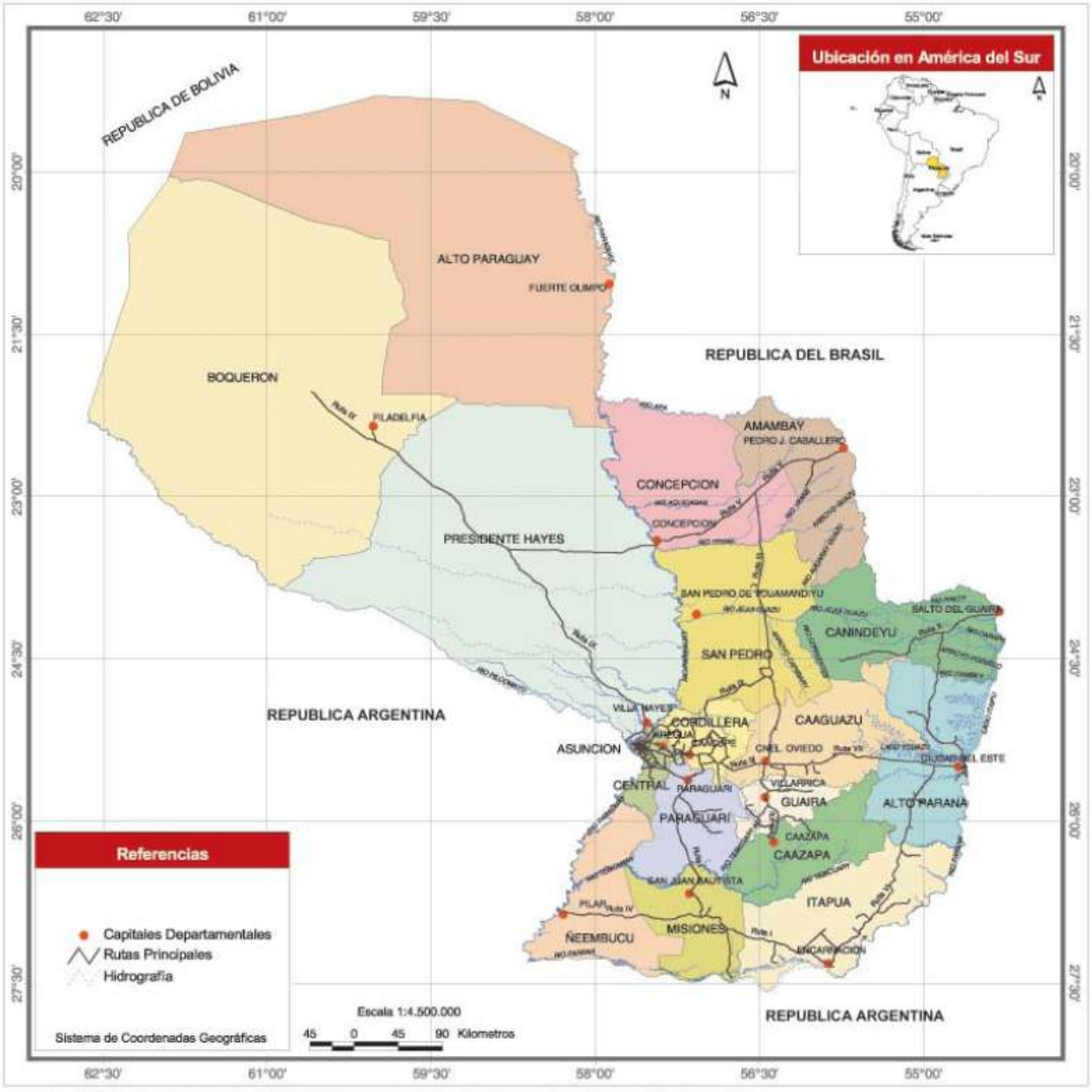
In 2008, agriculture contributed 15%, livestock 8% and forest products about 1.7% of Paraguay's Gross National Product. These three economic activities generated about 90% of Paraguay's exports and gave employment to 43% of its labor force. Soya is Paraguay's principal agricultural export, followed by meat. Soya production is concentrated in the

[1] These data probably have a wide margin of error. In particular, it is difficult on small-scale images to distinguish between some of the land uses. Some of the land classified as pasture, for example, may actually be recent forest regeneration, a consideration that could be of considerable significance for the formulation of forestry policy in Paraguay.

Departments of Alto Paraná, Itapúa, Canindeyú and Caaguazú. Rice, sugar cane, tobacco, and maize are other important Paraguayan agricultural crops.

## 4. Government

Paraguay has a democratic, representative government, with legislative, judicial and executive branches. The current president is Fernando A. Lugo, who assumed power on August 15, 2008 for a period of five years. Map 2 shows that Paraguay has 17 departments, 14 in the Eastern Region and three in the Chaco (CIA, 2009). There are 253 municipalities. Municipalities have more autonomy than departments and have responsibility for some basic environmental functions, such as the formulation and enforcement of land use planning regulations (Interviews, 2009).




**Map 2. Political divisions of Paraguay**

# III. STATUS OF THE BIODIVERSITY AND FORESTS OF PARAGUAY

## A. THE BIODIVERSITY OF PARAGUAY

### 1. Ecosystem Diversity

Five ecoregions have been identified in Paraguay (Bartrina, L., 2007). Map 3 shows the locations of these ecoregions.


**Map 3. Ecoregions and protected areas of Paraguay**

The Dry Chaco ecoregion occupies about 17,269,795 ha in Western Paraguay's extensive, flat area of alluvial soils. Its vegetation is subtropical; semi-deciduous low forest that is interspersed with savannah, which is dotted with *karanda'y* palms and is adapted to frequent flooding. The Humid Chaco occurs on 12,856,674 ha to the west and east of the Paraguay River. The Upper Parana Atlantic Forest (UPAF) ecoregion originally occupied about 8,551,796 ha in the eastern half of Eastern Paraguay. It is one of the world's most biodiverse vegetation types, but only 7% of its original area (including that of Argentina and Brazil) remains, making it one of the most threatened ecosystems in the world. The Cerrado ecoregion includes 819,598 ha, mostly in southern Eastern Paraguay where it occurs on sandy hills. The Pantanal ecoregion occupies 187,778 ha south of where the Paraguay River enters Paraguay from Brazil.

No classification equivalent to these terrestrial ecoregions exists for Paraguay's aquatic ecosystems. It is reasonable to suppose, however, that such a classification would distinguish Paraguay's three large rivers (Parana, Paraguay, Pilcomayo) as different ecosystems and would classify by their ecological characteristics its smaller rivers, streams, creeks, lakes, ponds, and reservoirs. The ecological characteristics of these water bodies vary with their size, volume of water, rate of flow, chemical composition, and sediment loads. These variables, moreover, can change frequently and quickly. In Western Paraguay, for example, months can pass without rain, and some lakes and rivers may even dry up. A heavy rainfall, however, can cause them to flood almost instantaneously. Agricultural or pasture practices may, likewise, turn what were originally fresh water lakes and rivers, and underground water reservoirs, salubrious or salty. Aquatic ecosystems also change in space, as rivers meander across the landscape, forming new courses and oxbow lakes.

## 2. Species Biodiversity

Table 3 indicates the diversity of Paraguay's plants and animals and the number of these that are considered threatened and endemic.

**Table 3. Diversity of plant and animal groups in Paraguay**

| Group | Estimated Number | Estimated Number of Threatened Species | Estimated Number of Endemic Species |
|---|---|---|---|
| Plants | 6.500 a 7.000* | 141 | No Data |
| Invertebrates | 100.000** | 50 | No Data |
| Fish | 230 a 250** | No data | No Data |
| Amphibians | 63 – 75** | 17 | 2 |
| Reptiles | 132 – 150** | 47 | 1 |
| Birds | 708*** | 120 | 79 |
| Mammals | 165 a 167** | 44 | 2 |
| **TOTAL** | | **419** | **84** |

Source: * Mereles (2007), ** SEAM (2006), *** Guyra (2005)

Table 3 indicates that there are between 6,500 and 7,000 species of plants in Paraguay. The highest number of species of plants occurs in the Upper Parana Atlantic Forest, which also provides habitat for many species of animals. Since this vegetation type has been so reduced in its area, 102 of its plant and animal species are endangered, threatened or vulnerable.

Paraguay has between 63 and 75 species of amphibians and between 132 and 150 species of reptiles. Two of its amphibians and one of its reptiles are endemic. The distribution and characteristics of Paraguay's amphibians and reptile species varies by its ecoregions. Since the Pantanal ecoregion frequently is flooded for long periods, its most characteristic

amphibians and reptiles can swim well and feed on aquatic insects and plants. Amphibians and reptiles that live in the Dry Chaco ecoregion can survive extreme drought though such adaptations as the fine skin of the *gekonidos* and the ability to hibernate of some frog species. A large number of amphibians and reptiles have evolved to inhabit successfully both the Dry and the Humid Chaco, although the granulated toad is the most typical amphibian of the Humid Chaco. Paraguay has numerous species of snakes, many of them poisonous, and lizards. The Cerrado ecoregion shares many species of amphibians and reptiles with the Humid Chaco but also has many endemic species, including the yellow toad, the caiman, and most of a large number of rare lizards (Cacciali, P. 2007).

Of the 50 countries with the most species of birds, Paraguay is ranked twenty-sixth, with about 708 species. Of these, 70% are resident species and 30% are migrants. Of the 79 endemic bird species, 23 are threatened. The Upper Parana Atlantic Forest contains the greatest variety of bird species of any ecoregion in Paraguay. The Cerrado ecoregion contains 11 endemic bird species of which four are threatened. A great variety of bird species inhabit the Humid Chaco and the Dry Chaco ecoregions, but none of them are endemic or threatened. The Pantanal, where water birds are the most common types of birds, likewise has no endemic or threatened species (Velazquez, M. 2007).

Birdlife international has identified 27 species of Paraguayan birds that are globally threatened with extinction and an additional 32 that are near-threatened. It has delimitated 57 Important Bird Areas (IBAs) which include the habitats inhabited by 22 of the 27 globally threatened species. On the average each globally threatened bird inhabits seven of the IBAs, but one, the purple-winged ground dove, occurs in only one IBA, and others occur in up to 15 IBAs. One species, the Eskimo Curlew is possibly extinct and another has not been reported since the early 1960's. Two species Dwarf Tinamou or Inambú enano (*Taoniscus nanus*) and the Pato serrucho or Brazilian Merganser (*Mergus octosetaceus*) are probably extinct in Paraguay (Clay, R. 2008).

Among South American countries, Paraguay is tenth is the number of its mammal species. It has at least 156 species of mammals, and perhaps as many as 167 species. Many of the mammal species are considered threatened. For example, of 49 species in the Chiroptera, 12 are threatened. Of 44 species of Rodentia, eight are threatened. Of 18 species of Carnivora, five are threatened. Of 15 species of Marsupialia, three are threatened. Of 14 species of Xenarthra, two are threatened. Of 10 species of Artiodactyla, six are threatened. Of five species of Primates, one is threatened. The one species of Perisodactyla and one species of Lagomorpha are both threatened. Although most of Paraguay's mammal species are widely distributed, rather than being restricted to only one ecoregion, there are some differences between the numbers of species of different families in different regions. The Dry Chaco, for example, is particularly abundant in species of rodents and armadillos, and two species of monkeys, the guanaco, the three-toed sloth and the free-tailed bat inhabit only this ecoregion. The Dry Chaco's remaining extensive areas of forest also provide habitat for viable populations of jaguar and other cats, the giant armadillo, the tagua, and the tapir. Only the tuco-tuco chaqueño (*Ctenomys dorsalis*) is endemic to this ecoregion within Paraguay (Morales, M. 2007).

None of Paraguay's mammals are restricted to only the Humid Chaco or the Pantanal ecoregions. The habitats of these ecoregions, however, do favor such species as the swamp deer, the capybara, the false nutria, the night monkey and howler monkey. Likewise, although Paraguay's Cerrado ecoregion has many species of mammals, none of them occur only there. Typical mammals are the Giant Anteater (*jurum*i), the Southern Tamandua (*kaguare)*, the Brown-brocket Deer (guasuvira), and the Pampas Deer (guasuti). The Upper Parana Atlantic Forest is particularly rich in bats and marsupials, a number of which are restricted in Paraguay to this ecoregion. Only the Spiny Burrowing Mice (hocicudo espinoso)

(*Oxymycterus delator*), however, is endemic within Paraguay to the Upper Parana Atlantic Forest (Morales, M. 2007).

### 3. Genetic Biodiversity

Genetic biodiversity in Paraguay occurs in wild and domestic species. Little information is available about the status of either type of genetic diversity. The conversion of most of Eastern Paraguay's forest to crop land and pasture, however, probably has greatly reduced the genetic variations that occurs in its wild living organisms. As the rapid clearing of Paraguay's natural vegetation proceeds, its genetic diversity is almost certainly also being reduced, at least in some species.

Many genetic variations of cultivated plants probably originated in Paraguay, include varieties of peanut, hot pepper, pineapple, corn, cassava, ka'a or yerba and Ka'a he'e, of which the last is in danger of extinction. Since 1986, the National Agronomic Institute (NAI) and the Regional Center for Agricultural Research (RCAR), which are divisions of the Ministry of Agriculture and Livestock (MAG), have been given the legal mandate to conserve Paraguay's cultivated genetic diversity. It was not possible for this report, however, to determine what actions these institutions have taken to achieve such conservation or how effective those actions have been.

## B. THE FORESTS OF PARAGUAY

### 1. Eastern Paraguay

Map 5 indicates that originally the eastern half of Eastern Paraguay was largely forested. The broad categories of forest types there are the following:

- High Forest was the most commercially important forest type in Eastern Paraguay, because it has a large variety of trees that grow tall, straight, and have commercially valuable wood. Its most typical tree species include urunde'y pará (*Astronium fraxinifolium*), tajy hu or lapacho (*Tabebuia heptaphylla*), peterevy (*Cordia trichotoma*), cedro or ygary (*Cedrela fissilis*).

- The Riverside Forest type occurs along the edge of rivers and on floodplains. Its trees rarely exceed 17 meters in height. The forest type has little commercial value but does protect watersheds. Typical tree species are ka'a ovetí (*Luehea divaricata*), nuatí arroyo (*Sebastiana* spp.), yvyra pi'u guasu (*Ruprechtia laxifolia*), *j*aguarata'y (*Cupania vernalis*) and uruku'ra or sangre de drago (*Croton urucurana*).

- The Low Forest type occurs on small islands within open savanna, principally in the southeast portion of Eastern Paraguay, where floods occur frequently. Its trees are too short and crooked for any commercial use other than firewood and charcoal. The most typical tree species is yvyra pytá (*Peltophorum dubium*). Other typical tree species are ka'a ovetí (*Luehea divaricata*), timbó (*Enterolobium contortisiliquum*), yvyra say'jú (*Terminalia triflora*) and *kurupika'y (Sapium* sp.),

- The Savannah Forest type occurs on only a small area and has more scientific than commercial value. Its most typical tree species is the palm yata'i (*Butia jatay*), but other common tree species are guavira'mí (*Campomanesia* sp.), ka'a mbara (*Gochnatia polymorpha*), yvyra ovi (*Helietta apiculata*), sará (*Lantana* sp.), and kurupa'y (*Anadenanthera peregrina*).

Table 4 indicates that the departments of Eastern Paraguay vary considerably in the extent of their remaining forest cover. Concepcion, San Pedro, Canindeyú and Amambay are the departments with most forest cover. Ñeembucú, Central and Misiones are the departments with least forest cover. According to this estimate, in 2008 the total area of forest in Eastern Paraguay was 2,202,278 ha.

**Table 4. Forest cover by department in Eastern Paraguay 2008**

| Department | Total Area (ha) | Forested Area (ha) | % of Department Forested |
|---|---|---|---|
| Concepción | 1,834,525 | 603,130 | 33 |
| San Pedro | 2,048,597 | 414,164 | 20 |
| Canindeyú | 1,507,559 | 304,404 | 20 |
| Amambay | 1,264,469 | 253,888 | 20 |
| Alto Paraná | 1,384,418 | 130,376 | 9 |
| Caaguazú | 1,292,120 | 128,464 | 10 |
| Itapúa | 1,511,827 | 124,252 | 8 |
| Caazapá | 935,122 | 112,586 | 12 |
| Guairá | 395,792 | 46,298 | 12 |
| Paraguari | 867,518 | 36,087 | 4 |
| Cordillera | 471,007 | 25,208 | 5 |
| Misiones | 830,192 | 21,077 | 3 |
| Central | 230,241 | 1,408 | 1 |
| Ñeembucú | 1,129,093 | 936 | 0 |
| **TOTAL** | 15,702,480 | 2,202,278 | 14 |

Source: UGP, 2008

In 2002, there were about 39,278 ha of forest tree plantations, mostly eucalyptus, in Eastern Paraguay. Most of these tree plantations were financed under different government reforestation programs that subsidized the costs of establishment. [2]

### 2. Western Paraguay

The following broad forest types occur in Western Paraguay:

- The High Forest type occurs on better drained sites. The typical trees are quebracho blanco (*Aspidosperma quebracho-blanco*), palo lanza (*Phyllostylon rhamnoides*), palo piedra (*Diplokeleba floribunda*), guajayvi (*Patagonula americana*), coronillo (*Schinopsis quebracho colorado*), guayacán (*Caesalpinia paraguariensis*). Trees on these sites may grow to as much as 15 meters in height. (Balbuena, 2008).

- The Low Forest type occurs on more poorly drained sites. The dominant tree species is palo blanco (*Calycophylum multiflorum*), which is frequently associated with palo piedra (*Diplokeleba floribunda*) and labón (*Tabebuia nodosa*). The trees on these sites may grow to 10 to 12 meters in height. Many sites with this forest type, however, have been burned, and they often become flooded. The typical forest on such sites tends to become dominated by palms, especially the karanda'y palm

[2] In contrast with its Brazil, Argentina, and Uruguay, Paraguay does not have a national plan for reforestation.

(*Copernicia alba*). In some poorly drained, sandy sites there are extensive forests of aromita (*Acacia aroma*), which is short tree of no commercial value. Palo santo (*Bulnesia sarmientoi*) is an especially valuable species in some parts of the low forest type of Western Paraguay and prosopis (*Prosopis ruscifolia*) is another important species, because it regenerates easily and makes excellent charcoal.

- The Riverside Forest type occurs along the edges of rivers and generally has trees of medium height and many lianas. The typical species include nandypa'í (*Sorocea bonplandii*), timbó morotí (*Cathormion polyanthum*), algarrobo blanco (*Prosopis alba),* and yam waaye (*Parkinsonia aculeate*) (Schvartzman, J., Santander, V. 1995).

- The Palm Forest type is composed of palm species interspersed with savannah and occurs mostly on poorly-drained sites.

- The Semi-arid Forest type occurs in the more western parts of Western Paraguay, has fewer species and is lower in height than the forest further east. The most typical species are coronillo (*Schinopsis quebracho-colorado*), samu'u (*Chorisia insignis*), and palo santo (*Bulnesia sarmientoi*).

No information was available for this report about large-scale forest tree plantations in Western Paraguay.

Table 5 indicates by department one of the most recent estimates of the area of forest in Western Paraguay

**Table 5. Area of forest cover in Western Paraguay by department 2009**

| Territorial Classification | Total | Departments | | | | | |
|---|---|---|---|---|---|---|---|
| | | Presidente Hayes | | Boquerón | | Alto Paraguay | |
| | | *Ha* | *%* | *Ha* | *%* | *Ha* | *%* |
| Dry quebracho forest | 11.876.086 | 2.531.913 | 34 | 5.298.358 | 60 | 4.045.815 | 52 |
| Protected areas | 2.042.698 | 257.297 | 3 | 584.807 | 7 | 1.200.594 | 16 |
| Indigenous Reserves | 899.187 | 239.797 | 3 | 414.949 | 5 | 244.441 | 3 |
| TOTAL | 14.817.971 | 3.029.007 | 40 | 6.298.114 | 70.93 | 5.490.850 | 70.89 |
| Area of Department | | 7.377.786 | | 8.879.183 | | 7.745.043 | |

Fuente: Asociación Rural del Paraguay 2009

Table 5 indicates that in 2010 there were between 11.876.086 ha and 14.817.971ha of forest in Western Paraguay. Forest covers 70% of Boquerón and Alto Paraguay Departments but only 40% of President Hayes Department. [3] Few forest inventories have been made in these forests. Table 6 indicates the results of three forest inventories in Western Paraguay.

[3] Some people who were interviewed for this report indicated that they believe that ARP may have overestimated the area of forest in the Paraguayan Chaco with the intention of minimizing the degree of deforestation. Data from Guyra Paraguay indicate that in 2009 there were approximately 13 million hectares of forest in the Paraguayan Chaco. .

**Table 6. Results of three forest inventories in Western Paraguay**

| Commercial Group | 1 | | 2 | | 3 | |
|---|---|---|---|---|---|---|
| | Vol/ha | % | Vol/ha | % | Vol/ha | % |
| Very valuable | 3,3 | 17 | 10,78 | 25 | 0,02 | 0 |
| Valuable | 4,49 | 32 | 18,81 | 44 | 22,93 | 92 |
| Little value | 0,00 | 0 | 11,96 | 28 | 1,69 | 7 |
| Without value | 7 | 51 | 1,24 | 3 | 0,32 | 1 |
| Total | 14,79 | 100 | 42,78 | 100 | 24,97 | 100 |

Source: Cesar Balbuena, per. com., 2009.

In these three inventories, the total volume of timber over 20 cm diameter breast height (dbh) ranged from 14.8 $m^3$/ha to 42.8 $m^3$/ha. The volume of the trees over 40 cm dbh in the very valuable or valuable commercial groups ranged from 2.3 $m^3$/ha to 8.9 $m^3$/ha. These volumes are similar to those found in managed forests in the dry forests of the Chiquitanía of Bolivia. The volumes indicated in Table 6 do not include that of the trees that could be utilized for posts, firewood or charcoal.

## 3. Forest Products

In 1945 the Food and Agriculture Organization of the United Nations (FAO) estimated that the average volume of commercial wood in the forests of Eastern Paraguay was 36 cubic meters per hectare. It estimated that there were a total of 283 million cubic meters of commercial valuable wood in the forests of Eastern Paraguay. In 2010, the forest that remains in Eastern Paraguay has little timber. Due to scarcity of natural forest, only 60% of the wood used by Paraguayan wood industry now originates in natural forests and forest products, once an important component of Paraguay's formal economy, in 2008 contributed only 1.7% of its GNP and only 0.2 % of its total payments for wages.

Rather than timber, firewood and charcoal are now the most important products of Paraguay's forest. Charcoal, a product produced mostly by the rural poor, for example, is about 20 % of the value of Paraguay's forest product exports. Recently, Paraguay has been exporting more than 400,000 tons of charcoal to Brazil every year for use in the steel industry. Most of this wood is being extracted from the remnant natural forest and is not being replaced by either the growth of natural forest or forest tree plantations.

Although Paraguay's hydroelectric plants on the Parana River produce ten times more electricity than the country uses, firewood still provides 22% of its energy for domestic and industrial use and 87 % of the energy used by industry (mostly for drying soya). Firewood particularly benefits poor rural families because it can often be gathered without the outlay of cash. In some parts of Eastern Paraguay, however, there is so little natural forest left that even firewood has become scarce. It is possible, however, that silvicultural treatments and protection from fire and depredation could re-establish the commercial value of some of the forest in Eastern Paraguay, since it has many sites with excellent conditions for forest regeneration and growth.

Western Paraguay has much less favorable growing conditions for commercial forest growth than Eastern Paraguay. Until recently, the only tree species that was cut on a large scale for commercial purposes was quebracho Colorado, from whose wood tannin was extracted. In the last few years, markets have been developed for the sawnwood of eight species - quebracho blanco, palo santo, quebracho colorado, coronillo, palo banco, palo lanza, urundey, algarrobo. There are now 26 wood process plants operating with wood species from Western Paraguay. Palo santo is the principal wood that currently is being exploited

and exported from Western Paraguay. Small amounts of quebracho blanco have been used for flooring, but its wood has proven difficult to saw and dry without splitting and warping (Zavala, S. per. com.).

### 4. Value of Ecosystem Services of the Forest

The degraded forests of Eastern Paraguay and the more intact but slower growing forests of Western Paraguay have enormous, although not quantified, non-commercial value for the environmental services such as the sequestration and storage of carbon, habitat for plants and animals, the protection of watersheds, and the amelioration local climates that they provide.

# IV. THREATS TO THE FORESTS AND BIODIVERSITY OF PARAGUAY

## A. DIRECT THREATS

### 1. Loss, Fragmentation and Degradation of Habitat and Forests

The principal direct threat to the biodiversity and forests of Paraguay is the elimination, fragmentation and degradation of its natural forests. Table 7 and Map 4 indicate the change in forest cover that has occurred in Paraguay by department during the period from 1990 to 2000.

**Table 7. Forest cover by department in Paraguay 1990 - 2000**

| Department | Total Area (ha) | Forested Area 1990 (ha) | Forested Area 2000 (ha) | Percent Change in Forested Area |
|---|---|---|---|---|
| **Occidente** | | | | |
| Alto Paraguay | 77,625 | 62,197 | 59,326 | 5 |
| Boquerón | 88,639 | 67,082 | 62,046 | 8 |
| Presidente Hayes | 73,035 | 28,282 | 25,653 | 9 |
| **Oriente** | | | | |
| Amambay | 12,585 | 4557 | 3,354 | 26 |
| San Pedro | 20,880 | 6307. | 4,354 | 31 |
| Paraguarí | 8687 | 778 | 721 | 7 |
| Caaguazú | 12,895 | 3813 | 2,262 | 41 |
| Caazapá | 9539 | 3217 | 1,933 | 40 |
| Canindeyú | 14,836 | 8263 | 4,903 | 41 |
| Central | 2488 | 89 | 81 | 9 |
| Cordillera | 4787 | 311 | 251 | 19 |
| Guairá | 3822 | 942 | 654 | 31 |
| Ñeembucú | 11,057 | 442 | 436 | 1 |
| Misiones | 8232 | 240 | 231 | 4 |
| Itapúa | 16,389 | 4192 | 2,578 | 55 |
| Alto Paraná | 13,693 | 5044 | 2,6 | 48 |
| Concepción | 18,756 | 6446 | 5,359 | 17 |

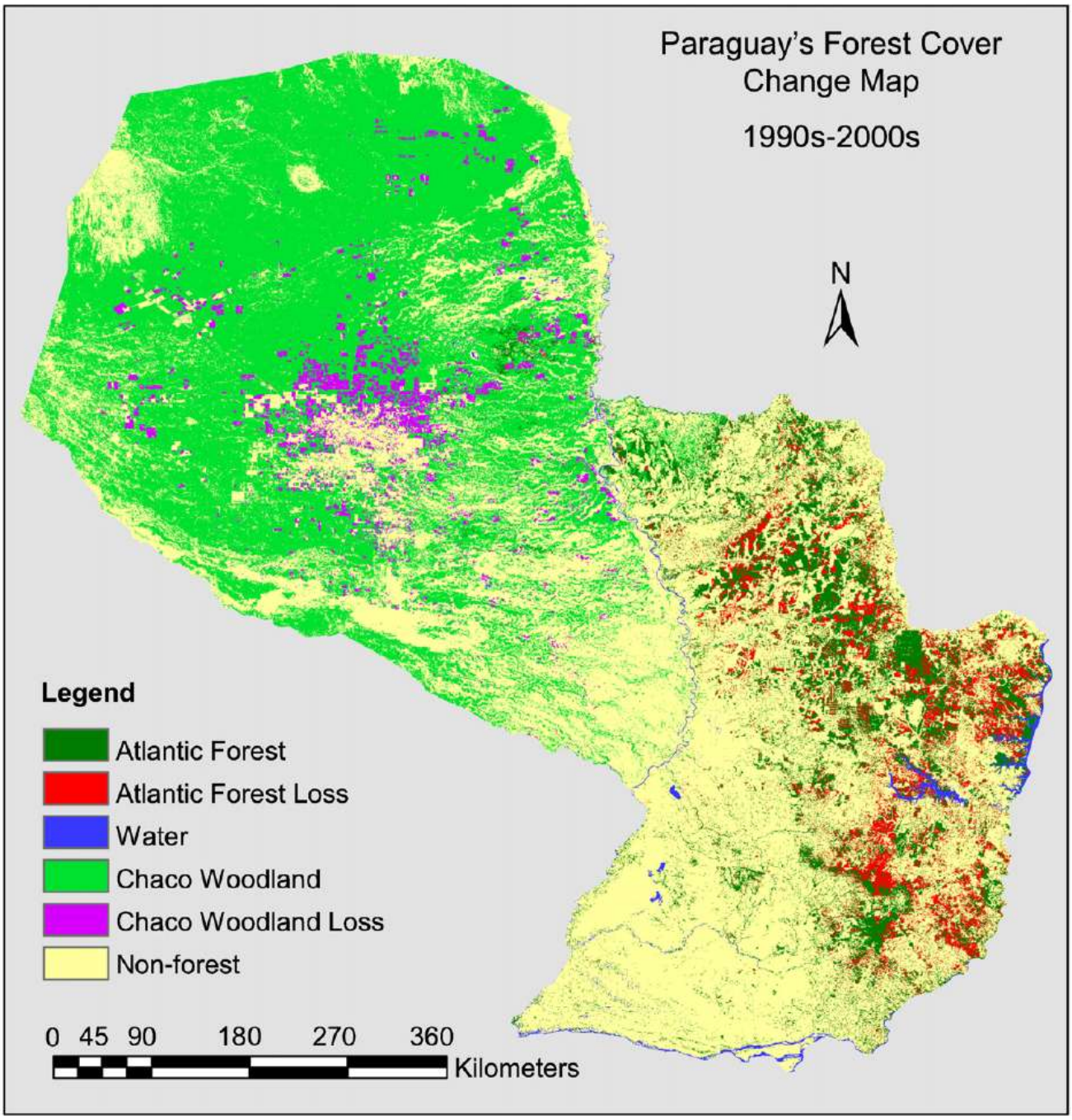
Fuente: Huang, C. et al., 2009

In Eastern Paraguay, the original forest cover was approximately 8,931,000 ha. Much of this forest was still intact until the 1950's. By 2009, however, the extent of forest had declined to under 2 million hectares. A comparison between Maps 5 and 6 clearly indicates how much Eastern Paraguay's forest has been eliminated and fragmented. Map 6 indicates that the areas of forest of more than 10,000 and more than 20,000 hectares have become uncommon in Eastern Paraguay.

The Zero Deforestation Law, which was promulgated in 2004 and prohibited any new authorizations for clearing forest in Eastern Paraguay, has contributed to slowing the rate of deforestation in Eastern Paraguay from over 110,000 ha per year prior to 2004 to about 8,000 ha in 2008 (Guyra Paraguay 2008 - WWF, 2009). Paraguay, however, has not planned or implemented any significant measures to keep the rate of deforestation and fragmentation in Eastern Paraguay from rising rapidly again when the Zero Deforestation Law ends in 2013. Moreover, although the Zero Deforestation Law has reduced the conversion of forest land to crop land and pastureland, degradation of forest has continued. The last timber trees, firewood and poles continue to be extracted from the remaining forest without any silvicultural or protection measures to ensure adequate forest regeneration and growth. Such degradation increases even more the probability that forest will be eliminated since the forest that remains is increasingly less valuable economically and more difficult to regenerate.

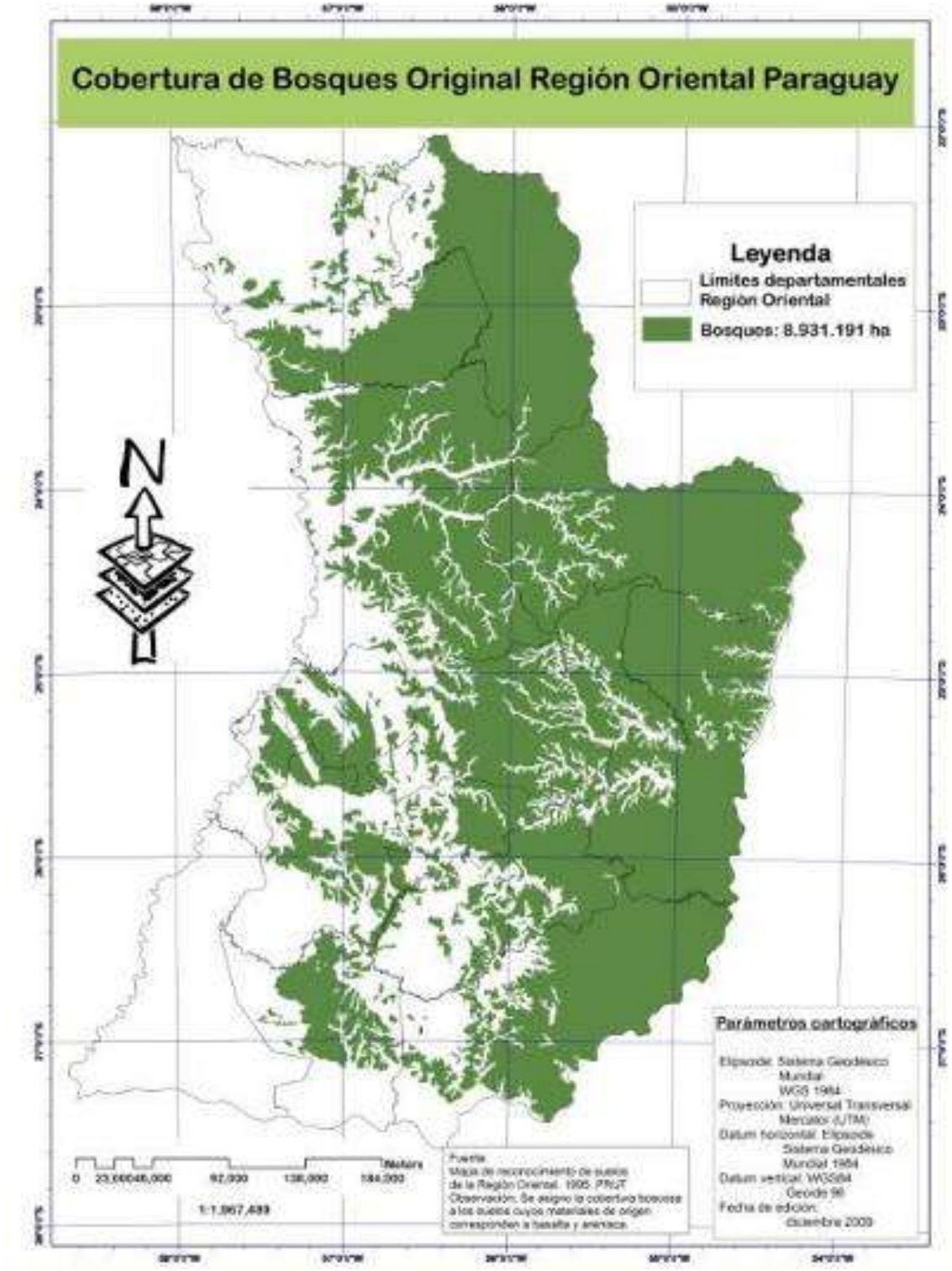
In Western Paraguay, where the Zero Deforestation Law does not apply, over 260,000 ha of forest land were cleared in 2009, mostly by agro-industry to establish pasture for cattle (Rodas, per. com.). Maps 7 and 8 indicate the changes that have occurred in the extent of forest cover in Western Paraguay between 1990 and 2009.

Generally, agro-industries are complying with the provisions of the Paraguay Forestry Law 422/73 that require that 25% of the forest on any property be left in one or two continuous blocks. The companies also are usually leaving additional forest in strips, generally 100 meter wide, around the pastureland that has been created through the clearing of forest. The Forestry Law and the Law of Environmental Impact and their regulations for environmental licenses and land use plans, clearly differentiate between these two types of remnant forest (Zavala, S., per. com.).

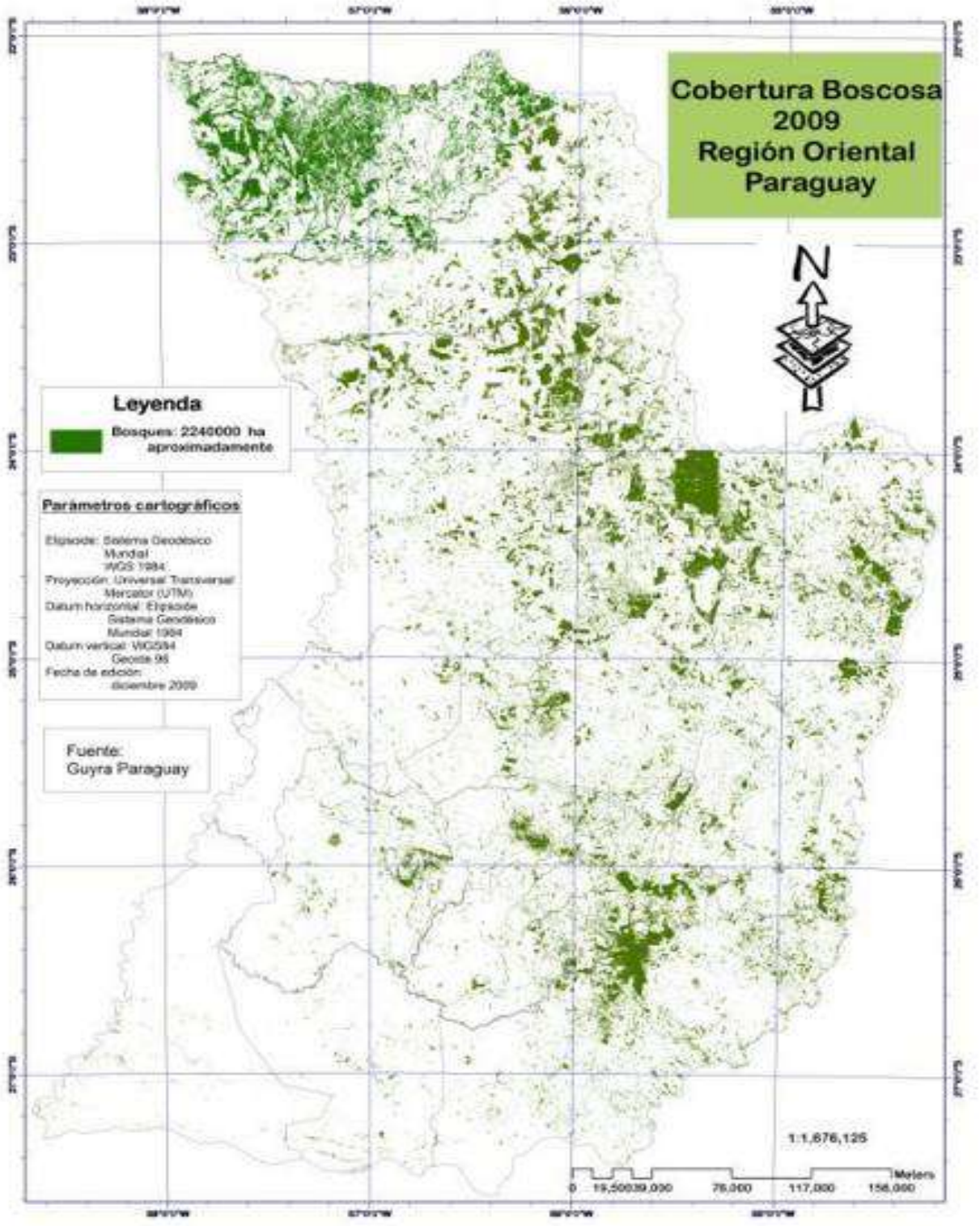



Source: Huang, C. et al. 2009

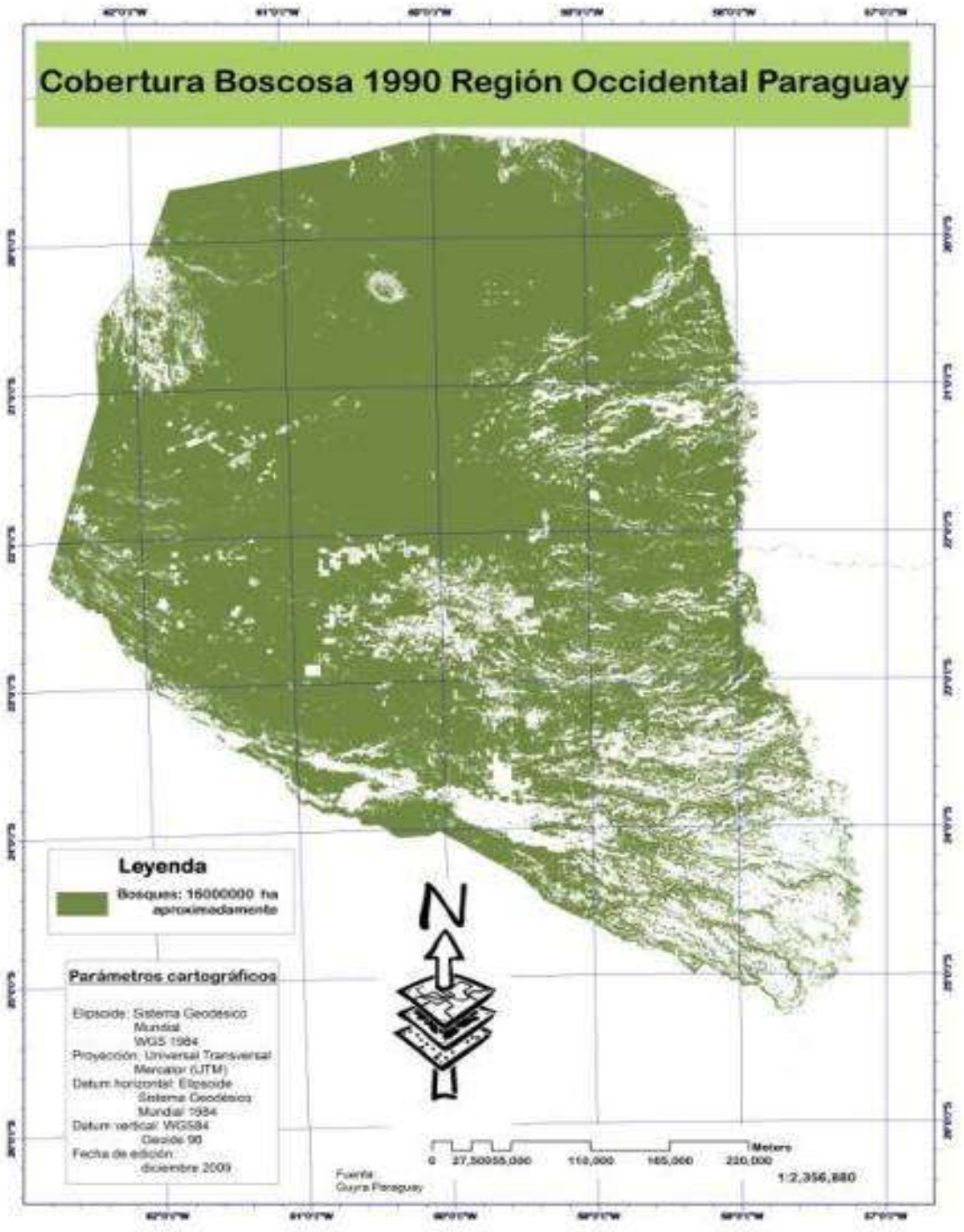
**Map 4. Changes in Paraguay's forest cover 1990 to 2009**



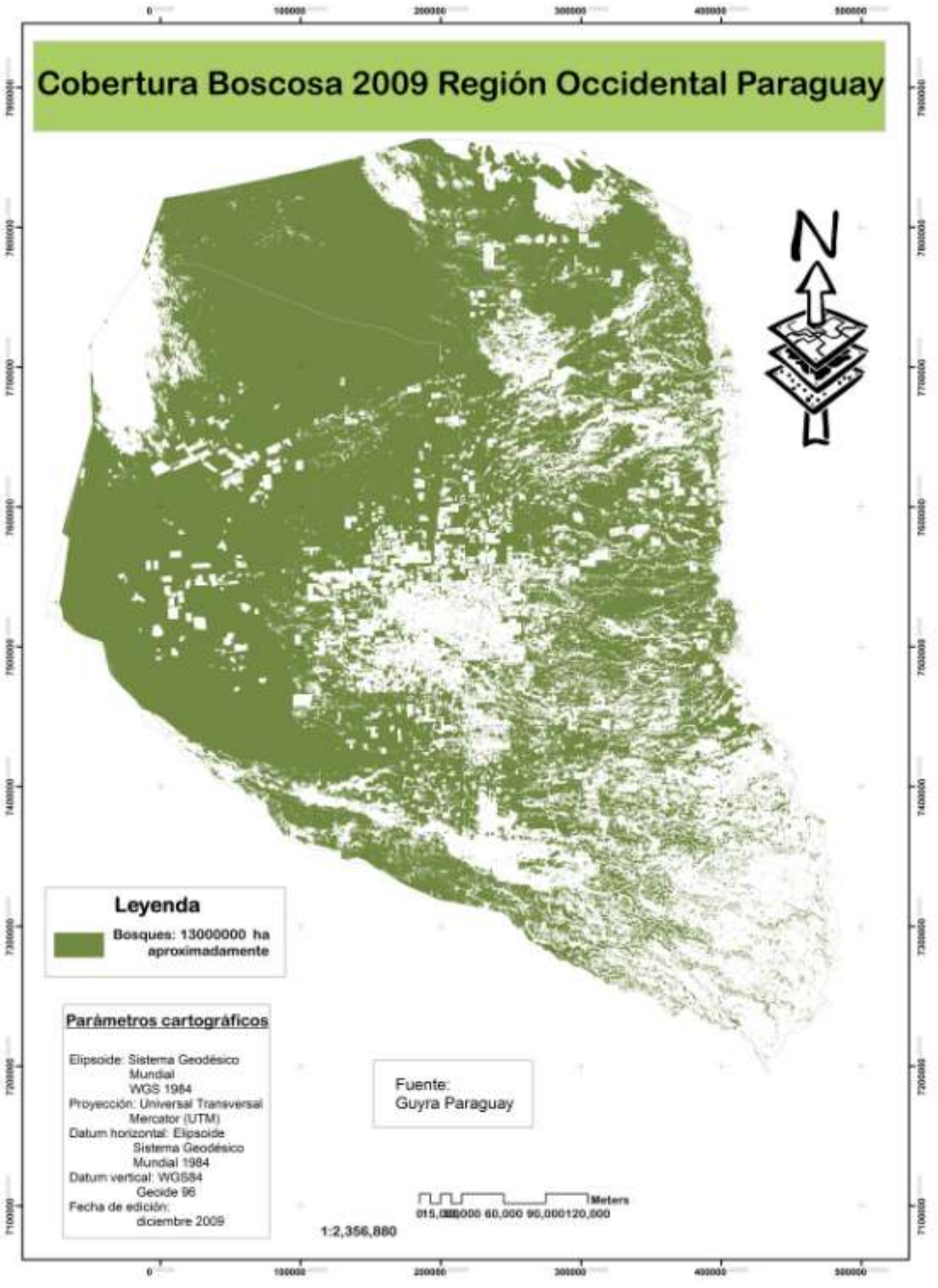

**Map 5. Original extent of forest in Eastern Paraguay**




**Map 6. Extent of forest in Eastern Paraguay in 2009**




**Map 7. Extent of forest in Western Paraguay 1990**




**Map 8. Extent of forest in Western Paraguay 2009**

Fire has been a severe, large-scale cause of forest loss, degradation and fragmentation in both Eastern and Western Paraguay. In 2007, for example, two weeks of widespread forest fires occurred in Paraguay and caused severe damage to forests and savannas, including

approximately 10,460 hectares within protected areas. Controlling fire is very difficult, since it is an established practice in Paraguay for clearing land for agriculture and pasture.

### 2. Over -Exploitation

In Eastern Paraguay for many decades over-exploitation has been causing forest degradation. First, the highest quality stems of the most valuable species were exploited for high-quality timber. Subsequently, lower quality stems and less valuable trees species were extracted for timber and poles. Currently, what remains of the forest is being exploited mostly for only poles, firewood and charcoal. Repeated exploitation without the application of any silvicultural practices has prevented most of these forests from regenerating and, where the land is sufficiently level and fertile, the degraded forest ends up being cleared and replaced by pasture or crop land. Most remaining forest in Eastern Paraguay, therefore, occurs on the less fertile, more steeply sloped and rocky sites.

In Western Paraguay, by contrast, the forests of Western Paraguay have not been so heavily exploited and quebracho colorado has been the only tree species that has been heavily exploited. Indeed, many officials of local governments and most landowners consider its forest to be "brushland" with no financial value (Zavala, S., per. com.). Even when forest is cleared for pasture, the wood is usually not utilized but rather is bulldozed into windrows and burned or left to rot.

No reliable data were available about the exploitation rates of wild game and fish. One knowledgeable interviewee said that populations of commercial fish species in the Paraguay River have declined, but no quantitative data could be obtained to confirm this statement.

### 3. Contamination

Paraguay is a lightly populated country without much industry, so contamination is not widespread threat to its biodiversity. Waste water from cities and towns and agrochemicals are the main sources of contamination. The most contaminated aquatic water bodies those around Asuncion and the Ypacarai Lake. No quantitative data are available about the magnitude of water contamination or its effects on aquatic biodiversity.

### 4. Aggressive Exotic Species

Two-hundred fifty-three species of introduced plants and animals have been recorded in Paraguay, but no data were available on how many and which of these are spreading so aggressively as to be affecting populations of native plants and animals. Even native plants and animals may become aggressive species when ecological conditions change. In degraded forests, for example, more light may reach the forest floor, modifying microclimatic conditions in ways that favor aggressive species, whether exotic or native. According to the National Strategy for Biodiversity, however, "the impact of exotic and invasive species on native species of the country is not known…" (SEAM/DGPCB/CDC/AlterVida, 2002).

### 5. Climate Change

No data or reports were found that indicated that changes in climate are affecting the biodiversity or tropical forests of Paraguay. Climate change is probably not currently a significant direct threat to Paraguay's biodiversity or tropical forests. Nonetheless, Paraguay's current rapid rate of deforestation in the Chaco is globally significant because it is releasing sequestered carbon and eliminating large areas of forest that have until now served to sequester atmospheric carbon.

# B. INDIRECT THREATS

## 1. State Policies and Laws

For decades, Paraguay's official state policy for attaining economic growth has been to promote industrial-scale, export-oriented agriculture and livestock operations. Such operations have frequently involved the conversion of forest land to pasture and crop land. Two laws in particular have stimulated such conversion of forest land.

The Agrarian Statute of 1963 permitted land that was classified as "unproductive" (defined to include all forest land) to be expropriated. The risk of expropriation has stimulated owners of forest land to convert it to crop land and pasture, thereby demonstrating "productive land use" and reducing the risk from expropriation. Although this statue has been recently modified to remove the definition of forest land as "unproductive", it contributed to the widespread, deep-seated belief that is evident in Paraguay that forest land has little or no financial or economic value compared to pasture land or crop land.

The Forest Law 422 of 1973 permits 75% of the forested land on any one property to be converted to crop land or pasture. If the forested 25% is transferred to another owner, then 75% of the forest on that property can also be eliminated. By sub-dividing a property, therefore, almost all of its forest can be legally cleared. It was not possible for this report to determine the extent to which this process of sub-divisions has in fact occurred. Nonetheless, similar to the Agrarian Statute, the concept behind Law 422 clearly reflects what interviews indicated to be a widespread and deeply-seated belief in Paraguay that forest land has little value other than for its potential to be converted to pasture or crop land.

## 2. Poverty, Inequity and Corruption

Paraguay's widespread poverty and inequitable distribution of land indirectly threatens its biodiversity and forests. Before the 1960's, internal migration to forested lands along the eastern frontier with Brazil alleviated the social discontent created by poverty and inequity of land ownership. Large landowners tended to use their land extensively, so they often did not object if settlers occupied a portion of their forest land to practice subsistence agriculture. Beginning in the 1960's, however, competition grew for land in Eastern Paraguay, as numerous Paraguayan landowners sold their properties to agro-industrial enterprises, many of them from Brazil, which used the land more intensively and did not permit spontaneous settlements by the rural poor. Poor immigrants also began to enter Paraguay from Brazil, where agro industrial enterprises had driven up the price of agricultural land. One estimate indicates that in 2008 there were 120,000 landless rural families in Eastern Paraguay (Ruiz, N. 2008). Therefore, the competition for land in Eastern Paraguay continues, as does the indirect threat that inequity in land tenure and poverty it poses to its remaining small areas of forest land.

Inequity of land distribution also creates an indirect threat to forests and biodiversity because it undermines security of land ownership. Rural people, especially those without land, commonly view forested land as unoccupied and unproductive and so legitimately open to invasion. In the face of this widespread belief, Paraguayan governments have tended to give low priority to protecting the rights of forest land owners. The trees on forested land can be sold, thus providing the cash that is needed to establish crops. When burned, the forest biomass provides fertility for one or two seasons of agricultural crops. Forest land is thus frequently invaded and burned as a means to obtain access to land that can produce agricultural crops without the cost involved in buying chemical fertilizer. Thus forest land owners have a tangible reason to convert their forest land to crop land or pasture, thereby

protecting themselves from invasions, rather than undertaking comparatively risky and long-term forest protection and management.

Corruption contributes to inequity of land ownership in Paraguay. In the early 1990's nearly eight million hectares of public lands which were illegally transferred to politicians, members of the military, and businessmen rather than being distributed to landless farmers. Some of these properties are now being sold to agro-industrial and cattle companies and being converted to crop land and pasture (http://upsidedownworld.org/main/paraguay-archives-44/1521-political-and-social-crisis-in-paraguay). It was beyond the possibilities of this report to examine the many other effects of corruption on conservation in Paraguay, but it is reasonable to assume that it debilitates conservation efforts in a variety of significant ways.

### 3. Infrastructure projects

Many infrastructure projects in Paraguay continue to be a severe indirect threat to its biodiversity and forests. During the 1970's and 1980's the construction of the Itaipu hydroelectric project not only flooded large areas of forest land but stimulated the immigration of more than 300,000 Brazilians to Paraguay, many of whom bought and cleared forest land. The construction of a network of roads and bridges in Eastern Paraguay during the 1990's in Western Paraguay permitted faster and cheaper access to forested areas, thereby stimulating conversion of forest land to crop land and pasture. The construction of roads and bridges in Western Paraguay continues to cause adverse indirect effects on its forests and biodiversity.

These large infrastructure projects have frequently been financed by the Inter-American Development Bank and consequently have been subjected to an environmental review process. It was beyond the possibility of this report, however, to evaluate the effectiveness of this process for avoiding, mitigating or compensating for the negative direct and indirect effects on Paraguay's tropical forests and biodiversity of infrastructure projects.

# V. ACTIONS TO CONSERVE PARAGUAY'S BIODIVERSITY AND FORESTS

## A. CONSERVATION ACTIONS

### 1. Conservation within Protected Areas

**Justification**

The primary purpose of establishing protected areas is to conserve ecosystems and biodiversity in perpetuity. Conservation within protected areas is thus a fundamental requirement for the protection of any country's biodiversity and tropical forests, especially their rarer, threatened and endangered ecosystems, species and genes which tend to occur predominately in original, undisturbed types of habitat.

**Status**

Table 8 indicates the names and areas in hectares of the protected areas in Paraguay that as of early 2010 were officially part of the National System of Protected Natural Areas (SINASIP). As indicated later in this report, other areas are in the process of being incorporated into SINASIP. The table does not include biosphere reserves, whose nuclear areas are official protected areas but which also include areas that are not officially protected and are not officially part of SINASIP.

**Table 8. Protected areas in Paraguay**

| No[4] | Category of Protected Area | Total Ha |
|---|---|---|
| | **Public Protected Areas** | **2,276,481** |
| 1 | Zona Nacional de Reserva Cerro Lambaré | 3 |
| 2 | Monumento Científico Moisés Bertoni | 200 |
| 3 | Parque Nacional Tinfunqué | 241,320 |
| 4 | Reserva Nacional Kuri'y | 2,000 |
| 5 | Reserva Nacional Saltos del Guairá | 900 |
| 6 | Parque Nacional Caazapá | 16,000 |
| 7 | Parque Nacional Ybycuí | 5,000 |
| 8 | Parque Nacional Defensores del Chaco | 720,000 |
| 9 | Parque Nacional Cerro Corá | 5,538 |
| 10 | Parque Nacional Teniente Agripino Enciso | 40,000 |
| 11 | Parque Nacional Lago Ypacaraí | 16,000 |
| 12 | Reserva de Recursos Manejadas Yvytyrusu | 24,000 |
| 13 | Parque Nacional Lago Ypoa | 100,000 |
| 14 | Monumento Natural Macizo Acahay | 2,500 |
| 15 | Reserva para Parque San Rafael | 72,849 |
| 16 | Refugio de Vida Silvestre Yabebyry | 30,000 |
| 17 | Parque Nacional Ñacunday | 2,000 |
| 18 | Monumento Nacional Cerro Chororí | 5 |
| 19 | Monumento Natural Cerro Koi | 12 |
| 20 | Parque Nacional Serranía de San Luis | 10,273 |

[4] These numbers correspond to the numbers on Map 3.

| No[4] | Category of Protected Area | Total Ha |
|---|---|---|
| 21 | Parque Nacional Bella Vista | 7,311 |
| 22 | Parque Nacional Paso Bravo | 103,018 |
| 23 | Reserva Nacional Cerro Cabrera/Timane | 125,823 |
| 24 | Reserva para Parque Nacional Cerro Chovoreca | 100,953 |
| 25 | Reserva Ecológica Capiibary | 3,082 |
| 26 | Parque Nacional Río Negro | 123,786 |
| 27 | Parque Nacional Médanos del Chaco | 514,233 |
| 28 | Reserva de Recursos Manejados Ñu Guazú | 280 |
| 29 | Reserva Ecológica Bahía de Asunción | 300 |
| 30 | Paisaje Protegida Cerro Dos Oro | 45 |
| 31 | Carrizales del Paraná en la Cuenca del Lago Sirena | 9.050 |
| | **Private Protected Areas** | **287,054** |
| 32 | Reserva Natural Cerrados del Tagatiya | 5,700 |
| 33 | Reserva Natural Tagatiya mi | 33,789 |
| 34 | Reserva Natural Arroyo Blanco | 5,714 |
| 35 | Reserva Natural del Bosque Mbaracayú | 64,405 |
| 36 | Reserva Natural Morombi | 25,000 |
| 37 | Reserva Natural Ypeti | 13,592 |
| 38 | Reserva Natural Tapytá | 4,736 |
| 39 | Reserva Natural Ñu Guazú | 50,000 |
| 40 | Reserva Natural Toro Mocho | 18,000 |
| 41 | Reserva Natural Ka'i Rague | 1,859 |
| 42 | Reserva Natural Cañada del Carmen | 3,973 |
| 43 | Reserva Natural Palmar Quemado | 9,478 |
| 44 | Reserva Natural Yaguareté Porã | 27,508 |
| 45 | Reserva Natural Tabucai | 559 |
| 46 | Reserva Natural Lote 1 | 5,364 |
| 47 | Reserva Natural Maharishi | 343 |
| 48 | Reserva Natural Fortín Salazar | 12,450 |
| 49 | Reserva Natural Punié Paëosi | 3,780 |
| 50 | Reserva Natural Laguna Blanca | 804 |
| | **Protected Areas Under Special Management** | **50,464** |
| 51 | Refugio Biológico Mbaracayú | 1,436 |
| 52 | Refugio Biológico Tati Yupi | 1,915 |
| 53 | Reserva Biológico Limoy | 13,396 |
| 54 | Reserva Biológico Itabó | 17,879 |
| 55 | Refugio Biológico Carapá | 2,575 |
| 56 | Refugio Biológico Pikyry | 1,109 |
| 57 | Reserva Natural Yvyty Rokái | 3,809 |
| 58 | Refugio de Vida Silvestre Isla Yacyretá | 8,345 |
| | **TOTAL** | **2,613,999** |

Sources: compiled by RED for this report from data provided by SEAM, RED

As of early 2010, the area of Paraguay's National System of Natural Protected Areas (SINASIP) consisted of 58 areas with a total area of 2,613,999 ha. Of these protected areas, 31 were in the category of Public Protected Areas, with 2,276,481 ha. In the category of Private Protected Areas there were 18 areas with 287,054 ha. In the category of Protected Areas under Special Management there were eight areas with 50,464 ha. Public Protected Areas thus have 53% of the number of areas in SINASIP and 87% of its area.

Private Protected Areas are 31% of SINASIP's areas and 11% of its total number of hectares. Protected Areas under Special Management are 23% of SINASIP's areas and 1.9% of its total hectares. Appendix 5 provides more details about Paraguay's protected areas.

The largest of the public areas are the National Park Defensores del Chaco with 720,000 ha and the National Park Médanos del Chaco with 514,233 ha. Together the area of these two parks is 1,234,233 ha, over 45% of all the hectares within SINASIP. Other large public protected areas are the National Park Tinfunque, with 241,320 ha, the National Reserve Cerro Cabrera/Timane with 125,018 ha, the National Park Rio Negro, with 123,786 ha, the National Park Paso Bravo with 103,018 ha and the National Park Lago Ypoa, with 100,000 ha. Together these five protected areas have a total area of 693,142 ha, making up another 25% of the area of SINASIP. The seven largest of SINASIP's Public Protected Areas thus contain 70% of its total area. The remaining 24 public areas range in size from as little as three hectares (Zona Nacional de Reserva Cerro Lambaré) to as large as 72,849 ha (Reserve for a future National Park San Rafael).

Table 9 indicates the approximate area and percentage of each of Paraguay's five ecoregions that occur within protected areas that are currently part of SINASIP.

**Table 9. Areas and percentage of Paraguay's ecoregions within SINASIP**

| Ecoregion | Total Area of Ecoregion in Paraguay (ha) | Total Protected Area in Ecoregion (ha) | % of SINASIP in Ecoregion | % of Ecoregion in SINASIP |
|---|---|---|---|---|
| Upper Parana Atlantic Forest | 8,591,122 | 299,794 | 11.5 | 3.5 |
| Cerrado | 819,133 | 152,780 | 5.8 | 18.7 |
| Humid Chaco | 12,858,456 | 177,206 | 6.8 | 1.4 |
| Dry Chaco | 17,484,326 | 1,955,081 | 74.8 | 11.2 |
| Pantanal | 198,494 | 28,139 | 1.1 | 14.2 |
| Other | 723,669 | 0 | 0 | 0 |
| TOTAL | 40,675,200 | 2,613,000 | 6.4 | 6.4 |

Source: RED, 2010

Column 4 of Table 9 indicates the percentage of SINASIP that is in each of Paraguay's ecoregions. The largest percentage of SINASIP (74.8%) is in the Dry Chaco ecoregion, due to the large size of the Defensores del Chaco and Médanos del Chaco National Parks. The next largest percentage of SINASIP (11.5%) is in the Atlantic Forest of Upper Parana. Only 6.8 % of SINASIP is in the Humid Chaco, 5.8% is in the Cerrado and 1.1 % is in the Pantanal ecoregions.

Column 5 of Table 9 indicates the percentage of the original area of each ecoregion that is included in SINASIP. The ecoregion that has the largest percentage of its original area included in SINASIP is the Cerrado with 18.7%. The Pantanal has 14.2% of its original area and the Dry Chaco has 11.2% of its original area included in SINASIP. The percentages of the Upper Parana Atlantic Forest (3.5%) and the Humid Chaco (1.4%) ecoregions within SINASIP are much smaller.

In Paraguay, protected areas can be created in four ways: (1) by a National Law approved by the national parliament; (2) by an Executive Decree issued by the national president; (3)

by a Resolution of the Executive Directorate of the Bi-National Entities of Itaipu and Yacyretá; and (4) by the purchase of land by NGOs specifically for conservation. Table 10 indicates the number of hectares and the number of areas that have been created under each of these modalities.

**Table 10. Summary of the legal status of the protected areas in SINASIP[5]**

| Type of Area | Law | | Decree | | Resolution Directorate | | TOTAL | |
|---|---|---|---|---|---|---|---|---|
| | Area (ha) | No | Area (ha) | No | Area (ha) | No | Area (ha) | No |
| Public | 31,230 | 8 | 2,252,761 | 23 | 0 | 0 | 2,276,481 | 31 |
| Private | 68,378 | 2 | 218,676 | 17 | 0 | 0 | 287,054 | 19 |
| Special | 0 | | 0 | 0 | 50,464 | 8 | 50,464 | 8 |
| TOTAL | 99,608 | 10 | 2,471,437 | 40 | 50,464 | 8 | 2,613,999 | 58 |

Source: prepared for this report by the Red Paraguaya de Conservación en Tierras Privadas

Table 10 indicates that by far the greatest number (40) and hectares (2,471,437 ha) of the protected areas in SINASIP have been created by Executive Decree. Only 10 areas with 99,608 ha have been created by the National Law, and only eight areas with 50,464 ha have been created by the Resolution of the Executive Directorate of Bi-National Entities of Itaipú and Yacyretá.

The NGOs have bought a total of 103,067 ha for conservation, of which 77,478 ha have been officially made part of SINASIP, in the areas of Mbaracayú, Tapytá, Cañada del Carmen and Lote 1. There are 22,089 ha located inside existing public protected areas (Complejo Guyra Reta, Pantanal Paraguayo and Fortín Galpón). The remaining 3,500 ha occur within the area of Campo Iris, which is in the process of being recognized as a private nature reserve.

- *Biosphere Reserves*

A Biosphere Reserve is a flexible use area where sustainable production may coincide with the conservation of biodiversity, and which can have several categories of management units, including both private and public lands and officially protected and non-protected areas.

[5] This table does not include the area of "Biosphere Reserves" because they are not part of SINASIP and include lands with many different types of ownership and use. The purpose of declaring a Biosphere Reserve is to encourage private landowners to manage their natural resources in a sustainable way. The declaration does not imply any intention of the government to confiscate the land and make it publically owned

**Table 11. Categories and areas of biosphere reserves in Paraguay**

| Category of Biosphere Reserve and Name | Total Área Oficially Protected (ha) | Net Total Area of the Biosphere Reserves[6] (ha) |
|---|---|---|
| **Established by Executive Order** | **4,975,086** | **3,290,034** |
| Biosphere Reserve of the Chaco | 4,707,250 | 3,115,810 |
| Biosphere Reserve of the Apa River's Cerrado | 267,836 | 174,224 |
| **Established by UNESCO** | **7,491,400** | **2,719,745** |
| Biosphere Reserve of the Chaco[7] | 7,200,000 | 2,492,750 |
| Biosphere Reserve of the Mbaracayu | 291,400 | 226,995 |

Sources: SINASIP 2007

Table 11 indicates that two types of Biosphere Reserves exist in Paraguay, those created by Decree of the Executive Power and included within SINASIP as a national category of management (Cerrados del Rio Apa and the Chaco) and those recognized by the MAP of UNESCO (Bosque Mbaracuay and Chaco). Column 1 of Table 11 indicates the categories and names of the biosphere reserves in Paraguay. Column 2 indicates the area within the biosphere reserve that has been officially declared as a protected area. Column 3 indicates the area within the reserve that has not been declared an official protected area.

In the case of the Biosphere Reserve of the Chaco recognized by UNESCO, the area declared includes the area of protected areas and two natural reserves, in addition to other properties that are not within any protected area. The total area is 7,200,000 ha. Appendix 11 provides additional information on Paraguay's Biosphere Reserves.

- *Private Reserves in Process of Creation*

Table 12 indicates the number, name and area of private protected areas that were in the process of creation as of early 2010 in Paraguay.

**Table 12. Private protected areas in the process of creation**

| No | Name | Area (ha) |
|---|---|---|
| 63 | Ypytu | 5,425 |
| 64 | El Ceibo | 5,065 |
| 65 | Fortín Patria | 29,745 |
| 66 | Riacho Florida | 1,075 |
| 67 | Laguna Yacare | 1,000 |
| 68 | Estrella Sayte | 19,926 |
| 69 | Estrella | 1,019 |
| 70 | Yukeri | 4,100 |
| 71 | Villa Josefina | 179 |
| 72 | La Morena | 2,077 |
| 73 | Sombrero | 25,980 |
| 74 | Salto Cristal | 41 |

[6] The net area indicates the area that occurs outside of the protected areas.
[7] The area of 7.200.00 ha includes the Biosphere Reserve of the Chaco which has been declared as a national category.

| No | Name | Area (ha) |
|---|---|---|
| 75 | Guyrati | 3,811 |
| | **TOTAL** | **99,443** |

Source: prepared for this report by RED

As of early 2010, the total area that was in the process of creation as private areas was 99,443 ha located in 13 different areas. Three of these areas (Fortin Patria, Estrella Sayte, Sombrero) are large, having over 19,000 ha each, while the other areas are smaller.

## Principal Issues and Priority Actions

- *Clarify regulations of private land within public protected areas*

In Paraguay the declaration of a public protected area does not necessarily mean that the government owns all of the land included in that area. In fact, portions or all of most of the public protected areas have been super-imposed on private land. Data were not available to determine what percentage of SINASIP's public protected areas is public land and what percentage is private land. Only the Serranía de San Luis, Ybycui, and Caazapá National Parks, however, have land titles in the name of the national government. No clear regulatory guidance has been prepared or applied to regulate the use of private land that lies within an area that has been legally declared a public protected area. A priority action therefore is to clarify the regulations that apply to private lands that are within legally declared national protected areas and ensure that these regulations serve to reconcile the public interest in conservation with the private interests of their landowners.

- *Prepare and implement management plans for protected areas*

Of the 31 public protected areas, three have approved management plans, four have management plans in preparation and 24 have neither an existing management plan nor one in the process of preparation and are managed according to Annual Operating Plans (AOPs). Of the 19 private protected areas, five have management plans that have been approved by the government, two have preliminary management plans that are in the process of being prepared, eight have management plans in the process of approval and four lack a management plan. Of the eight protected areas created by the bi-national entities Itaipu and Yacyretá, one has an approved management plan (Yacyretá) and seven have management plans in some stage of preparation (Itaipú).

The high cost of preparing management plans is the main reason for delays in their preparation. Furthermore, frequently for lack of funds, the actions recommended in the management plans for the public areas, other than the routine payment of salaries and basic operating costs, have not been implemented. A priority action, therefore, is to prepare feasible management plans for those areas that do not have them, emphasizing how their recommendations for actions will be sufficiently financed and effectively implemented.

- *Increase the representativeness of SINASIP*

Ideally, SINASIP would have an adequate representative area of each of the five terrestrial ecoregions in Paraguay to provide sufficient protection to their ecosystem, species and genetic biodiversity. In fact, one ecoregion, the Dry Chaco, composes 74.8% of all of SINASIP, while other ecoregions are underrepresented. For example, the Atlantic Rainforest of Upper Parana, Paraguay's most globally significant ecoregion for the conservation of biodiversity, comprises only 11.5% of SINASIP, and the Pantanal only 1%. Not only is Paraguay's ecosystem diversity not represented proportionally in SINASIP, but its species diversity is also not completely represented. Of all the species of flora and fauna in Paraguay, 40% are not represented in the SINASIP. Only 18% of Paraguay's plant species

and only 16% of its endemic plant species are found within the boundaries of a protected area. A priority action therefore is to increase the representativeness of the areas included in SINASIP.

- *Increase the number and area of private reserves*

More than 95% of Paraguay is private property, and there are almost no public lands left that could be used for creating additional public protected areas. Although SINASIP does include protected areas in all of the country's broad ecoregions, it does not include many types of habitats that are important for the conservation of Paraguay's biodiversity. Private landowners thus must play the principal role in conserving biodiversity and forests in Paraguay. A priority action, therefore, is to expand the number and area of private nature reserves in Paraguay through support and incentives of various types for private landowners to register their land as protected areas and to protect its biodiversity.

## 2. Conservation outside of Protected Areas

### Justification

The area of land within SINASIP is unlikely ever to include more than a small percentage of Paraguay or to include a large percentage of most of its ecoregions. SINASIP, therefore, will never be able to provide adequate protection for all of Paraguay's biodiversity and ecosystem types. Therefore, strategies are needed to protect effectively biodiversity and forests within privately owned lands that are not included in SINASIP.

### Status

- *Conservation Easements*

Paraguay has two small areas of conservation easements that total 216 ha, as indicated in Table 13. Mbatovi is developing nature tourism and adventure tourism programs. Mamorei is a site devoted to rural tourism and environmental education.

**Table 13. Conservation easements in Paraguay**

| NO | Name | Area (ha) |
|---|---|---|
| 76 | Mbatovi | 16 |
| 77 | Mamorei | 200 |
| | TOTAL | 216 |

Source: prepared for this report by RED

- *Managed Forests*

Since 2005, INFONA has approved about 266 forest management plans. Several private enterprises have attempted to produce wood from managed natural forests. The largest obstacle to achieving this goal has been the invasions of private forest property by the rural poor, without effective enforcement of property rights by the government.[8] Yaguareté Forests, for example, was a promising sustainable forest management company and was the first forest company in Paraguay to achieve the certification of its forest management

[8] These invasions of forest land may be stimulated as much by a desire to extract forest products, especially firewood and charcoal, as by a desire to occupy land for agriculture.

based on the criteria of the Forest Stewardship Council (FSC). When its forest land was invaded by rural people, however, it was obliged to stop its forest management operations.

Currently, there are two forests in Paraguay that are certified, the 2,700 ha of natural forest of the Sociedad Agrícola Golondrina/Unique Wood and the 10,543 ha of tree plantations in the department of Alto Parana owned by the company Desarrollos Madereros del Paraguay ( Ex-Forestal Yguazú S.A.). (Bricapar is another wood industry that is starting a forest management project in the Chaco with the intention of obtaining certification according to FSC standards and export wood and charcoal). Neither company, however, receives a sufficient volume of certified wood to be able to operate only with certified wood Some other foreign investors that are acquiring land in the Chaco are making evaluations of the feasibility of establishing forest management units. (Zavala, S., per. com.).

Various interviews indicated that some of the management plans that INFONA has approved do not comply with generally accepted technical standards for the sustainable forest management criteria and that most of the management plans are being used not to manage forest units technically, but only to comply with the paperwork required by government regulations to transport wood on public roads. INFONA is currently reviewing its procedures for controlling logging and the transport of logs and existing management plans and the standards and procedures for their preparation, but no information was yet available on the conclusions of this review.

- *Reforestation*

Large-scale reforestation has not occurred in Paraguay, as it has in Uruguay, Brazil and Argentina, in spite of several incentive schemes, strong demand for wood and the existence of many sites that would be excellent for the establishment of fast-growing forest tree plantations. Table 14 indicates the main reforestation incentive programs in Paraguay through 2002 and the number of hectares of reforestation that INFONA officially attributes to them. The total area reforested through 2002 as part of these incentive programs is a little under 40,000.

**Table 14. Hectares reforested through 2002**

| Incentive Scheme | Dates | Description | Main Problems | Area (ha) |
|---|---|---|---|---|
| 422/73 Law<br>National Reforestation Plan | 1973 | Central eastern provinces; mostly ornamental plantations | Mostly ornamental plantations | 10,025 |
| Nº 14.047 Decree<br>Compensation scheme | '92-'93 | Forest industry paid for wood with reforestation; | Corruption | 1,227 |
| Ley 536/95<br>Promotion of Afforestation and Reforestation | '95-98 | State paid 75% of costs of establishment & maintenance; | Over-payment; no objectives for plantations; poor site & species; no protection; insufficient financing & has not reimbursed many landowners | 26,148 |
| Energy Plantations | '92-'93 | Established for firewood for cities; State & landowner | Have not been harvested due to regulations | 1,763 |

| Incentive Scheme | Dates | Description | Main Problems | Area (ha) |
|---|---|---|---|---|
| | | shared costs; only Eucalyptus sp. | | |
| Model Forests | | Financed by JICA | | 115 |
| **TOTAL** | | | | **39,278** |

Source: Compiled for this report by William Cordero

The principal obstacles to establishing a large-scale reforestation program in Paraguay are (1) the tendency for corruption in the administration of such programs; (2) poor administration and planning; (3) inadequate technical supervision in the field; and (4) irregular and insufficient funding.

Additionally, in general neither the government nor the private sector has treated reforestation as a profitable business opportunity. Rather they have considered it as a subsidized, marginal economic activity carried out not to produce wood products, but to take advantage of government subsidies. For that reason, upon the termination of the subsidies reforestation and management of plantations have also usually ceased.

Law 3703, approved in 2009, is applicable to reforestation as well as to forest management. Unlike previous incentives for reforestation, Law 3703 requires no outlay on the part of the state. Perhaps for that reason it may have a better chance than former laws of stimulating large-scale reforestation.

- *Conservation on Private Property*

About 100 private landowners in Paraguay have indicated their interest in managing and protecting natural vegetation on their properties by becoming members of the Network of Private Reserves (RED). Only 19 of them, however, have established official nature reserves that are registered with SEAM. Of these reserves, nine are located in the BAAPA, with a total of 117 012 ha, seven are in the Dry Chaco, with 118,103 ha, two are in the Cerrado with 39,489 ha, and one is in the Humid Chaco, with 12,450 ha. The 81 members of RED who have not registered their properties with SEAM as private reserves may be in the process of doing so, or may simply be interested in conservation without wanting to enroll their land officially with SEAM. [9]

## Principal Issues and Priority Actions

- *Establish managed forests and biological corridors*

A comparison of the forest cover shown on Maps 4 through 8 visually indicates that the forests in all of Eastern Paraguay and part of Western Paraguay have become severely fragmented. In addition, over-cutting and burning of the forest that remains in Eastern Paraguay has caused most of it to become highly degraded, through a reduction in the variety of species and in the quality of the remaining trees.

The maps, however, also indicate that large blocks of forest do still remain in both Eastern and Western Paraguay. The conservation of Paraguay's biodiversity requires that many of

[9] Speculation suggests that some private landowners may be reluctant to establish a formal private reserve, since by doing so they give some control over their land to the government.

these blocks of forest do not shrink further in size, be protected from further degradation and be treated with silvicultural practices that will hasten their restoration to productive, healthy forest that provides habitat for a range of plant and animals species. Furthermore, the landscape between the blocks of forest that remain should not become devoid of natural vegetation, thereby isolating the forest blocks from each other. Rather, natural vegetation should provide corridors between the blocks of forest, enabling the movement of plant and animal species and genes between the forest blocks, thereby increasing their long-term viability as species.

Most land in Paraguay is privately owned, so the decisions of private landowners about the use of their land will largely determine the fate of Paraguay's remaining forested blocks and the corridors of vegetation between them. Paraguay's rapid rate of deforestation and the degraded state of the forest that remains clearly demonstrates that most Paraguayan landowners have been choosing to eliminate and degrade, not protect and improve their forests. The incentives for Paraguayan forest land owners to degrade and eliminate their forests were discussed previously.

Private forest land owners in Paraguay, however, have at least four reasons to conserve and improve, rather than eliminate and degrade, their forests. First, some of they may come to feel forest conservation is an ethical responsibility associated with owning land. Second, maintenance of forest and trees on the property may enhance its value as a property and therefore be worthwhile as a financial investment. Third, trees and forests may contribute to the overall profitability of an agricultural or livestock enterprise. Fourth, by undertaking conservation actions, the landowners may receive some benefits such as reduced taxes or more legal security in the ownership of land.

A long-term program is required, therefore, to encourage Paraguayan landowners to conserve and improve the forests that occur on their land and to establish corridors of natural vegetation between blocks of forest land. The SEAM and INFONA are regulatory institutions, which lack the institutional capacity and funding necessary to support owners in protecting and managing their forests.

A forestry program with landowners, then, is likely to be successful only if it is implemented with and through the private sector, with the support but not interference of governmental institutions. A forestry program should be planned to include a long term education program for landowners about the benefits of maintaining habitats of forests on their properties. The main focus of this program should be to conserve the last large blocks of forests that still remains in Eastern Paraguay and in Western Paraguay, and conserve and reestablish the habitats of forests that are in the corridors between these large blocks. The program should be designed to be geographically focused in the forests that are particularly important for the conservation of species, of plants and animals, rare, endangered and endemic. In Appendix 11 there are three maps that show the areas in Paraguay that have been identified as having particular importance for the conservation of rare, endangered and endemic species.

- *Promote large-scale reforestation*

One way to reduce the pressure on natural forests from the production of firewood and charcoal to meet the demand for energy from rural households, from industry, and for drying soya beans, would be to increase the area planted to fast-growing species of trees. A eucalyptus plantation on a good site can grow 20 or more cubic meters of wood per hectare per year. By comparison, a natural forest generally can grow less than 2 cubic meters per hectare per year. To maintain their rates of growth, tree plantations usually should be thinned two or three times before their final harvest. The wood from these thinning could be use for firewood and charcoal. In the final harvest for wood, the branches and lower-quality parts of the trees could also be used for firewood and charcoal. A priority action, therefore, is

for Paraguay to embark on a large-scale reforestation program with fast-growing species of trees.

Large-scale reforestation in Paraguay would probably best be planned and implemented by the private sector. If Law 3703 were to interest the agri-businesses that pay income tax in Paraguay, it could stimulate large-scale reforestation in Eastern Paraguay. It was beyond the scope of this report to study Law 3703 in detail or to determine the interest of agri-businesses in financing reforestation in order to take advantage of the tax reductions it provides. Actions are required, however, to make Law 3703 succeed in the objective of promoting wide-scale reforestation.

## 3. Policies, Strategies, Laws and Regulations

### Justification

Conservation of forests, biodiversity and the sustainable use of natural resources require a coherent, effective set of supportive policies, strategies, laws and regulations.

### Status

- *National Constitution*

Articles 6, 7, and 8 of Paraguay's 1992 Constitution state that a clean environment is a basic right of Paraguayan citizens and that Paraguay's environment should be protected from degradation and restored when damaged.

- *Environmental Policy*

In 1973 Paraguay approved the Forestry and in the 1990's approved laws concerning CITES, wildlife, environmental impact assessment, biodiversity, protected areas, climate change, natural resources, aquatic fauna, wetlands, environmental crimes, reforestation, desertification, fisheries, migratory species. Paraguay thus has established a legal basis for protecting its biodiversity and tropical forests. Appendix 6 provides a complete list of Paraguayan laws and regulations related to the conservation of its forests and biodiversity.

In 1996, Paraguay established Sector Guidelines for a National Policy in Environment, a Natural Resources and a National Strategy for the Protection of Natural Resources and Environment and a proposal for a law creating a National Environmental System (SISNAM) including a National Environmental Council (CONAM). The government did not adopt the environmental policy but, in 2000, by Law 1561/00, it did create CONAM, assigning it responsibility for promoting and coordinating environmental protection in Paraguay and adherence to international conservation and environmental treaties. Article 12(k) of Law 1561/00 gave CONAM specific responsibility for coordinating the conservation of Paraguay's biodiversity. The law also created the Secretariat for the Environment (SEAM) which, in 2003, prepared a National Strategy and Action Plan for the Conservation of Biodiversity in Paraguay for 2004 to 2009. In 2004, CONAM produced another National Environmental Policy, which was approved by the national legislature. SEAM is currently preparing a new strategy and action plan, as required by the Convention on Biodiversity. It was not possible for this report to ascertain the content of this new strategy and action plan.

- *Forestry Policy, Laws and Regulations*

In 2008, Law 3464 created the National Forestry Institute (INFONA), as an autonomous institution. It made no other substantial changes to Forestry Law 422, which was approved

in 1973, almost forty years ago, and which in many aspects is no longer applicable to Paraguay's current conditions. Law 3464, however, does permit INFONA to keep the fees it receives for authorizing the clearing of forest land, thus providing it with a regular source of funds. Paraguay does not currently have an official forestry policy or strategy. The National Forestry Group was intended to bring together different organizations and people involved in the forestry sector in order to promote the implementation of the forestry program that had been proposed in the National Forestry Development Plan. In 2007, the group prepared a documented entitled "National Forestry Policy: A Proposal from the National Forestry Group". The government has never approved this document and the National Forestry Group is not currently active

The Deforestation Zero Law was promulgated in 2004. This law prohibits the conversion of forest land in Eastern Paraguay to other uses, unless the required permits were approved prior to the promulgation of the law. The rate of deforestation in Eastern Paraguay decreased from 110,000 ha in 2002 to 20,000 ha in 2005 and 9,503 ha in 2008. The projected rate for 2009 was a little over 8,000 ha. (Guyra Paraguay, WWF, 2009). The Zero Deforestation Law will be in effect until the end of 2013. The premise of the law, however, was that by the end of 2013 Paraguay would have formulated and implemented actions to slow permanently the rate of deforestation in Eastern Paraguay. In fact, no actions to keep the rate of deforestation low after the Zero Deforestation Law ends in 2013 have yet been formulated or implemented. Consequently, unless Paraguay implements effective actions quickly it is likely that when the Zero Deforestation Law expires at the end of 2013 the rate of deforestation in Eastern Paraguay will increase sharply, as landowners compensate for the deforestation that has been prohibited over the last six years or prepare for some additional restrictions on conversion of forest land.

- *Agricultural and Livestock Policies*

Paraguay's agricultural and livestock policies affect its forests perhaps as much or more than it forestry policies. For example, the vision statement in the document "Strategic Framework for Agriculture 2009-2010" states:

> "By the year 2018 the agricultural and livestock sector of rural Paraguay will have increased in a sustained and sustainable way the production for internal consumption and exports and will have improved the equity of distribution in rural areas and among rural people and indigenous communities" (MAG, 2008)

Note that this statement ignores the relationship between the growth of agriculture and livestock production and the conversion of forest land to crop land and pasture land. The document, moreover, recommends the production of "agro-energy" without referring to production and use of firewood or charcoal which, as previously mentioned, already provide a large percentage of Paraguay's energy, especially for its rural poor and for the soya industry. That the "Strategic Framework" so entirely ignores forests and the forestry sector of the economy clearly indicates that in Paraguay there has been little or no coordination or consultation between the formulation of agricultural and livestock policies and forestry and conservation policies.

## Principal Issues and Priority Actions

- *Ensure security of forest land tenure*

The most important action the Paraguayan public sector could take to conserve biodiversity and forests would be to ensure the security of forest land owners in their ownership of forested land. If the government condones invasions of forest land, it is to be expected that fewer owners of private forest land will conserve, rather than eliminate, their forests. A priority action, therefore, is for national and local governments to express formally their support for the security of tenure for the owners of private forest land and then to take effective measures to counter attempts to invade such forest land.

- *Coordinate national policies for conservation, agriculture and livestock*

Paraguay's public policies for the promotion of agriculture and livestock must be in accordance with its environmental and conservation policies in order for Paraguay to achieve sustainable development. Otherwise, its agricultural and livestock policies will continue to encourage, and even subsidize, the rapid, large-scale conversion of forest land to crop land and pastureland, making futile efforts to conserve Paraguay's forests and the biodiversity they harbor on a significant scale. The National Council for the Environment (CONAM) was established in order coordinate GOP policies for agriculture, livestock and conservation. It has been largely ineffective in doing so, as indicated in the content of the "Strategic Framework for Agriculture 2009-2010", discussed above. A priority action, therefore, is for the Government to coordinate national policies that affect conservation, agriculture and livestock, so that they support rather than conflict with each other.

- *Reformulate forests laws and regulations*

Some of Paraguay's laws and regulations are causing perverse effects on its forests and biodiversity. For example, the regulations governing the land reform process require the complete payment for land before a legal title can be granted. Several interviewees suggested that this requirement may force some rural people to sell off as quickly as possible all the commercial products their forests can produce, usually with long-term, and often irreversible, negative effects on the forest's and land's long-term productive potential. Another example is INFONA's dependence for part of its operational funds from the fees it charges for giving permissions to change land use from forest to agriculture and pasture. This practice may reduce its institutional incentive to enforce the regulations that would reduce the rate of deforestation. A third example concerns the time-consuming and costly administrative procedures required to comply with the regulations of the Forestry Law. Rather than providing an incentive to landowners to protect and manage their forests, these regulations encourage them to reduce the costs and problems involved in owning forest land by simply converting forest land to crop land or pasture, whose use and management involves no bothersome and costly regulations. A priority action, therefore, is to reformulate Paraguay's forestry laws and regulations, so that they assist forest land owners to protect and manage their forests rather than give them incentives for deforestation.

- *Simplify regulations for the approval of private protected areas*

In order to include adequate samples of all of Paraguay's ecosystems within SINASIP additional protected areas are required. There are very few areas of public land left in Paraguay, so such new protected areas can be established for the most part only on privately owned land. The superposition of public protected areas on privately owned land, however, has not proven to be an effective method for the creation of protected areas. The process for establishing private protected areas, however, is excessively time-consuming, administratively onerous and costly and thus discourages private landowners from establishing private reserves. A priority action, therefore, is to simplify and to make less costly the process for enrolling land as a protected area.

- *Prepare for the end of the Zero Deforestation Law*

The Zero Deforestation Law may be the principal reason that since its passage in 2004 the rate of deforestation in Eastern Paraguay has decreased to less than 10,000 ha per year.[10] The law, however, expires at the end of 2013 and Paraguay has taken no measures to ensure that the rate of deforestation in Eastern Paraguay will not subsequently increase. This report presents a number of measures that if implemented effectively would contribute to reducing the rate of deforestation in Eastern Paraguay. However, the formulation and implementation of these measures will take more time than is available before the end of 2013. It might be possible to extend or make permanent the prohibition on deforestation in the Zero Deforestation Law, giving Paraguay additional time to formulate and adopt measures to control deforestation before the ban is lifted. It was not possible for this report, however, to study the feasibility of this possibility. A priority action, therefore, is to analyze what is likely to happen to the rate of deforestation in Eastern Paraguay when the Law of Zero Deforestation expires and what measures should be taken immediately in order to prevent a rapid increase in the rate of deforestation after the Zero Deforestation Law ends.

## 4. Research for Conservation

### Justification

To be effective actions to conserve Paraguay's biodiversity and forests must be based on the results of scientific research, including the biological, social and economic aspects of their conservation.

### Status

Until the 1980's, relatively little scientific research had been undertaken related to Paraguay's biodiversity and forests and their conservation. The founding of the National Museum of Natural History in the 1980's, with support from USAID and the Peace Corps, provided an institutional basis for encouraging such research. The museum has collaborated with the botanical gardens of Missouri and Geneva and with the Museum of Natural History of Sweden. Another center for research activity is the National University of Asuncion. Its forestry and biology students must complete a research thesis in order to graduate. The NGOs Fundación Moisés Bertoni and Guyra Paraguay have been especially active in research programs, in particular through the participation in several international research networks.

### Principal Issues and Priority Actions

- *Promote research on the silviculture of the forests of Western Paraguay*

Until recently the forests of Western Paraguay had been exploited almost exclusively for palo santo and quebracho colorado. As the wood supplies from Eastern Paraguay have diminished in the last few years, however, the number of tree species that are being exploited in Western Paraguay has diversified and the number of wood harvesting operations has increased. This exploitation, however, is taking place without any type of organized or scientific forest management. Parts of Western Paraguay's forests could be

[10] It was not possible to thoroughly study the effects of the Zero Deforestation Law on the rate of deforestation in Eastern Paraguay. It is possible that the rate of deforestation could have decreased even without the law, as the area of forest left in Eastern Paraguay has decreased and clearing of forest for pasture has shifted to Western Paraguay.

managed for the long-term production of wood and other forest products without adversely affecting their biodiversity. The location of these areas, however, has not been identified and there is almost no silvicultural knowledge about their principal commercial species of trees. One priority action, therefore, is to do silvicultural research that would identify forest areas in Western Paraguay whose site conditions and tree species composition indicate a strong potential for the establishment of permanent forest management units and indicate the practices that are required to regenerate and manage these forests.

- *Promote research on agroforestry and silvipastorial production*

Relatively few landowners in Paraguay attach much importance to their forest lands. One reason for their disinterest in their forests is that they often do not know much about the contribution that forests and trees could make to the overall profitability of their agricultural and livestock enterprises and to the commercial value of their properties. If it could be demonstrated convincingly that forests and trees make agricultural and livestock enterprises more profitable and add to the commercial value of rural land, then it is likely that more landowners would be interested in conserving and managing their forests. A priority action, therefore, is to carry out research on the contribution that forests and trees can make to increase the profitability of agricultural and livestock enterprises and to increasing the real estate value of rural properties.

## 5. Formal Education in Conservation and Sustainable Use

**Justification**

The conservation of Paraguay's biodiversity and forests requires the application of professional and technical expertise in such fields of conservation and sustainable development as biology, ecology, forestry, conservation biology, management of protected areas, watershed management, and soil conservation.

**Status**

Table 15 indicates the names of Paraguay's principal universities and the main content of their programs that is related to the conservation of biodiversity and forests.

**Table 15. Environmental programs of principal Paraguayan universities**

| University | Educational Programs | Levels |
|---|---|---|
| **Public** | | |
| National University of Asuncion (UNA) | Forest Engineering, Environmental Engineering, Sciences Biology, Environmental Impact Assessment, Audit and Environmental Management, Natural Resource and Environmental Management planning, Conservation Biology. | B, M,PG |
| **Private** | | . |
| Catholic University (UC) | Environmental engineering | B |
| Comunera University (UCOM) | Agro-environmental engineering and Tourism Development and Environment | B |
| University of the North UNINORTE) | Tourism Development and Environment | B,M |
| Autonomous University of | Environmental Sciences; Sustainable | B,M |

| | | |
|---|---|---|
| Asuncion (UAA) | development | |
| Technical University of Commercialization and Development (UTCD) | Environmental engineering | B,M, PG |
| Central University of Paraguay (CUP) | Environmental geodesic engineering | B |

Source: Prepared for this report by RED
Key: B – Bachelors Degree; M – Masters Degree; PG – Post-graduate Degree

The one public university in Paraguay, the National University of Asuncion, has a program in forestry and environment. Six private universities, as listed in Table 14, provide education in some aspect of the environmental sciences, but none offer a program in forestry. Between them, the seven universities offer seven bachelor's programs, four master's programs and two post-graduate programs. None of the universities offer a PhD degree. It was not possible for this report to determine the number of graduates each of these programs has each year.

It was also not possible to determine the gap between the numbers and types of conservation professionals and technicians that Paraguay requires and the numbers that are being trained. Nor was it possible to evaluate the content or quality of Paraguay's existing education programs for conservation professionals. However, it is likely that there is a gap between the numbers of professionals and technicians that are needed and the numbers that are being trained. Of course, the quality and content of any academic program needs to be constantly updated and improved.

**Principal Issues and Priority Actions**

- *Survey, evaluate and improve professional and technical programs*

Three actions are needed in order to develop a sound, permanent professional training in Paraguay in fields related to conservation. First, the numbers, training, and experience of professionals and technicians in Paraguay should be determined. Second, the future needs for professionals and technicians in conservation fields in Paraguay should be predicted. Third, the current curriculums of Paraguayan institutions in the conservation fields should be evaluated and recommendations formulated for their improvement. In particular, it is necessary that the curricula of agricultural and livestock programs include an important component of conservation topics, such as forestry, conservation of biodiversity and soil conservation, thereby reducing the current sharp and pernicious division between the education for conservation fields and for agricultural and livestock production.

- *Finance fund for theses in conservation fields*

One of the principal obstacles for students in the conservation fields to complete their degrees is that they so frequently lack sufficient funds to do field research and prepare their theses. A priority action therefore is to finance a fund that would support the completion of theses for students in conservation fields.

## 6. Institutions

**Justification**

Capable public and private, national and local institutions are a prerequisite for formulating, organizing, implementing and evaluating actions to conserve Paraguay's tropical forests and biodiversity.

**Status**

- *Public Institutions*

The National Council on the Environment (CONAM) is a consultative group that has the legal responsibility of coordinating environmental policies and actions within the GOP. Its members are representatives from SEAM, INFONA, national ministries, departmental and municipal governments, and indigenous, environmental organizations and for-profit organizations.

The Secretariat for the Environment (SEAM) is responsible for formulating environmental policies and coordinating and supervising the implementation of the environmental projects that form part of the National Development Plan. It is also responsible for enforcing environmental and conservation regulations and for managing SINASIP. Figure 1 indicates the organization structure of SEAM.

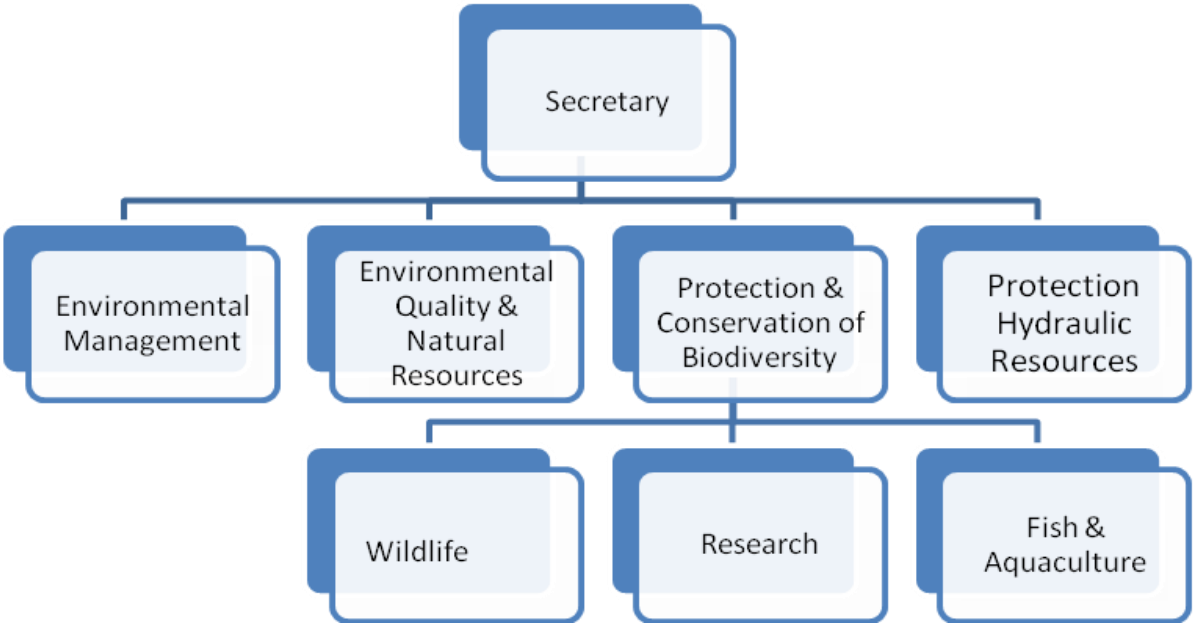



Figure 1. Organization of the Secretariat of the Environment (SEAM)

Because it is not a member of the Cabinet of Ministers, SEAM has relatively little influence on national policies. It can do little, for example, to influence policies that promote the expansion of livestock and agricultural policy through conversion of forest to pasture and crop land. A proposal currently being considered by the national legislature would convert SEAM into the Ministry of Environment and Water, which would be a member of the Cabinet of Ministers.

SEAM is legally permitted to delegate many of its functions to municipal governments. Municipal governments are often more informed than SEAM about specific environmental and conservation problems in rural areas, so they could become important actors in formulating and implementing measures to conserve forests and biodiversity. In particular, municipal governments, through their power to issue and enforce ordinances, have an important role in land use planning and regulation. For this study, it was not possible to evaluate the capacity of Paraguay's municipal governments to play an important role in the actions required to conserve forests and biodiversity. However, interviews indicated that

considerable variation exists in the capabilities of Paraguay's municipal governments, with those in Eastern Paraguay generally stronger than those in Western Paraguay.

The Institute for Land and Rural Development (INDERT) was created in place of the former Institute for Rural Welfare (IBR). INDERT is responsible for implementing agrarian reform and seeks to resolve the problem of inequity in the distribution of land.

The National Forestry Institute (INFONA) was created in 2008 as an autonomous organization, replacing the National Forestry Service, which had been part of the Ministry of Agriculture and Livestock. INFONA, however, has retained most of the personnel who worked previously in the forestry service and operates according to the same regulations as the forestry service did previously. INFONA's president is chosen by the president of Paraguay from a list proposed by the Minister of Agriculture. It has an Advisory Council formed from representatives of other parts of the national government, the association of professional foresters, the wood industry and the Association of Rural Paraguay (ARP), which represents agriculture and farming interests. INFONA's operations are financed partly from appropriations from the national budget and partly from the income it receives from fines, auctions of illegal wood, and fees for clearing forest land. INFONA has 18 field offices. It personnel consists of 224 people of whom 51 are foresters and 82 are forestry technicians. The remaining personnel are administrative support staff. Figure 2 indicates the organizational structure of INFONA.

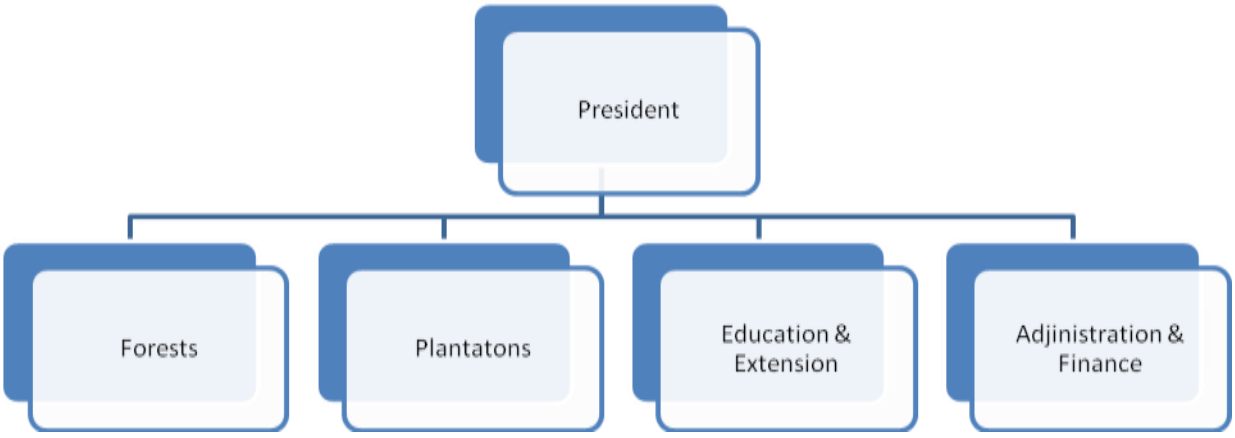



Figure 2. Institutional Structure of the National Forestry Institute (INFONA)

- *Non-Governmental Environmental Organizations (ENGOs)*

The most important environmental NGOs in Paraguay are the Fundación Moisés Bertoni, the Fundación para el Desarrollo Sustentable del Chaco, the Asociación Guyra Paraguay, the Institute for Environmental Law and Economics (IDEA), WWF, the Red Paraguaya de Conservación en Tierras Privadas (RED), the Fondo para la Conservación de Bosques Tropicales, Sobrevivencia, Alter Vida, Environmental Management for Sustainable Development (GEAM) and Pro Cordillera San Rafael (PROCOSARA).

In general these ONGs have sufficient infrastructure, equipment and trained personnel, to carry out their current programs. Most of them, however, depend almost entirely for their financing on obtaining short-term contracts and grants. The Fundacion Moises Bertoni is an exception since it has an endowment fund that finances the portion of its program that has to do with the Natural Reserve Mbaracayu Forest. Between them, these NOGs have more than 90 professional staff. The largest ONG is the Fundación Moisés Bertoni, which has 60 professional staff.

- *Private Sector*

The Paraguay Federation of Wood Industries (FEPAMA) represents the interests of Paraguay's wood industries. FEPAMA, in the past, has financed public education campaigns about the importance of forests for Paraguay and, in collaboration with MIC has been involved in certifying the origin of wood products for export.

The Rural Association of Paraguay (ARP) is an association of farmers and ranchers that assists its members to defend their interests and improve their economic, social and cultural levels. ARP assists, promotes and participates in efforts to development the country through improvements in all aspects of rural life and improvements in agricultural and livestock production and complementary industries (http://www.arp.org.py).

**Principal Issues and Priority Actions**

- *Increase coordination between institutions*

CONAM has not been fulfilling its legal responsibility for coordinating Paraguayan public and private institutions that have a role in conserving Paraguay's biodiversity and forests. Such coordination is inherently difficult, given the disparity of institutional and economic interests that affect Paraguay's forests and biodiversity. CONAM, however, has not been assigned the budget or staff that would enable it to play a coordinating role. Moreover, Paraguayan's principal conservation NGOs such as the Fundación Moisés Bertoni, IDEA, Fundación para el Desarrolo del Chaco, the Paraguayan Network for Environmental Conservation on Private Lands (RED) and Guyra Paraguay, are not represented within CONAM. A priority action, therefore, is to make CONAM a functional consultative group that includes representation of the principal Paraguayan conservation NGOs and which can work effectively to coordinate policies that are favorable for conservation, both within in the GOP and between public and private sector institutions.

- *Educate municipal officials in conservation actions*

Few Paraguayan municipal officials are aware of the legal responsibilities and powers that municipal governments have with respect to conservation. Nor do they tend to know much about the characteristics and values of the natural resources that occur within the boundaries of the municipalities for which they work. Yet, given their legal authority and their knowledge of local situations, municipal governments could play an important role in the conservation of Paraguay's biodiversity and forests, especially through their planning and regulatory functions. A priority action, therefore, is to educate municipal officials and political leaders about how actions by the municipal governments could contribute to conservation of forests and biodiversity. Such education could occur through training courses designed specifically for municipal leaders and officials.

- *Increase presence of SEAM and INFONA in rural areas*

SEAM and INFONA have relatively little presence in rural areas, so they are currently unable to carry out fully their responsibilities for promoting the conservation of biodiversity and forests. A priority action therefore is to increase their presence in rural areas. One way to do so would be for SEAM and INFORNA to form alliances with municipal governments, and specifically with their environmental units. Although currently mostly concerned with resolving urban environmental problems, such as the collection of trash, the municipal environmental units could also become involved in the actions to conserve and sustainably use the biodiversity and natural resources within the municipal boundaries. SEAM and INFONA could provide training and technical assistance to the environmental units, thereby

both multiplying their own effectiveness and presence in rural areas and linking their institutions to the local presence, influence and knowledge that already exist within the municipal governments. Several alliances between SEAM and municipal governments have already been established, but an evaluation of their results was not available for this report. An analysis of the effectiveness of current partnerships INFONA, SEAM, and municipal environmental units will establish a solid foundation to adapt existing alliances and to build new ones.

It would be useful to select one or more municipalities for testing how alliances between INFONA, SEAM and the municipal environmental units could function to promote the conservation of biodiversity and forests within a municipality. The three institutions could jointly define specific objectives for such a model program. The program could define specific issues within the municipality, such as land use planning, reforestation, management of natural forests, or the application of agroforestry and silvopastoral systems, and set targets for a municipal-level program to address these issues. The results could then be compared and analyzed and form the basis for a national level program of cooperation between SEAM, INFONA and municipal governments.

- *Increase the participation of business in conservation actions*

Businesses in various economic sectors of Paraguay already have promoted or implemented "socially responsible" actions. Few Paraguayan businesses, however, have included within their definition of "social responsibility" actions to conserve biodiversity and forests. A priority action for the conservation of Paraguay's biodiversity and forests, therefore, is to design and implement actions to give incentives to Paraguay's businesses to participate in the conservation and sustainable use of forests and biodiversity as part of their "social responsibility" programs.

- *Define the roles of conservation NGOs*

Paraguay's conservation NGOs are generally professional and capable. However, instead of dividing the work among themselves, and specializing in specific conservation problems, the NGOs have sometimes worked at cross-purposes or duplicated each other's actions. As a result, they have been less effective than they could have been with more coordination and a clearer division of specialties and responsibilities. A priority action, therefore, is for Paraguayan conservation NGOs to coordinate among themselves, define a common agenda and divide up its tasks so as to correspond to their institutional interests and strengths.

## 7. Land Use Planning and Regulation

### Justification

The planning and regulation of land use establishes the basis for establishing which parts of the forest will be conserved permanently and which will be converted to other land uses. It is thus a basic requirement for the conservation of Paraguay's biodiversity and forests.

### Status and Issues

- *Land Use Planning*

In Paraguay, municipal governments are responsible for land use planning and the promulgation of land-use regulations. Most of the municipal governments have not prepared land use plans. However, at least one project, ORDAZUR, is developing Land Use Plans for several districts of Eastern Paraguay.

## Principal issues and Priority Actions

- *Utilize land use plans in environmental impact assessments*

Infrastructure projects, such as roads, bridges, power lines and irrigation canals, can cause severe negative effects on biodiversity and forests by stimulating large-scale changes in land use from forest land to pasture and agriculture. The environmental impact assessments for such infrastructure projects, therefore, should include complete and careful consideration of the potential adverse effects of such projects on land use and therefore on biodiversity and forests. Land use plans, however, are under the control of municipal governments and most municipal governments have not prepared them. Therefore, environmental impact assessments for infrastructure projects often do not give adequate attention to the potential adverse effects on land use, such as increased conversion of forest land to agriculture and pasture. A priority action, then, is to promote the development of land use plans for municipalities and use them in the preparation of environmental impact assessments.

- *Train municipal government officials in land use planning*

Municipal government officials should be capable of using technical criteria when establishing the terms of reference for land use planning studies and when enforcing land use regulations. Although no data were available, it can be assumed that few municipal officials have been trained in the preparation of land use plans or in their enforcement. Therefore a priority action is to train municipal government officials in land use planning procedures and regulations. The emphasis of such training should be on how land use planning and regulation can both help to conserve biodiversity, especially through the designation of public and private reserves and promote municipal economic growth and social welfare.

- *Implement a national land cadastre*

Most Paraguayan municipalities lack a cadastral survey. Preparing and enforcing land use planning and regulations without a cadastral survey is impossible. A priority conservation action, therefore, is for Paraguay to organize, finance and implement a technically sound, systematic long-term program to establish a cadastral survey for all of its municipalities.

- *Evaluate effect of land reform on forests*

Agrarian reform in Paraguay has been based on the distribution of forest land to the rural, landless poor, who then tend to eliminate or degrade forest. Although the area of forest in Eastern Paraguay has been greatly reduced, this manner of implementing land reform still continues. Both the remaining original forest and the regeneration of brush and forests, known as *barbecho,* continue to be eliminated and replaced by crop land and pasture. Therefore, a priority action is to find ways to resolve this conflict between providing the rural poor with land and with protecting the small areas of natural forest that are left in Eastern Paraguay. A specific action would be to map the location and condition of existing *barbecho*, especially in relation to soil types. The *barbecho* on soils suitable for agriculture could then be assigned for agriculture and the *barbecho* on poorer soils could be reserved for forest land. This mapping of *barbecho* would also contribute to identifying where forests can be retained or re-established in order to create biological corridors between existing protected areas.

- *Resolve super-position of protected areas on private and indigenous lands*

Many of Paraguay's public protected areas were super-imposed on private property and indigenous territories. The government cannot resolve this problem by buying the land from its owners, since it is not going to make such purchases a priority use for public funds. The super-position of public regulations on privately-owned land and on indigenous territories thus has created a conflict that is making effective conservation actions difficult in large parts of SINASIP. A priority action therefore is to change the category of the protected areas in SINASIP that are super-imposed on private or indigenous territories so that they correspond to their actual status as private property. This change would enable programs to be formulated and implemented that would encourage private landowners to conserve biodiversity and forests, while also permitting them to make use of their land without the restrictions imposed by the regulations that govern the use of public protected areas.

## 8. Public Support for Conservation and Sustainable Use

### Justification

In a democracy, the opinions of the citizens presumably often influence the decisions of the leaders of the government. Therefore, a majority of Paraguayan citizens must support conservation measures if Paraguayan's elected leaders are to formulate, approve and implement them.

### Status and Issues

Two public education campaigns related to the issues of conservation currently going on in Paraguay, both with the cooperation of the WWF. The campaign Paraguay Respira a Todo Pulmón encourages people to plant trees. Another campaign is educating the general public about the characteristics and values of the Upper Parana Atlantic Forest

### Priority Actions

- *Implement an education campaign for private forest land owners*

A public education campaign about conservation of biodiversity should identify its target audience or audiences so that the campaign's message can be designed to appeal to specific interests. An educational campaign in Paraguay about conservation of biodiversity could be targeted to a number of audiences, including politicians, businessmen or school children. More than any other group, however, the decisions of private forest land owners in Paraguay about how to use their forests will determine how much of Paraguay's remaining forest land, and the biodiversity it harbors, will be conserved. A priority action is to educate landowners in the benefits of maintaining rather than eliminating the forest that occurs on their properties.

- *Implement an education campaign for policy makers*

Paraguay's leaders, those people who formulate and implement the country's policies, must understand and appreciate the benefits of conserving biodiversity and forests if their conservation is to be achieved. A priority action therefore is to design and implement a communication program for policy makers about Paraguay's biodiversity and forests, the measures that are needed to achieve their conservation and sustainable use and the economic benefits for Paraguay that such conservation will produce.

## 9. Financial incentives for conservation

### Justification

Most land in Paraguay is privately owned. The most common objective of land ownership in Paraguay is to make a financial profit by using the land for agriculture or livestock production. Making a profit from land in Paraguay frequently involves converting natural habitat, often forest, to another land use, usually agriculture or pasture. Conservation of habitat and biodiversity on private lands, however, yields benefits for all of Paraguayan society. Financial incentives for conservation may sometimes be used to bridge the gap between the private interest in earning a profit from land and the public interest in conservation of forests and biodiversity.

### Status

One financial incentive for conservation that already exists in Paraguay is the tax deduction provided under Law 3703, discussed previously, for reforestation and forest management projects. Reforestation projects do not directly conserve biodiversity, because they generally use exotic species of trees and are planted in monocultures. Such plantations, however, often grow fast and produce wood that have well-established markets, thereby justifying the financial expense involved in their establishment, management and protection. Forest management projects also can conserve biodiversity, through silvicultural practices, by zoning of a forest unit to include protection as well as production areas and by producing larger volumes of higher-quality wood, thereby relieving the pressure to over-exploit the forest resources on other forest land.

Another tax incentive in Paraguay is Law 3.001/06 of Payment for Environmental Services. This new legal framework breaks a tradition in Paraguay of reliance on regulations and instead provides financial incentives for the conservation of biodiversity. The law authorizes the GOP to establish the monetary value of environmental services, updating this value every five years, based in its relation with the economic, environmental, social and cultural benefits that these services provide. One advantage of this law is that does not require funds from the GOP for the payment of the environmental services.

According to these regulations, any landowner who has conserved more forest than required by the Article 42 of the Forestry Law 422/73 can receive from the GOP a certificate of environmental services. The certificate can be negotiated so other landowners can buy them in order to fulfill their legal obligations to conserve forest land. Landowners, for example, who have not fulfilled the minimum obligation of Article 42 must develop a reforestation program with native species or buy environmental services certificates until they fulfill their legal obligations. Obtaining such certificates is a requirement for landowners to obtain or renew their environmental licenses. The amount of money that the owners of additional forests (more than the percentage required by Law 422/73) will receive can be negotiated with landowners who need to buy certificates of environmental services. The SEAM will establish a nominal value for each certificate. The negotiations can be done directly between the owner of the certificate and the potential buyer or on the stock market. The SEAM is responsible for determining if the companies or individuals have or have not fulfilled the requirement of preserving these natural forests.

### Principal Issues and Priority Actions

- *Implement Law 3703/09*

Law 3703/09 has already been passed, but it has not been implemented. Indeed, few forest landowners even know about the tax advantages this law may offer them. A priority action, therefore, is to implement this law, especially by making it known among the business enterprises which can take advantage of its provisions, such as soya agri-businesses and large-scale ranching businesses.

- *Implement Law for Payment of Environmental Services*

Law 3.001/06 has not been implemented because it is in the process of developing its regulations. A priority action is to finish the regulation process, train governmental officers that are in charge of the enforcement of this law and its regulation and make information about this law widely available for landowners, businessmen and governmental authorities.

## 10. Financing for Conservation Institutions

### Justification

The long-term and large-scale conservation of Paraguay's biodiversity and forests requires appropriate budgets for public and private conservation institutions that will permit them to develop long-term and high-impact programs and projects for attaining conservation goals.

### Status

SEAM's budget was the same in 2009 as it was in 2000, about US$260,000, far less than is required to finance the actions that are required to carry out its many responsibilities. Given the history of financing for SEAM since 2000, there is no reason to expect that the Government of Paraguay will augment SEAM's budget. SEAM, however, under Law 3679, has recently been authorized to keep the funds that it charges in fines and fees. A resolution to create the required bank account for SEAM to receive these funds was to have been approved in early 2010. One estimate is that this will increase its budget by about five times, making it about US$ 1.3 million per year.

No information was available about the budget of INFONA. This institution, however, may be largely self-financed, since it can retain the income it receives from fines, cutting fees and other operations involving forest exploitation.

The main environmental Paraguayan NGOs have been largely successful in obtaining funds to cover the costs of their operational costs and projects. Normally, these organizations depend mostly on funding from contracts, projects, consulting fees and grants.

### Principal Issues and Priority Actions

- *Improve and rationalize financing for SEAM*

SEAM, the authority responsible for the application of the Law of Wildlife Protected Areas, has not been assigned a budget that is large enough to permit it to manage SINASIP effectively or efficiently. Nor have the funds it does receive always been distributed between each of its directorates in a way that is commensurate with the scale and importance of their responsibilities. As discussed previously, it is possible that the total amount of funding for SEAM may soon increase, since it will be permitted to retain the income it receives, such as fees and fines. SEAM's principal problem then may be to make the best possible use of its increased funding, rather than a lack of funding in itself. A priority action, therefore, is to

assist SEAM to plan for the most rationale use of its budget and develop strategies for its long-term financial stability.

- *Economic support to creation of private nature reserves*

Private Paraguayan landowners who establish private reserves are for the most part financing the costs involved in doing so from their own financial resources. The high cost of establishing private reserves is a limitation for the creation of new private protected areas. Consequently, insufficient numbers and areas of private protected areas are being created to protect adequately Paraguay's biodiversity and forests. A priority action is to identify sources of financing to subsidize the cost of creating more private protected areas and to design means to reduce the cost of creating private protected areas.

# B. DESIGNING AND IMPLEMENTING CONSERVATION ACTIONS

## 1. Evaluation of Prior Conservation Experiences

Future conservation actions in Paraguay should be based on a sound understanding of the reasons for the successes and failures of the prior conservation projects in the country. Table 15 indicates the principal recent projects in Paraguay. These projects provide a wide range of experience in how to design and implement conservation actions in Paraguay. They should be analyzed, compared and evaluated as a basis for designing and implementing conservation projects that may be financed in the future in Paraguay. Otherwise, it is likely that past mistakes will be repeated and scarce funds for conservation will be wasted.

**Table 16. Recent conservation projects in Paraguay**

| Project | Years |
|---|---|
| ***Fundación Moisés Bertoni*** | |
| Conservation Mbaracayú | 2003- 2007 |
| Reserva Natural Tapytá | 2004- 2007 |
| Protección áreas protegidas | 2007 -2009 |
| Reserva de Biosfera de Mbaracayú | 2007 - 2008 |
| Reserva Natural Tapytá | 2009- 2011 |
| Alianza para desarrollo | 2008-2011 |
| Poblaciones vulnerables, Reserva Natural Privada | 2007-2010 |
| ***Pro Cosara*** | |
| Consolidación y protección de la Cordillera San Rafael | 2008-2009 |
| Leyes ambientales, Reserva para Parque San Rafael | 2008-2009 |
| Recomposición del Corredor Sur | 2006-2007 |
| Implementación de Leyes Ambientales | 2006-2007 |
| Fortalecimiento de Reserva San Rafael | 2003-2005 |
| Conservación Reserva San Rafael | 2001-2005 |
| Conservación, Chaco y Pantanal | 2000-2004 |
| Mejoramiento, Leyes Ambiental | 2001-2002 |
| Acceso ciudadano al Congreso Nacional". | 2002-2005 |
| Planificación Ecorregional Bosque Atlántico Interior" | 2003-2008 |
| Observatorio, Corrupción Ambiental | 2005 |
| Liderazgo cuestiones de desarrollo en el Paraguay" | 2001-2004 |

| Project | Years |
|---|---|
| Conservación y desarrollo forestal, Chiquitano | 2007-2008 |
| Apoyo a la implementación de la ley de servicios ambientales | 2008-2010 |
| Desarrollo forestal de la ecorregión del Bosque Seco Chiquitano | 2009 |
| Bosques en la zona Blas Garay – Serranías del Ybturuzú | 2009- 2011 |
| Conservación de los recursos en la Reserva Natural Tapytá | 2009-2011 |

Source: compiled from various documents for this report

It is possible that the evaluations of some of these projects exist. A priority action is, therefore, to find the evaluations of the projects that have already finished and to prepare evaluations of other conservation projects that have been carried out in Paraguay in the past.

## 2. Environmental Assessment

The USAID/Paraguay Strategic Objectives remain the same as when the Report on Tropical Forests and Biodiversity was prepared in 2004 and USAID/Paraguay intends to finance the same types of activities as were contemplated under the current Country Development Strategy. For the Democracy and Governance and Health and Education Strategic Objectives, there is no reason to question the conclusions of the 2004 Report on Tropical Forests and Biodiversity that the proposed activities will be unlikely to affect adversely Paraguay's biodiversity and tropical forests.

Some of the activities that are being financed under the Economic Growth Strategic Objective, however, could potentially cause adverse effects on Paraguay's biodiversity and tropical forests. Specifically, activities that are intended to increase agricultural production could possibly also stimulate the further conversion of forest land to crop land or pasture.

The USAID Environmental Regulations, Section 216 of the Foreign Assistance Act, require an environmental review of all proposed USAID activities that are not covered by a Categorical Exclusion. Such a review should identify those proposed activities that may cause adverse effects on Paraguay's forests and biodiversity. If the review indicates that the proposed activity may cause adverse impacts on tropical forests and biodiversity then an Initial Environmental Examination (IEE) must be prepared. If the IEE indicates that a proposed action will be likely to cause significant negative impacts on biodiversity or tropical forests, and that standard avoidance or mitigation measures have not been incorporated into the design of the activity, then usually an Environmental Assessment of the proposed action is required. An Environmental Assessment evaluates the degree of impact that the proposed action will have on tropical forests and biodiversity and formulates measures to avoid, mitigate or compensate for those negative impacts. It also makes a recommendation to decision- makers, based on environmental criteria, as to whether USAID should proceed with the proposed action.

## 3. Coordination

- *Coordination by the Government of Paraguay*

Coordination between public institutions, including municipalities, SEAM, INFONA, MAG, USAID/Paraguay and other donors is required in order for a conservation program to be successful, especially one that focuses on conservation on private lands. This report has previously recommended that CONAM implement actions to carry out its legal responsibility for coordinating between Paraguayan public institutions to avoid or mitigate negative impacts on biodiversity and forests.

- *Coordination among USAID/Paraguay Strategic Objectives*

The activities of the Democracy and Governance Strategic Objective related to municipal governance in general, and in particular for land use planning and regulation, could contribute to the conservation of Paraguay's tropical forests and biodiversity. According to Paraguayan law, municipal governments have the lead role in planning and regulating land use. If municipalities in Paraguay were to include attention to forests and biodiversity when they plan and regulate land use they could contribute enormously to their conservation. If USAID/Paraguay assists municipal governments in this aspect of governance, then it could make an important contribution to conservation in Paraguay.

The activities of the Economic Growth Strategic Objective could be closely linked to the use of land and natural resources. The use of Paraguay's natural ecosystems for agriculture, ranching, tourism, production of wood and non-wood forest products or fish, for example, contributes to the economic growth of the country. If the Economic Growth Strategic Objective finances activities that use natural resources, therefore, coordination with activities under a conservation program would create synergies that could be to the benefit for the conservation of biodiversity and forests in Paraguay.

## 4. Monitoring and Evaluation

Reliable monitoring and objective evaluation of conservation activities is a requirement for the conservation of Paraguay's biodiversity and forests. Conservation is a technical activity that is usually complex, difficult, and long-term. Without monitoring of conservation activities reliable data will not be available as the basis for objective evaluations of conservation activities. If conservation activities are not evaluated objectively it will not be possible to adjust them to make them continuously more efficient and effective and to avoid repeating conservation actions that do not achieve their objectives. Thus reliable monitoring and objective evaluation should be part of the design of any conservation activity, should be systematically and rigorously implemented and should provide the basis for continually improving current conservation activities and for designing new ones.

# VI. CONCLUSIONS AND RECOMMENDATIONS

The report makes the following eight principal conclusions and recommendations:

(1) Paraguay is an extremely important country for the conservation of globally significant biodiversity and for preventing and mitigating global warming. Especially significant for the conservation of biodiversity is the Atlantic Forest of Upper Panama (BAAPA), while the forest of Western Paraguay is important for preventing and mitigating climate change, since it sequesters and stores a large amount of carbon. The report therefore recommends that Paraguay take measures to conserve effectively all that remains of the forest in Eastern Paraguay, especially the BAAPA, and large areas of the forest in Western Paraguay.

(2) Deforestation due to the rapid conversion of forest to pastures and agriculture is by far the most severe threat to the forests and biodiversity of Paraguay. Currently, almost all state policies that affect land use in Western Paraguay encourage deforestation for the creation of pasture and deforestation there is occurring at a rate of over 260,000 ha per year. Although currently the deforestation rate in Eastern Paraguay is only about 8,000 ha per year, when the Law of Zero Deforestation expires at the end of 2013 the rate of deforestation in Eastern Paraguay will almost certainly rise rapidly. Policies should be established that will be in effective in controlling deforestation and will provide incentives for the protection and sustainable management of natural forest and the establishment of fast-growing tree plantations.

(3) Most forest land in both Eastern and Western Paraguay is privately owned. Even much of the land that has been included in the National System of Protected Areas (SINASIP) is private land. The future of the forests in both regions, therefore, depends to a great extent on the decisions that private landowners make about how to use their land. Measures should be implemented that will provide incentives to private forest land owners to protect and manage their forests rather than eliminate it, such as guarantying their security of tenure in forest land, financial incentives for protecting and managing natural forest, and programs for technical assistance and education about the benefits of maintaining forest on private properties.

(4) Thirty priority actions are required to conserve the biodiversity and forests of Paraguay. Paraguayan public institutions should work closely with non-governmental, bi-lateral and multilateral organizations to finance and implement their implementation. Table 17 summarizes these conservation actions.

**PRIORITY CONSERVATION ACTIONS**

| **Category & Priority Conservation Action** |
|---|
| **Conservation within protected areas** |
| *(1) Clarify regulations of private land within public protected areas* |
| *(2) Prepare management plans for protected areas* |
| *(3) Increase representativeness of SINASIP* |
| *(4) Increase number and area of private reserves* |
| **Conservation outside of protected areas** |
| *(5) Establish biological corridors* |
| *(6) Promote large-scale reforestation* |
| **Policies, Strategies, Laws & Regulations** |
| *(7) Ensure security of forest land tenure* |
| *(8) Reformulate forests laws and regulations* |
| *(9) Simplify regulations for the approval of private protected areas* |
| *(10) Prepare for end of Zero Deforestation Law* |

| Category & Priority Conservation Action |
|---|
| **Conservation Research** |
| *(11)Promote research on the silviculture of the forests of Western Paraguay* |
| *(12)Promote research on agro forestry and silvopastoril production* |
| **Conservation Education** |
| *(13)Survey and evaluate professional and technical programs* |
| *(14)Finance fund for theses in conservation fields* |
| **Institutional capacity** |
| *(15)Increase coordination between institutions* |
| *(16)Educate municipal officials in conservation actions* |
| *(17)Increase presence of the State in rural areas* |
| *(18)Increase the participation of business in the conservation actions* |
| *(19)Define the roles of conservation NGOs* |
| **Land use planning & conflict resolution** |
| *(20)Clarify role of land use planning in environmental impact assessments* |
| *(21)Train municipal government officials in land use planning* |
| *(22)Implement a national land cadastre* |
| *(23)Evaluate effect of land reform on forests* |
| *(24)Resolve super-position of protected areas on private and indigenous lands* |
| **Public support for conservation** |
| *(25)Implement an education campaign for private forest land owners* |
| *(26)Implement an education campaign for policy makers* |
| **Financial incentives for conservation** |
| *(27)Implement Law 3703/09* |
| *(28)Implement Law for Payment of Environmental Services* |
| **Financing for conservation institutions** |
| *(29)Improve and rationalize financing for SEAM* |
| *(30)Subsidize creation of private reserves* |

(5) Previous conservation experiences in Paraguay have not been adequately evaluated and so do not provide a solid basis for designing and implementing future conservation actions. Before additional conservation projects are designed and financed in Paraguay, a thorough and objective evaluation of conservation projects that have been implemented over the past 20 years should be prepared.

(6) The activities USAID/Paraguay is planning to finance under its Strategic Objectives of “Health and Education” and “Democracy and Governance” are unlikely to cause adverse effects on Paraguay’s biodiversity or tropical forests. However, the activities it is planning to finance under the Strategic Objective of “Economic Growth” could cause negative impacts on Paraguay’s biodiversity and tropical forests if they result in an increase in demand for agricultural or livestock products without a concomitant increase in productivity per unit area of land. USAID/Paraguay should utilize the environmental review process to ensure that such adverse environmental effects do not occur as a result of activities under this Strategic Objective.

(7) Large infrastructure projects, such as dams, bridges and roads, in Paraguay frequently cause in indirect but significant adverse impacts on biodiversity and forests. Although often essential for economic development these infrastructure projects should be accompanied by effective measures to avoid, mitigate or compensate for these impacts, which often can in themselves reduce the potential for economic prosperity of Paraguay. Consequently, the environmental impact assessment process for such projects should always include analysis of such potential adverse impacts on biodiversity and tropical forests and the infrastructure

projects should include adequate financing for the effective implementation of such measures over the long-term.

(8) The coordination of conservation actions is essential if they are to be successful on an important geographic scale over the long-term. The government of Paraguay should ensure that all the different public, private and international organizations that finance or implement conservation activities maintain effective coordination.

Appendix 1. Bibliography

Acevedo, 1998 citado por Estrategia Nacional de Protección y Conservación de la Vida Silvestre (SINAVISI). 2003. Unpublished.

Asociación Rural de Paraguay. 2009. Uso de la Tierra y Vegetación Región Occidental del Paraguay

Banco Inter Amerciano de Desarrollo. 2008. Herramientas para mejorar la efectividad del Mercado de Combustibles de Madera en la economía rural. Informe Diagnóstico Paraguay. Proyecto ATN/AU-10038.RJ. Financiado pro el Fondo Fiduciario Austriaco para la Cooperación Técnica

Cacciali, Pier, 2007, Diversidad de anfibios y reptiles en Paraguay, p109- 118 IN Salas-Duenas, D. and J.F. Facetti, 2007, Biodiversidad del Paraguay, Asunción, 253 pp..

Catterson, Thomas M. and Franck V. Fragano. 2004. Tropical Forestry and Biodiversity Conservation in Paraguay: Final Report of a Section 118/119 Assessment. EPIQ II Task Order No. 1, Asuncion, 43 pp. plus Appendixes

CIA. 2009. https://www.cia.gov/library/publications/the-world-factbook/geos/pa.html

Clay, R. 2008, An overview of the Important Bird Areas in Paraguay, IN Guyra Paraguay (ed.) Areas importantes para la conservación de las Aves del Paraguay, First Edition, Chapter 5 Guyra/Birdlife Int., Asunción

Cañiza, E. 2006. Debilidades de la normativa ambiental: la impunidad contamina. Instituto de Derecho y Economía Ambiental. Asunción, Paraguay.

Cayuela, L. 2006 Deforestación y fragmentación de bosques tropicales montanos en los Altos de Chiapas, México. Efectos sobre la diversidad de árboles. Departamento de Ecología. Universidad de Alcalá, 28871. Alcalá de Henares. Madrid. España

CIF. 1994. Uso de la Tierra y deforestación en la Región Oriental del Paraguay: Período 1986 – 1987. San Lorenzo: Carrera de Ingeniería Forestal. 32 p.

Estrategia Nacional de Protección y Conservación de la Vida Silvestre (SINAVISI). 2003. Unpublished

Estrategia Nacional de Protección y Conservación de la Vida Silvestre (SINAVISI), Unpublished

Glatzle, A., Stosiek, D., 2001. Paraguay Country Pasture/Forrage Resource Profiles. FAO. **http://www.fao.org/ag/AGP/AGPC/doc/Counprof/paraguay.htm**

Guyrá Paraguay FAO, 1948. Los recursos forestales del Paraguay: Estudio Forestal 1945. Unasylva Número: Vol. 2, No. 3

FAO, 2002. Estado de la información forestal en Paraguay. Información para el Desarrollo Forestal Sostenible. Santiago de Chile.

FAO, 2005. Evaluación de los recursos forestales mundiales 2005. Informe Nacional Paraguay.

FAO, 2005b. Global Forest Resources Assessment 2005. Food and Agriculture Organization of the United Nations, Roma, Italia. URL: http://www.fao.org/forestry/fra2005.

FAO, 2009. State of the World's Forests 2009 Series title: State of the World's Forests 2009. Rome, Italy. 144 páginas

Gonzáles, R. 2004. Estudio de tendencias y perspectivas del sector forestal en América Latina. Documento de Trabajo - ESFAL/N/09 2004. Informe Nacional Paraguay. 98 páginas.
(http://www.farn.org.ar/docs/p06/publicaciones

Ibarra, J., Nuñez, F. 1998. Un Estudio de Caso en las Serranías del Yvytyrusu. IN: Underlying Causes of Deforestation and Forest Degradation. Asunción, Paraguay, Octubre 1998

Irrazabal, C. 2008. Situación de la Cobertura Boscosa en el Paraguay. Presentación 25/4/2008

MAG, 2008. Marco Estratégico Agrario 2009/2018 Directrices Básicas. Ministerio de Agricultura y Ganadería. Asunción, Paraguay. 25 páginas

MAG/SSERNMA. 1998. Cobertura boscosa 1997. (Mapa)

Morales, Miguel. 2007 Diversidad de mamíferos en Paraguay. IN Guyra Paraguay (ed.) Áreas importantes para la conservación de las Aves del Paraguay, First Edition, Chapter 10, Guyra/Birdlife Int., Asuncion

Ortiz, 2001. Estado actual del manejo forestal en Paraguay Proyecto Información y Análisis para el Manejo Forestal Sostenible: integrando esfuerzos nacionales e internacionales en 13 países tropicales en América Latina. (GCP/RLA/133/EC). Santiago Chile.

Pinazzo, J. 1996. Diagnóstico sobre el estado actual de los ecosistemas forestales del Paraguay. Informe preparado por Alter Vida, Fundación Moisés Bertoni y Sobrevivencia. Estrategia sudamericana de conservación de bosques. Consulta regional del Cono Sur. San Bernardino. Paraguay.

Rodas, M. 1998. Situación del sector forestal en Paraguay. XIII Jornadas Forestales de Entre Rios, Primer Encuentro Forestal CEDEFOR del MERCOSUR, Concordia, Paraguay

Schvartzman, J., Santander, V. 1995. Informe Nacional para la Conferencia Técnica Internacional de la Fao Sobre Los Recursos Filogenéticos. Asunción. Paraguay

Velásquez, Miriam, 2007, Diversidad de aves en Paraguay, pp 199-132 IN Salas-Duenas, D. and J.F. Facetti, 2007, Biodiversidad del Paraguay, Asunción, 253 pp..

Vera, O. 2009. Información forestal sobre el Paraguay. Comunicación Personal Diciembre 12, 2009.

Vera, V. 2000. Impactos de la Intervención del Banco Mundial y Propuestas de la Sociedad Civil para la Nueva Política Forestal. UICN. Comité Nacional del Paraguay.

Vera, V. 2003. Diagnóstico del Sector Forestal del Paraguay. NATURAL Land Trust. Asunción. Paraguay

World Bank, 2008. Climate change aspects in agriculture: Paraguay Country Note.

Yanosky, A y O. Rodas. 2009. Cambios de uso de la tierra en el Paraguay en los últimos 5 años. Presentación ante CONADERNA, 14 de octubre de 2009

Appendix 2. **Scope of Work**

STATEMENT OF WORK

In order to achieve integrating environment issues into Paraguay's new strategy, it is necessary to make an analysis of the current status of tropical forests and biological diversity in Paraguay, identify actions needed to conserve biodiversity and tropical forests, assess the current and planned activities of other donor programs and stakeholders in meeting these needs, and analyze the planned activities of USAID/Paraguay in reference to the actions needed. The assessment to build upon the foundation laid by the 2004 Report and to focus on the changed conditions from December 2004 to the present.

Analysis to include:

1. An overview of the status and trends of Paraguay's tropical forests and biodiversity, including ecosystem diversity, species diversity, threatened and endangered species, genetic diversity, agricultural diversity, aquatic diversity, ecological processes and ecosystem services, and values and economics of biodiversity and forests.
2. An overview of the social, economic, and political context for sustainable natural resources management and the conservation of biodiversity and forests, including the social and economic environment; institutions, policies, and laws affecting conservation; the national protected area system; laws affecting the protection of endangered species; and participation in international treaties.
3. Assessment of the factors affecting the management of these natural resources, including direct and indirect threats and opportunities to sustainable management of tropical forests and biological diversity in Paraguay.
4. Review and summary of government, NGOs, private sector and donor programs and activities that contribute to conservation of Paraguay's tropical forests and biodiversity, and an assessment of their effectiveness, including strengths and weaknesses. Interview key personnel of key institutions.
5. A list or description of the actions necessary to conserve biodiversity and forests, and what is currently being done by government, NGOs, and donor programs that address those threats.
6. Review changes in the legislative basis from 2004, if any, both at the national and local levels, for the protection and sustainable management of biological resources, including tropical forests in Paraguay. Review the ratification of and compliance to international treaties and agreements. (such as CITES, the Convention on Biodiversity, the Convention on Desertification, the Convention of Climate Change, and the effectiveness of national implementation)
7. Review private/commercial sector aspects of the forestry and wood industry, including non-timber forest products, and including an analysis of national and international markets and opportunities for products obtained under sustainable forests management. Interview key personnel of key companies/associations.
8. Identify the priority actions (which are cost effective and implementable) necessary to achieve sustainable management of tropical forests and the conservation of biological diversity in Paraguay.
9. Identify the extent to which current or proposed programs of other donors and USAID/Paraguay meets these identified needs.
10. Point out any implementation constraints that USAID/Paraguay might encounter in implementing these actions.
11. Recommend any further actions for USAID/Paraguay to consider that are not described or outlined in the Strategic Statement.
12. Analyze the effects of USAID/Paraguay's entire proposed strategy on Paraguay's tropical forests and biodiversity. Review proposed USAID/Paraguay strategy statement

and programs, (Democracy, Economic Growth and Environment, and Health), followed by an analysis of the extent to which actions proposed for support by USAID help meet the needs identified.

13. Point out any threats to biodiversity and forests from activities proposed for USAID support, and suggest mitigating actions. Includes all Mission programs, not just the environmental program.
14. With the assistance of the Acting MEO, identify opportunities for cross-cutting, cross-sectoral linkages with proposed activities (Mission-wide); especially those that would be low cost and/or would enhance the effectiveness of the proposed activities. For example, linkages with: economic growth, democracy, and health teams.

Appendix 3. Participants in the Workshop

**WWF**

1. Lucy Aquino;
2. Fátima Mereles
3. Carmen Vitale
4. Sonia Delphin
5. Francisco Pereira

**FMB**

6. Danilo Salas
7. Maria del Carmen Fleytas

**Guyra**

8. Oscar Rodas
9. Cristina Morales
10. José Luis Cartes
11. Enrique Bragayrac

**IDEA**

12. Patricia Abed;
13. Ezequiel Santagada
14. Maria del Mar Zavala Abed
15. Alma Poletti
16. Gabriela Alvarado

**FDSChaco**

17. WIlfried Giesbrecht;
18. Bruno Brack

**INFONA**

19. Damiana Mann;
20. Karem Elizeche

**UNA**

21. Lidia Perez de Molas

**SEAM**

22. Isabel Basualdo

**ARP**

23. Anairis Balbuena

**USAID**

24. Shirley Zavada
25. Fernando Balsevich

Michael Kaiser

**MOPC**

26. Cesar Balbuena

**Otras Personas**

27. Cesar Balbuena Ferreiro

Appendix 4. **Persons Interviewed**

| Name | Institution | Position |
|---|---|---|
| Arq. Oscar Rivas | Secretaria del Ambiente -SEAM | Ministro |
| Dra. Isabel Basualdo | SEAM | Directora- DGPCB |
| Raul Alonso | SEAM | Director de Areas Protegidas |
| Ing. Agr. Luis T. | Instituto Forestal Nacional - INFONA | Presidente |
| Natalia Chavez | Instituto Forestal Nacional - INFONA | Secretaria del Presidente |
| Yan Speranza | Fundación Moises Bertoni -FMB | Director Ejecutivo |
| Danilo Salas | Fundación Moises Bertoni | Coordinador de Programas |
| Maria del Carmen | Fundación Moises Bertoni | Coordinador de Programas |
| René Palacios | Fundación Moises Bertoni | Gerente de Áreas Protegidas |
| Angel Brusquetti | Fundación Moises Bertoni | Gerente de Desarrollo Rural |
| Laura Rodriguez | Fundación Moises Bertoni | Departamento de GIS |
| Myrian Velazquez | Fundación Moises Bertoni | Gerente de Investigación |
| María I. Vera-Jiménez | Fundación Moises Bertoni | Encargada de Área Botanica |
| José Luis Cartes | Guyra Paraguay | Coordinador de Programa Sitios |
| Oscar Rodas | Guyra Paraguay | Coordinador de Programa |
| Marcelo Arevalos | Guyra Paraguay | Oficial de Desarrollo Sustentable |
| Lucy Aquino | WWF | Directora ejecutiva |
| Fatima Mereles | WWF | Directora de Conservación |
| Carmen Vitale | WWF | Coordinadora de Proyectos |
| Sonia Delphin | WWF | Departamento GIS |
| Francisco Pereira | WWF | Oficial de Políticas Públicas |
| Sheila Abed | IDEA | Presidente |
| Patricia Abed | IDEA | Directora Ejecutiva |
| Ezequiel Santagada | IDEA | Abogado |
| Gabriela Alvarado | IDEA | Economista |
| Janet Villalba | Red Paraguaya de Conservación en Tierras Privadas | Ing. Forestal |
| Mirta Vera | Carrera de Ing. Forestal / UNA | Directora, Carrera de Ing. |
| Liza Monges | Carrera de Ing. Forestal / UNA | Jefe Departamento de |
| Larissa Rejalaga | Carrera de Ing. Forestal / UNA | Jefe, Dept. Recursos Naturales |
| Delia Ramirez | Carrera de Ing. Forestal / UNA | Jefe. Dept. Tecnologia de la |
| Stela Maris Amarilla | Pos grado Ciencias Agrarias/UNA | Directora |
| Rafael Ortiz | Unique Wood | Director |
| Alvaro Ramírez | Unique Wood | Técnico Júnior |
| Wilfried Giesbrecht | Fundación Desdelchaco | Director Ejecutivo |
| Laura Villalba | Fundación Desdelchaco | Conservación de Biodiversidad |
| Milciades Pacce | Fundación Desdelchaco | Coordinador Operaciones y |
| Anita Giesbrecht | Fundación Desdelchaco | Gerente, Administración y |
| Edith Thiessen | Fundación Desdelchaco | Coordinador,Finanzas y |
| Raúl Rivarola | Fundación Desdelchaco | Miembro Suplente Consejo |
| David Sawatzky | Fundación Desdelchaco | Consejero |
| Bruno Brack | Fundación Desdelchaco | Sindico |
| Peter Klassen | RN Toro Mocho | Propietario |
| Anton Schroeder | CETEMACH | Director |

| Name | Institution | Position |
|---|---|---|
| Justo Fernández | Gobernación de Alto Paraguay | Gobernador |
| Josephine Pryor | Fortin Patria | Gerente |
| Roberto Eaton | RN Fortin Salazar | Propietario |
| John Mosby | RN Fortin Salazar | Propietario |
| Christine Hostettler | Procosara | Directora Ejecutiva |
| Hans Hostettler | Procosara | |
| Marcelo Arevalos | Guyra Paraguay | Oficial de Desarrollo Sustentable |
| Reinaldo Sanchez | Guyra Paraguay | Gerente de Manejo de la |
| Victor Algarin | Libertad del Sur / Itapua | Productor y lugar donde esta |
| Firmo Vera Alvarin | Libertad del Sur / Itapua | Productor |
| Hugo Mora | Fundación Moisés Bertoni | Jefe de Manejo RN Tapyta |
| Artemio Villalba | Fundación Moisés Bertoni | Guardabosque RN Tapyta |
| Alfonso Benitez | Fundación Moisés Bertoni | Jefe de Desarrollo Rural |
| Cesar Romero | Enramadita/ Caazapa | Productor |
| Blanca de Romero | Enramadita/ Caazapa | Productora |
| Miguel Roja | Corazón de Maria / Caazapá | Productor |

Appendix 5. Protected Areas in Paraguay by Ecoregion

| | ***DENOMINACION*** | ***SUPERFICIE PROTEGIDA (ha)*** | ***Base Legal Ley o Decreto*** | ***ECORREGION*** |
|---|---|---|---|---|
| *1* | *Zona Nacional de Reserva Cerro Lambaré* | *3* | *25.764/48* | *CHACO HUMEDO* |
| *2* | *Monumento Científico Moisés Bertoni* | *199,85* | *11.270/55* | *BAAPA* |
| *3* | *Parque Nacional Tinfunqué* | *241.320* | *18.205/66* | *CHACO SECO* |
| *4* | *Reserva Nacional Kuri'y* | *2.000* | *30.956/73* | *BAAPA* |
| *5* | *Reserva Nacional Saltos del Guairá* | *900* | *30.955/73* | *BAAPA* |
| *6* | *Parque Nacional Caaguazú PN Caazapa* | *16.000* | *20.933/73 Ley 2.583/05* | *BAAPA* |
| *7* | *Parque Nacional Ybycuí* | *5.000* | *32.772/73* | *BAAPA* |
| *8* | *Parque Nacional Defensores del Chaco* | *720.000* | *16.806/75* | *CHACO SECO* |
| *9* | *Parque Nacional Cerro Corá* | *5.538* | *Ley 2.714/05* | *BAAPA* |
| *10* | *Parque Nacional Teniente Agripino Enciso* | *40.000* | *15.936/80* | *CHACO SECO* |
| *11* | *Parque Nacional Lago Ypacarai* | *16.000* | *5.686/90* | *CHACO HUMEDO* |
| *12* | *Reserva de Recursos Manejados Yvytyrusú* | *24.000* | *5.815/90* | *BAAPA* |
| *13* | *Parque Nacional Lago Ypoá* | *100.000* | *13.681/92* | *CHACO HUMEDO* |
| *14* | *Monumento Natural Macizo Acahay* | *2.500* | *13.682/92* | *CHACO HUMEDO* |
| *15* | *Reserva para Parque San Rafael* | *80.359* | *13.680/92* | *BAAPA* |
| *16* | *Refugio de Vida Silvestre Yabebyry* | *30.000* | *16.147/93* | *CHACO HUMEDO* |
| *17* | *Parque Nacional Ñacunday* | *2.000* | *16.146/93* | *BAAPA* |
| *18* | *Monumento Natural Cerro Chororí* | *5* | *Ley 179/93* | *CHACO HUMEDO* |
| *19* | *Monumento Natural Cerro Kói* | *12* | *Ley 179/93* | *CHACO HUMEDO* |
| *20* | *Parque Nacional Serranía de San Luis* | *10.273* | *17.740/97* | *CERRADO* |
| *21* | *Parque Nacional Bella Vista* | *7.311* | *20.713/98* | *CHACO HUMEDO* |
| *22* | *Parque Nacional Paso Bravo* | *103.018* | *20.712/98* | *CERRADO* |
| *23* | *Reserva Natural Cerro Cabrera/Timane* | *125.823* | *13.202/01* | *CHACO SECO* |

| | DENOMINACION | SUPERFICIE PROTEGIDA (ha) | Base Legal Ley o Decreto | ECORREGION |
|---|---|---|---|---|
| 24 | Reserva para Parque Nacional Cerro Chovorecá | 100.953 | 13202/01 | CHACO SECO |
| 25 | Reserva Ecológica Capiibary | 3.082 | 18.219/02 | BAAPA |
| 26 | Parque Nacional Río Negro | 123.786 | 1478/04 | CHACO SECO PANTANAL |
| 27 | Parque Nacional Médanos del Chaco | 514.233 | 2726/04 | CHACO SECO |
| 28 | Reserva de Recursos Manejados Nu Guazu | 280 | Ley 2795/05 | CHACO HUMEDO |
| 29 | Reserva Ecológica Bahía de Asunción | 300 | Ley 2.715/05 | CHACO HUMEDO |
| 30 | Paisaje Protegido Cerro Dos Oro | 44,958 | Ley 2.971/05 | BAAPA |
| 31 | Carrizales del Paraná en la cuenca del Lago Sirena | 9.049,77 | Ley 3601/08 | BAAPA |
| **TOTAL ASP BAJO DOMINIO PUBLICO** | | **2.283.990,58** | | |
| 1 | Reserva Natural Cerrados del Tagatiya | 5.700 | 7.791/05 | CERRADO |
| 2 | Reserva Natural Tagatiya mi | 33.789 | 10.396/05 | CERRADO |
| 3 | Reserva Natural Arroyo Blanco | 5.714 | 14944/01 | BAAPA |
| 4 | Reserva Natural del Bosque Mbaracayú | 64.405 | Ley 112/91 | BAAPA |
| 5 | Reserva Natural Morombí | 25.000 | 14.910/01 | BAAPA |
| 6 | Reserva Natural Ypetí | 13.592 | 21.346/03 | BAAPA |
| 7 | Reserva Natural Tapytá | 4.736 | 5.831/05 | BAAPA |
| 8 | Reserva Natural Ñú Guazú | 50.000 | 5.845/04 | CHACO SECO |
| 9 | Reserva Natural Toro Mocho | 18.000 | 5.841/04 | CHACO SECO |
| 10 | Reserva Natural Ka'í Ragüe | 1.859 | 1.977/04 | BAAPA |
| 11 | Reserva Natural Cañada del Carmen | 3.973 | Ley 2.703/06 | CHACO SECO |
| 12 | Reserva Natural Palmar Quemado | 9.478 | 8.001/06 | CHACO SECO |
| 13 | Reserva Natural Yaguarete Porá | 27.508 | 11.726/08 | CHACO SECO |
| 14 | Reserva Natural Tabucai | 559 | 11.760/08 | BAAPA |
| 15 | Reserva Natural Lote 1 | 5.364 | 11.762/08 | CHACO SECO |
| 16 | Reserva Natural Maharishi | 343 | 11.763/08 | BAAPA |
| 17 | Reserva natural Fortín Salazar | 12.450 | 11.804/08 | CHACO HUMEDO |
| 18 | Reserva Natural Punié Paëosi | 3.780 | 11761/08 | CHACO SECO |

| | DENOMINACION | SUPERFICIE PROTEGIDA (ha) | Base Legal Ley o Decreto | ECORREGION |
|---|---|---|---|---|
| 19 | Reserva natural Laguna Blanca | 804 | 3893/10 | BAAPA |
| **TOTAL ASP BAJO DOMINIO PRIVADO** | | **287054** | | |
| **TOTAL SUPERFICIE PROTEGIDA** | | **2.51.044,58** | | |
| 1 | Refugio Biológico Mbaracayú | 1.436 | RDE 051/84 | BAAPA |
| 2 | Refugio Biológico Tatí Yupí | 1.915 | RDE 052/84 | BAAPA |
| 3 | Reserva Biológica Limo'y | 13.396 | RDE 052/84 | BAAPA |
| 4 | Reserva Biológica Itabó | 17.879 | RDE 052/84 | BAAPA |
| 5 | Refugio Biológico Carapá | 2.575 | RDE 183/08 | BAAPA |
| 6 | Refugio Biológico Pikyry | 1109 | RDE 186/08 | BAAPA |
| 7 | Reserva Natural Yvyty rokay | 3809 | RDE 113/08 | BAAPA |
| 8 | Refugio de Vida Silvestre Isla Yacyretá | 8.345 | *RDE 28.131/94 | CHACO HUMEDO |
| **TOTAL SUPERFICIE PROTEGIDA** | | **50.464** | | |
| | RESERVAS DE BIOFERA | | | |
| | RB Cerrados del Río Apa*(a) | 174.224 | | |
| | RB del Chaco*(a) | 3.115.810 | | |
| | RB del Bosque Mbaracayú** (a) | 226.995 | | |
| | RB del Chaco** (b) | 2.492.757 | | |
| **TOTAL RESERVA BIOSFERA** | | **6.009.786** | | |
| **TOTAL GENERAL BAJO ALGUN TIPO DE PROTECCION** | | **10.915.285** | | |
| **TOTAL SUPERFICIE DEL PY** | | **40.675.200** | | |

***** Superficie de la R.Biosfera Categoría Nacional*
****** Superficie de la R. Biosfera reconocidas por la UNESCO*
*(a) Superficie declarada sin las la superficie de las áreas protegidas*
*(b)Superficie de la RB UNESCO sin las áreas protegidas declaradas, descontando la superficie del área declarada como RB de categoría nacional.*

Note: the table uses the period where a comma would be used in English

## Appendix 6. List of Paraguayan Conservation Laws and Regulations

| | Leyes | Año |
|---|---|---|
| FORESTAL | Ley Nº 422/73 Ley Forestal | 1973 |
| AMBIENTE | Ley N° 42/90 Que prohíbe la importación, deposito, utilización de productos calificados como residuos industriales peligrosos basuras toxicas y establece las penas correspondientes por el incumplimiento. | 1990 |
| CONVENCION INTERNACIONAL | Ley N° 112/91 - Que aprueba y ratifica el Convenio para establecer y conservar la Reserva Natural del Bosque Mbaracayu y la cuenca que lo rodea del Rio Jejui, suscrito entre el Gobierno del Paraguay y el Sistema de las Naciones Unidas, The Nature Conservancy y la Fundación Moisés Bertoni para la Conservación de la Naturaleza. | 1991 |
| PESCA Y VIDA SILVESTRES | Ley Nº 96/92 De Vida Silvestre | 1992 |
| AMBIENTE | Ley N° 294/93 Evaluación de Impacto Ambiental | 1993 |
| BIODIVERSIDAD | Ley N° 352/94 De Áreas Silvestres Protegidas | 1994 |
| FORESTAL | Ley N° 515/94 Que Prohíbe la Exportación y Trafico de Rollos, Trozos y Vigas de Madera | 1994 |
| FORESTAL | Ley N° 515/94 Que prohíbe la exportación y trafico de rollos, trozos y vigas de madera. | 1994 |
| AMBIENTE | Ley N° 716/95 Que sanciona delitos contra el Medio Ambiente. | 1995 |
| FORESTAL | Ley N° 751/95 Que Aprueba el Acuerdo sobre Cooperación Para el Combate al Trafico Ilícito de Madera | 1995 |
| FORESTAL | Ley N° 536/95 De fomento a la forestación y reforestación | 1995 |
| BIODIVERSIDAD | Ley N° 816/96 Que Adopta Medidas de Defensa de los Recursos Naturales | 1996 |
| PESCA Y VIDA SILVESTRES | Ley Nº 799/96 de Pesca | 1996 |
| AMBIENTE | Ley N° 1.100/97 De Prevención de la Polución Sonora | 1997 |
| AMBIENTE | Ley N° 1561/00 Que Crea el Sistema Nacional del Ambiente, el Consejo Nacional del Ambiente y la Secretaría del Ambiente | 2000 |

| | Leyes | Año |
|---|---|---|
| FORESTAL | Ley N° 2524/04 - De Prohibición en la Región Oriental de las Actividades de Transformación y Conversión de Superficies con Cobertura de Bosques. | 2004 |
| SEGURIDAD FRONTERIZA | LEY Nº 2.532/05 - QUE ESTABLECE LA ZONA DE SEGURIDAD FRONTERIZA DE LA REPÚBLICA DEL PARAGUAY.". 17 de Febrero de 2005 | 2005 |
| FORESTAL | Ley Nº 3139/06 - que prorroga la vigencia de los artículos 2º Y 3º y amplia la Ley 2524/04 "de prohibición en la región oriental de las actividades de transformación y conversión de superficies de cobertura de bosques". | 2006 |
| AMBIENTE | LEY N° 3001/06 – De valoración y retribución de los Servicios Ambientales. | 2006 |
| CONVENCION INTERNACIONAL | LEY N° 3003 - Que aprueba los acuerdos entre el gobierno de los estados unidos de América y el gobierno de la republica del paraguay, en el marco del programa Tropical Forest Conservation Act (TFCA), para el establecimiento de un fondo de conservación de bosques tropicales y de un consejo de conservación de bosques tropicales; y la reducción de ciertas deudas mantenidas con el gobierno de los estados unidos de América y sus agencias, del 7 de junio de 2006; y que amplia el presupuesto general de la nación para el ejercicio fiscal 2006. | 2006 |
| MINERIA | Ley N° 3.180/06 – De Minería. | 2006 |
| BIODIVERSIDAD | Ley N° 1324/06 Sobre Conservación de especies migratorias | 2006 |
| AMBIENTE | LEY N° 3239/07 – De los Recursos Hídricos del Paraguay | 2007 |
| FORESTAL | Ley N° 3464/08 "Que crea el Instituto Forestal Nacional-INFONA" | 2008 |
| FORESTAL | Ley N° 3.663/08 - que modifica los artículos 2º Y 3º de la Ley Nº 2.524/04 "de prohibición en la región oriental de las actividades de transformación y conversión de superficies con cobertura de bosques", modificada por la Ley Nº 3.139/06. | 2008 |
| AMBIENTE | Ley Nº 3679/08 – Que Modifica el Articulo 8º de la Ley Nº 1561/00 "Que crea el Sistema Nacional del Ambiente, el Consejo Nacional del Ambiente y la Secretaria del Ambiente". | 2008 |
| REGIMEN TRIBUTARIO | Ley N° 3.703/09 – Que amplia el articulo 8 de la Ley 125/91 que establece el nuevo régimen tributario, modificado por la Ley 2421/04 de Reordenamiento Administrativo y de Adecuación Fiscal. | 2009 |
| FALTA LA LEY QUE REGLAMENTA EL INFONA | ES DE FEBRERO DEL 2010 | |

| | Decretos | |
|---|---|---|
| FORESTAL | Decreto Nº 9425/95. Por el Cual se Reglamenta la Ley N º 536/95 "De Fomento a la Forestación y Reforestación | 1995 |
| AMBIENTE | Decreto N° 1428/96 - Por el cual se Reglamenta la Ley Nº 294/93 de Evaluación de Impacto Ambiental. | 1996 |
| AMBIENTE | Decreto N° 10.579/00 - Por el cual se reglamenta la Ley N° 1561/00, “que crea el Sistema Nacional del Ambiente, el Consejo Nacional del Ambiente y la Secretaría del Ambiente”. | 2000 |
| AMBIENTE | Decreto N° 10.961/00 - por el cual se modifican los artículos 14 y 39 al 49 del decreto N° 10.579 de fecha 20 de septiembre de 2000, Por el cual se reglamenta la Ley N° 1.561/00, “que crea el Sistema Nacional del Ambiente y el Consejo Nacional del Ambiente y la Secretaria del Ambiente. | 2000 |
| FORESTAL | Decreto N° 9076/07 - Por el cual se estipulan normas reglamentarias para las transferencias de recursos al fondo de conservación de bosques tropicales instituido en la Ley N° 3003, del 6 de septiembre de 2006. 27 de febrero de 2007 | 2007 |

Appendix 7. **Past and Current Conservation Projects in Paraguay**

La información sobre proyectos relacionados a Bosques y Biodiversidad no está sistematizada y tampoco es de fácil acceso. La compilación de las informaciones de la Tabla 17, costo mucho trabajo e persistencia, y aún así no es completa.

Se puede notar que algunos proyectos son de impacto más global y otros muy específicos, según los objetivos de las instituciones y su área de acción.

Además, es importante hacer notar los montos que manejan las ONGs y las capacidades institucionales para gestionar y ejecutar fondos para la Conservación de bosques y Biodiversidad.

Aunque no accedimos a la información de la SEAM y del INFONA, los presupuestos que manejan algunas ONGs, superan a los montos que se conocen de estas instituciones publicas. Eso se debe muchas veces a las normas de algunos donantes que no quieren o no poden trabajar directamente con instituciones del Estado, debido a sus reglas internas.

La realización de evaluaciones no es obligatoria y algunas instituciones la realizan por las normas internas de la institución y/o por exigencia de algunos donantes.

**Summary of multi-lateral, bi-lateral and NGO conservation projects in Paraguay**

| Nombre Proyecto | Montos 2007-2009 | Agencia Financiadora | Fechas |
|---|---|---|---|
| **ONGs** | | | |
| *Fundacion Moises Bertoni* | | | |
| Conservación de la Biodiversidad y Uso Sostenible en Mbaracayú - Paraguay | US$ 973.512 | Banco Mundial | Noviembre de 2003 hasta Mayo de 2007 |
| Conservación y Uso Sostenible de la Reserva Natural Tapytá | US$ 220.000 | USAID | Octubre 2004 a Marzo 2007 |
| Autosustentabilidad alimenticia y financiera de las comunidades indígenas Aché y Avá Guaraní | US$ 148.663 | BID | Febrero 2007 a Agosto 2009 |
| Protección y Uso Sostenible de los Recursos Naturales en la zona de influencia de tres áreas protegidas | EUR 49.485 | UICN Holanda | Octubre 2007 a Septiembre 2009 |
| Estrategia de Fortalecimiento del tejido social para la gestión sostenible de la Reserva de Biosfera de Mbaracayú (Paraguay) e intercambio de experiencias con la Reserva de Biosfera de Monfragüe (España) | EUR 152.322 | Fundación Biodiversidad-Fundación Globla Nature | Noviembre 2007 a Noviembre 2008 |
| Conservación y Uso sostenible de los recursos en la Reserva Natural Tapytá y su área de influencia | US$ 100.000 | Fondo de Conservación de Bosques Tropicales (Fondos Estatales) | Julio 2009 a Julio 2011 |
| Una alianza innovadora para el desarrollo social, económico y | US$ 634.692 | USAID | Octubre 2008 a |

| Nombre Proyecto | Montos 2007-2009 | Agencia Financiadora | Fechas |
|---|---|---|---|
| ambiental | | | Octubre 2011 |
| Construcción de Tejido Empresarial para el Desarrollo Sostenible de Poblaciones vulnerables en el área de influencia de la Reserva Natural Privada | EUR 79.750 | AECID-Global Nature | Noviembre 2007 a Junio 2010 |
| *Pro Cosara* | | | |
| EGP 600177 Consolidación y protección de la Cordillera San Rafael | 84.877.00 Euros | | Abril 2008 hasta Setiembre 2009 |
| FT 84 Implementación de Leyes Ambientales y recomposición del paisaje en la Reserva para Parque San Rafael | 23.910$ | | 01/09/2008 hasta 30/06/2009 |
| FS 49 Recomposición del Corredor Sur | 13.000$ | | 15/12/2006 hasta 30/06/2007 |
| FT 24 Implementación de Leyes Ambientales en la Reserva para Parque Nacional San Rafael | 9.000$ | | 15/12/2007 hasta 30/06/2008 |
| FR 44 Implementación de Leyes Ambiental | 44.000$ | | 2006 hasta junio 2007 |
| FD 22 Fortalecimiento del Sistema de Implementación de Leyes Ambientales en la reserva de Recurso manejado San Rafael | 51.000$ | | 30/01/2003 hasta 01/06/2005 |
| Iniciativa para sustentabilidad y conservación de la cuenca alta del río Tebicuary en la cordillera de San Rafael | 298.268$ | | Enero de 2001 hasta Diciembre de 2005 |
| *Institute for Environmental Law and Economics (IDEA)* | | | |
| "Iniciativas de Conservación Transfronteriza en el Chaco y Pantanal del Paraguay" | U$S 245.239 | TNC /USAID | May 2000 / Sep 2004 |
| "Programa de Apoyo para el Mejoramiento del Marco Legal Ambiental del Paraguay" | U$S 96.236 | USAID | Ago 2001/ Dic 2002 |
| "Acceso Ciudadano al Congreso Nacional". | Gs. 461.700.000 | CIRD/USAID | Abr 2002 /Mayo 2004 Oct 2003 / Nov 2005 |
| "Reforma Ambiental Nacional y Planificación Ecorregional del Bloque Norte del Bosque Atlántico Interior" | U$S 1.450.000 | USAID | Oct 2003 / Oct 2008 |
| "Alianza de la Sociedad Civil para la Reforma del Poder Judicial" | Gs. 150.000.000 | CIRD/USAID | Ene/Jun 2004 |
| "Apoyo en el proceso de | U$S 56.625 | MSI / USAID | Mar/Dic |

| Nombre Proyecto | Montos 2007-2009 | Agencia Financiadora | Fechas |
|---|---|---|---|
| aprobación del Código de Ética Judicial" | | | 2004 |
| "Observatorio de la Impunidad y la Corrupción en el Sector Ambiental en Paraguay" | U$S 53.670 | Casals / USAID | Ago/Oct 2005 |
| "Centro y Ventanas de acceso a la Información" | Gs. 1.126.131.075 | CIRD / USAID | Oct 2006 / Oct 2009 |
| Medios de Comunicación y Democracia en América Latina | Honrad-Adenauer-Stiftunge e.V. | U$S 10.500 | Febrero a Mayo de 2003 |
| Implementación en Paraguay de Estrategia de Seguimiento de la Sociedad Civil al Plan de Acción de Québec | Agencia Canadiense de Desarrollo Internacional | U$S Canadienses 18.340 | Feb. 2003 / Junio 2005 |
| The Access Initiative Paraguay Assessment | World Resources Institute | U$S 25.000 | Septiembre 2005 a Diciembre 2006 |
| Guías de Desarrollo Comunitario en Asentamiento Ex Jaguarete Forest | Banco Internacional de Reconstrucción y Fomento | U$S 10.000 | Año 2005 |
| Asistencia Técnica para las Organizaciones Rurales y sus Asociados del Dpto. de San Pedro | Fundación Paraguaya - BID | Gs. 263.169.200 | Marzo 2007 a Marzo 2009 |
| Veeduría Social del Ministerio Público | NED – National Endowment for Democracy | U$S 34.972 | Abril 2007 a Marzo 2008 |
| "Liderazgo dentro del debate público sobre cuestiones de desarrollo en el Paraguay" | Avina | U$S 510.000 | Junio 2001 a Junio 2004 |
| Conservación y Desarrollo forestal de la ecorregión del Bosque Seco Chiquitano | FCBC – Fundación para la Conservación del Bosque Seco Chiquitano | U$S 58.104 | 2007/2008 |
| Apoyo a la implementación de la ley de servicios ambientales en Paraguay | UICN Holanda | EUROS 74.232 | 01-04-2008 al 01-04-2010 |
| Veeduría Social del Ministerio Público | NED – National Endowment for Democracy | U$S 40.000 | 01-07-2008 al 30-06-2009 |
| Acceso a la información en el Paraguay | World Resources Institute | U$S 23.800 | Junio a Diciembre 2009 |
| Conservación y Desarrollo forestal de la ecorregión del Bosque Seco Chiquitano | FCBC – Fundación para la Conservación del Bosque Seco Chiquitano | U$S 61.400 | Año 2009 |
| Análisis de sustentabilidad de cultivos | OEA | U$S 29.066,66 | Año 2008 |

| Nombre Proyecto | Montos 2007-2009 | Agencia Financiadora | Fechas |
|---|---|---|---|
| Análisis de sustentabilidad de cultivos | NED – National Endowment for Democracy | U$S 9.700 | Año 2009 |
| *FONDO PARA LA CONSERVACION DE BOSQUES TROPICALES* | | | |
| Restauración de bosques en la zona Blas Garay – Serranías del Ybyturuzú | FCBT-Py | 300.000.000 U$S | Set 2009 a Set 2011 |
| "Conservación y Uso sostenible de los recursos en la Reserva Natural Tapytá y su área de influencia" | FCBT-Py | 400.000.000 U$S | Julio 2009 – Julio 2011 |
| "Preservación de los recursos naturales de la Reserva San Rafael y su entorno" | FCBT-Py | 400.000.000 U$S | Jun 2009 a Dic 2010 |
| **INSTITUCIONES PUBLICAS** | | | |
| INFONA | | | |
| SEAM | | | |
| AGENCIAS MULTILATERALES Y BILATERALES | | | |
| AECID | | | |
| Araucaria XXI para la sostenibilidad ambiental en el Bosque Atlántico del Alto Paraná en Paraguay | 2007 – 400.000 EUR<br>2008 – 500.000 EUR<br>2009 – 175.000 EUR | AECID (*) (administrados por la Secretaría Técnica de Planificación (STP) y la ejecución del proyecto es por SEAM y la Secretaría Nacional de Turismo (SENATUR)) | 2007 - 2011 |

Appendix 8. **Environmental Services Law 3001.06**

La Ley 3001/06 define servicios ambientales como:

**a)** servicios ambientales relacionados con la mitigación de las emisiones de gases de efecto invernadero: fijación, reducción, secuestro, almacenamiento y absorción de carbono y otros gases de efecto invernadero. Las actividades a retribuir o financiar por este servicio incluyen protección y manejo de: bosques, proyectos de reforestación, arborización urbana, componente forestal de los proyectos o sistemas agroforestales, reforestación de orillas de ríos y nacientes, palmares, independientemente del tamaño o magnitud del proyecto de que se trate;

**b)** servicios ambientales de protección de los recursos hídricos para diferentes modalidades de uso (energético, industrial, turístico, doméstico, riego, etc.) y sus elementos conexos (acuíferos, manantiales, fuentes de agua en general, humedales, protección y recuperación de cuencas y microcuencas, arborización, etc.);

**c)** servicios ambientales relacionados con la protección y uso sostenible de la biodiversidad: protección de especies, ecosistemas y formas de vida; acceso a elementos de biodiversidad para fines científicos y comerciales;

**d)** servicios ambientales de belleza escénica derivados de la presencia de los bosques y paisajes naturales y de la existencia de elementos de biodiversidad y áreas silvestres protegidas, sean estatales o privadas, debidamente declaradas como tales; y,

**e)** servicios ambientales de protección y recuperación de suelos, y de mitigación de daños provocados por fenómenos naturales.

El Poder Ejecutivo establecerá el valor de los servicios ambientales, el que será actualizado cada cinco años, sin perjuicio del establecimiento de un índice de
ajuste de precios para mantener dicho valor entre cada nueva valorización. Su precio inicial será establecido en relación con el valor o beneficio económico, ambiental o sociocultural que satisfaga.

Se emitirá un Certificado de Servicios Ambientales, a ser obtenido por personas físicas o jurídicas que, en virtud del proyecto que vayan a ejecutar o la actividad que realicen, estén obligadas a invertir en servicios ambientales; así como por cualquier otra persona física o jurídica, nacional o extranjera que tenga interés en prestar dichos servicios o a pagar para que un tercero lo preste, en las condiciones previstas en esta Ley.

El Certificado de Servicios Ambientales es un título valor libremente negociable por quienes no están obligados en virtud de esta Ley o por sentencia judicial a invertir en servicios ambientales, y podrán negociarse en el mercado internacional para el pago de compensaciones medioambientales efectuadas por las personas físicas o jurídicas obligadas al efecto por las actividades o explotaciones que realicen y que sean consideradas nocivas para el ambiente. También podrán utilizarse para la compensación de tributos locales o nacionales como el IMAGRO, el Impuesto Inmobiliario y el Impuesto a la Renta Personal.

**OBLIGACION DE INVERTIR EN SERVICIOS AMBIENTALES**

Los proyectos de obras y actividades definidos como de alto impacto ambiental, tales como construcción y mantenimiento de caminos, obras hidráulicas, usinas, líneas de transmisión eléctrica, ductos, obras portuarias, industrias con altos niveles de emisión de gases, vertido de efluentes urbanos e industriales u otros, según el listado que al efecto determine el Poder Ejecutivo, deberán incluir dentro de su esquema de inversiones la compensación por servicios ambientales por medio de la adquisición de Certificados de Servicios Ambientales, sin perjuicio de las demás medidas de mitigación y conservación a las que se encuentren obligados. Las inversiones en servicios ambientales de estos proyectos de obras o actividades no podrán ser inferiores al 1% (uno por ciento) del costo de la obra o del presupuesto anual operativo de la actividad.

En el momento de dictar sentencia definitiva por la comisión de hechos punibles contra el medio ambiente o en procesos civiles en los que se peticione la reparación del daño ambiental en sí mismo, los jueces podrán disponer que el monto de las multas y/o composiciones, así como el de las condenas pecuniarias civiles se destine o se realice a través del Régimen de Servicios Ambientales.

Quienes no hayan cumplido con el requisito de reserva legal de bosques naturales establecido en la Ley N°422/73 “FORESTAL” deberán adquirir Certificados de Servicios Ambientales hasta compensar el déficit de dicha reserva legal.

La Secretaría del Ambiente (SEAM) determinará por resolución las condiciones por las cuales aquellas personas, físicas o jurídicas, en cuyas propiedades no se cumpla con el requisito de reserva legal de bosques naturales establecido en la Ley Nº 422/73 “FORESTAL”, deberán adquirir Certificados de Servicios Ambientales. Dicha resolución se elaborará teniendo en consideración la fragilidad de los ecosistemas naturales y la localización geográfica y ambiental del área sin reserva legal, y el impacto ambiental verificado y a ser compensado.

Appendix 9. **Itinerary and Schedule**

The itinerary and schedule for the preparation of the report included four weeks of work in Paraguay during November 2009. During that time the team made a field trip to Eastern Paraguay to see the area of San Rafael and made an over flight of Western Paraguay with field visits in the Departments of Alto Paraguay and President Hayes. The preparation of the report occurred during the period from December 2009 through June 2010 as the report was reviewed by the team members, staff from USAID/Paraguay and staff from USAID/Washington, D.C. and the U.S. Forest Service.

Appendix 10. Biographical Sketch of Team Members

Bruce Kernan, Team Leader, has been working in and from Ecuador since 1983, first as a Foreign Service Officer in USAID and then as an independent consultant for the forestry and environmental aspects of development projects. He studied forestry and conservation of biodiversity in the universities of the State University of New York, Yale and Cornell. He has participated in numerous project evaluations, designs and environmental assessments and has been the Team Leader for the preparation of USAID reports on biodiversity and tropical forests in Peru, Ecuador, Colombia, Panamá and El Salvador and a member of the preparation team in Bolivia and Uganda. He spends several months every year doing silvicultural work in his family's private forest in New York State.

William Cordero, he studied to become a Forestry Engineer in the Technological Institute of Costa Rica. He also has a master degree from Idaho University in Forestry Products (with emphasis in Forest Use) obtained in 1982. He has more than 30 years of experience in teaching, research and field work related to management and use of tropical forests. He has worked in several levels for organizations such as FAO, IUCN, GTZ, USAID, COTESU, and the WORLD BANK. His experience was developed in Bolivia, Costa Rica, Peru, Colombia, Nicaragua and also Panama. In Bolivia he was responsible to promote the changes that allowed Bolivia to achieve more than two million certified hectares of forests between 1996 and 2002. In Peru he was responsible to promote and implement sustainable forest management as a viable economic activity. He worked with different forest concessionaries in the real implementation of their concessions. He coordinated different forest projects that were developed in the same regions. Currently, he is the team leader that coordinates the implementation of the Community Forests Project with communities in the region of the Darien, a project financed by USAID. This project's objective is to secure biodiversity conservation in a very rich and diverse region, and, at the same time, improve the socioeconomic conditions of the communities that own their forests.

**Ana Maria Macedo Sienra,** is a biologist with more than two decades of experience in fields related to biodiversity conservation in Paraguay, particularly in private properties. She coordinated the Project for the Management of the Atlantic Forest of the Interior that includes portions of this type of forest in Argentina, Brazil and Paraguay. She was, for almost 10 years, the Director of the Program for Private Conservation Initiatives in the Moisés Bertoni Foundation. She also participated in the process to update the Strategic Plan for the National System of Natural Protected Areas (SINASIP). She was, for four years, Executive Director of Natural Land Trust and she is currently the Director of the Paraguayan Network for the Conservation of Private Lands. She was involved in the creation of 13 of the 21 currently existing Private Nature Reserves and of two Environmental Easements. She also coordinated the process to elaborate 23 management plans for public and private protected areas.

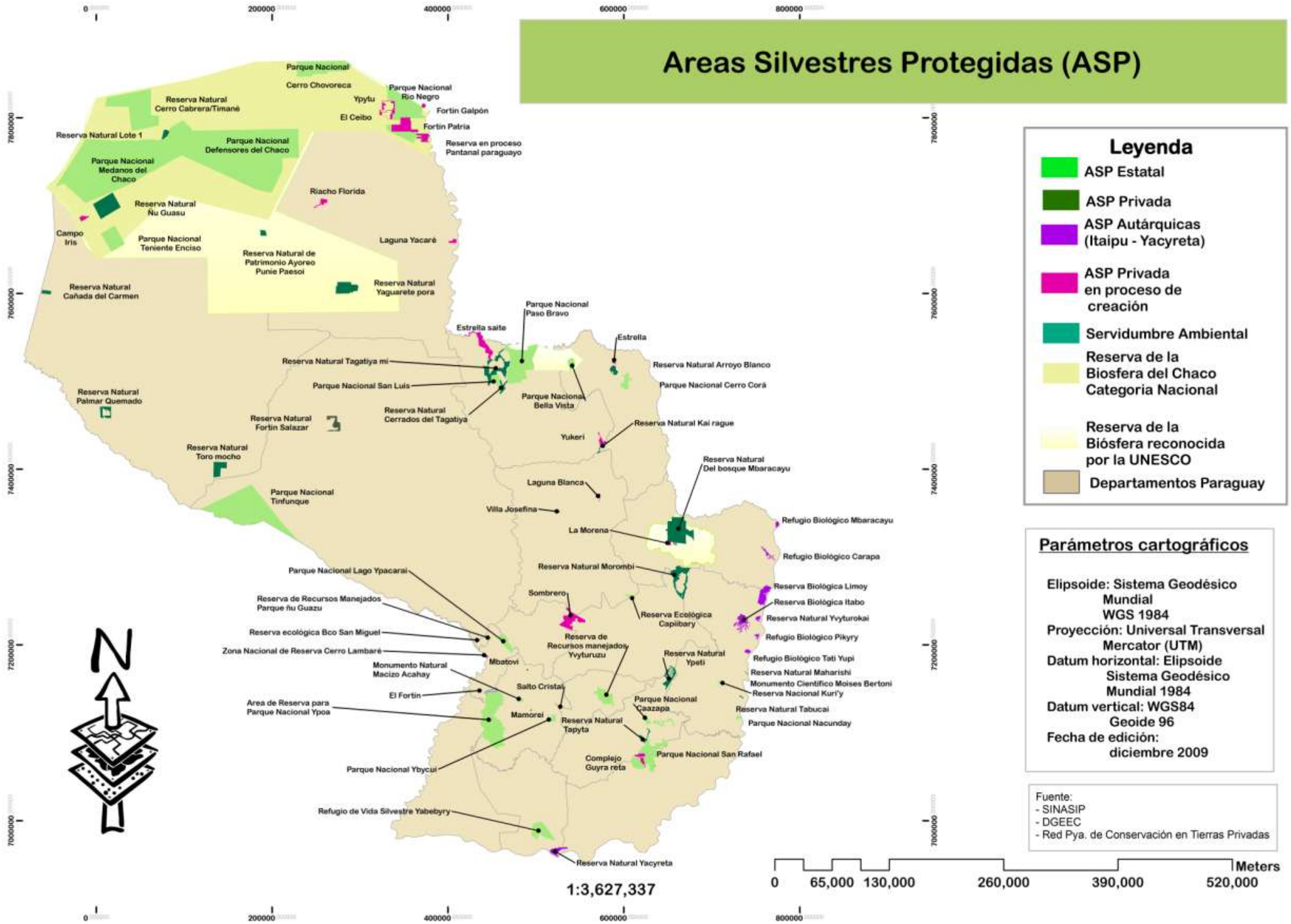
**Janet Villalba Marín**

Forestry Engineer specialized in Geographical Information Systems (GIS). Currently, she is the Conservation Officer of the Paraguayan Network for the Conservation of Private Lands and she is a teacher at the National University of Asunción. She participated in the elaboration of more than 12 technical justifications and management plans for public and private protected areas.

Appendix 11. Additional Maps

- Áreas Silvestres Protegidas del Paraguay
- Ecorregiones del Paraguay y las Áreas Silvestres Protegidas
- Áreas de Importancia para la Conservación de Aves (IBAs)
- Áreas prioritarias para la conservación en la Región Oriental
- Áreas prioritarias para la conservación en la región Occidental

# Areas Silvestres Protegidas (ASP)




## Leyenda

- ASP Estatal
- ASP Privada
- ASP Autárquicas (Itaipu - Yacyreta)
- ASP Privada en proceso de creación
- Servidumbre Ambiental
- Reserva de la Biosfera del Chaco Categoria Nacional
- Reserva de la Biósfera reconocida por la UNESCO
- Departamentos Paraguay

## Parámetros cartográficos

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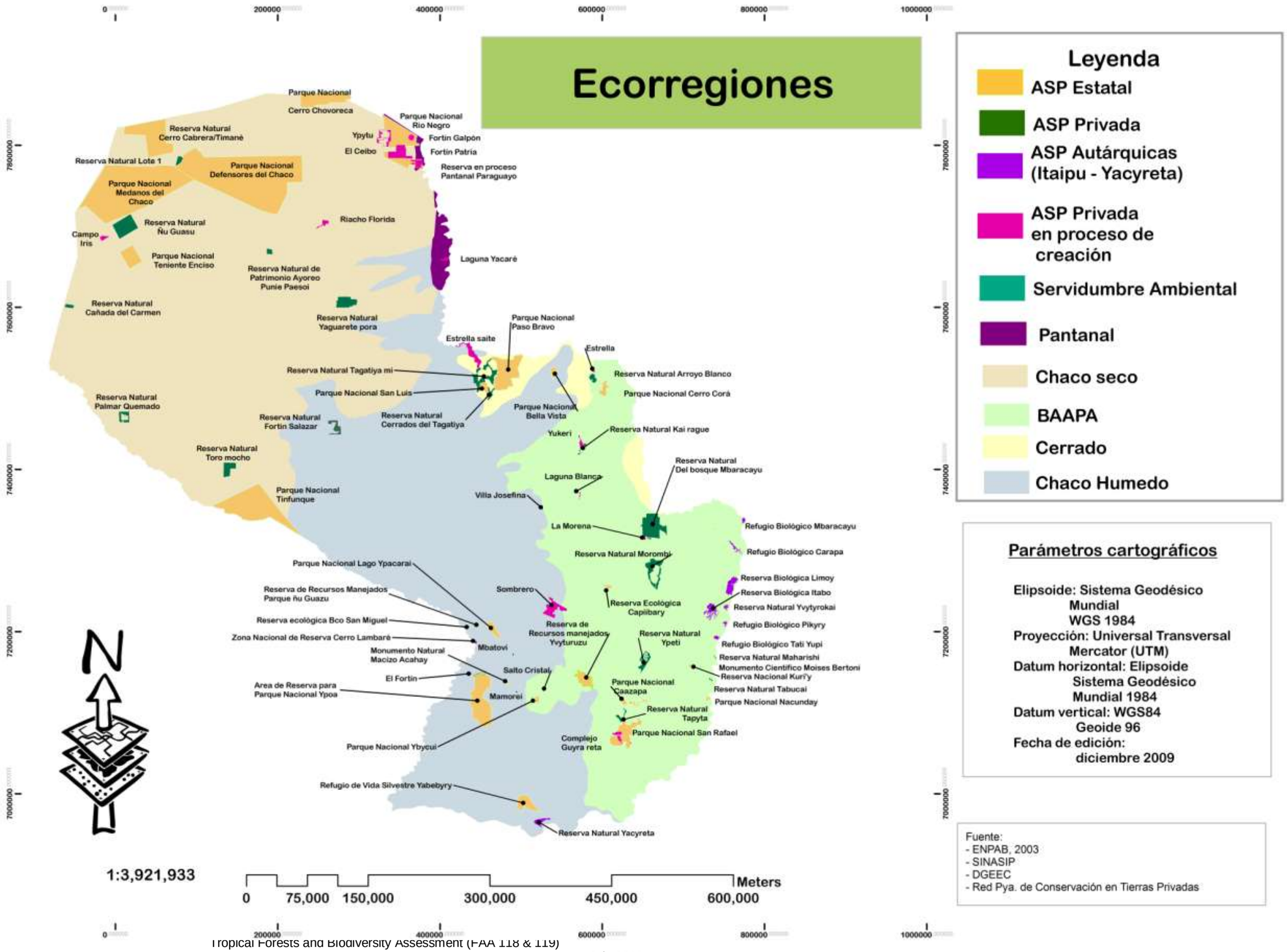
Proyección: Universal Transversal Mercator (UTM)
Datum horizontal: Elipsoide Sistema Geodésico Mundial 1984
Datum vertical: WGS84 Geoide 96
Fecha de edición: diciembre 2009

Fuente:
- SINASIP
- DGEEC
- Red Pya. de Conservación en Tierras Privadas

# Ecorregiones




## Leyenda

- ASP Estatal
- ASP Privada
- ASP Autárquicas (Itaipu - Yacyreta)
- ASP Privada en proceso de creación
- Servidumbre Ambiental
- Pantanal
- Chaco seco
- BAAPA
- Cerrado
- Chaco Humedo

## Parámetros cartográficos

Elipsoide: Sistema Geodésico Mundial WGS 1984
Proyección: Universal Transversal Mercator (UTM)
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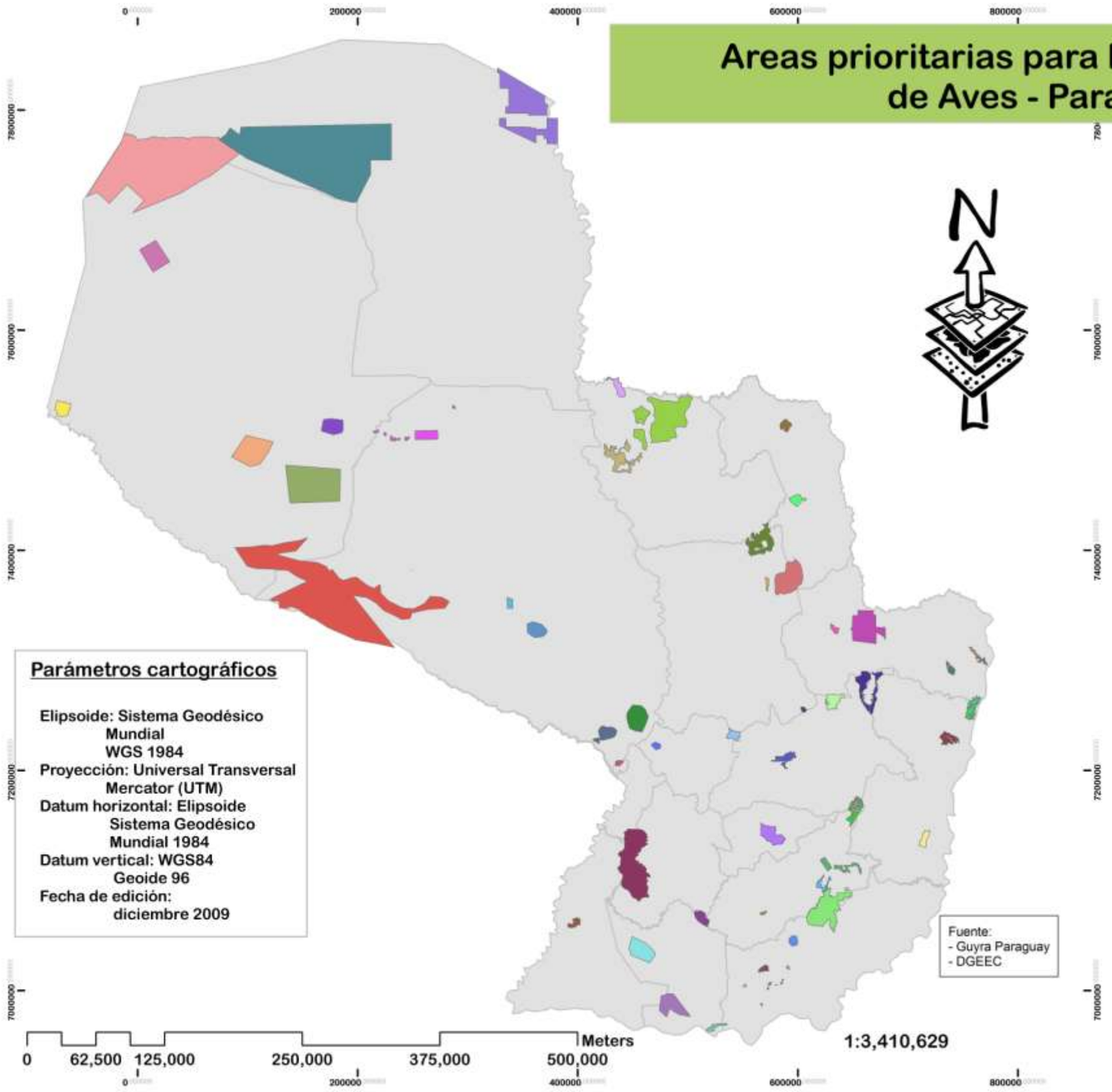
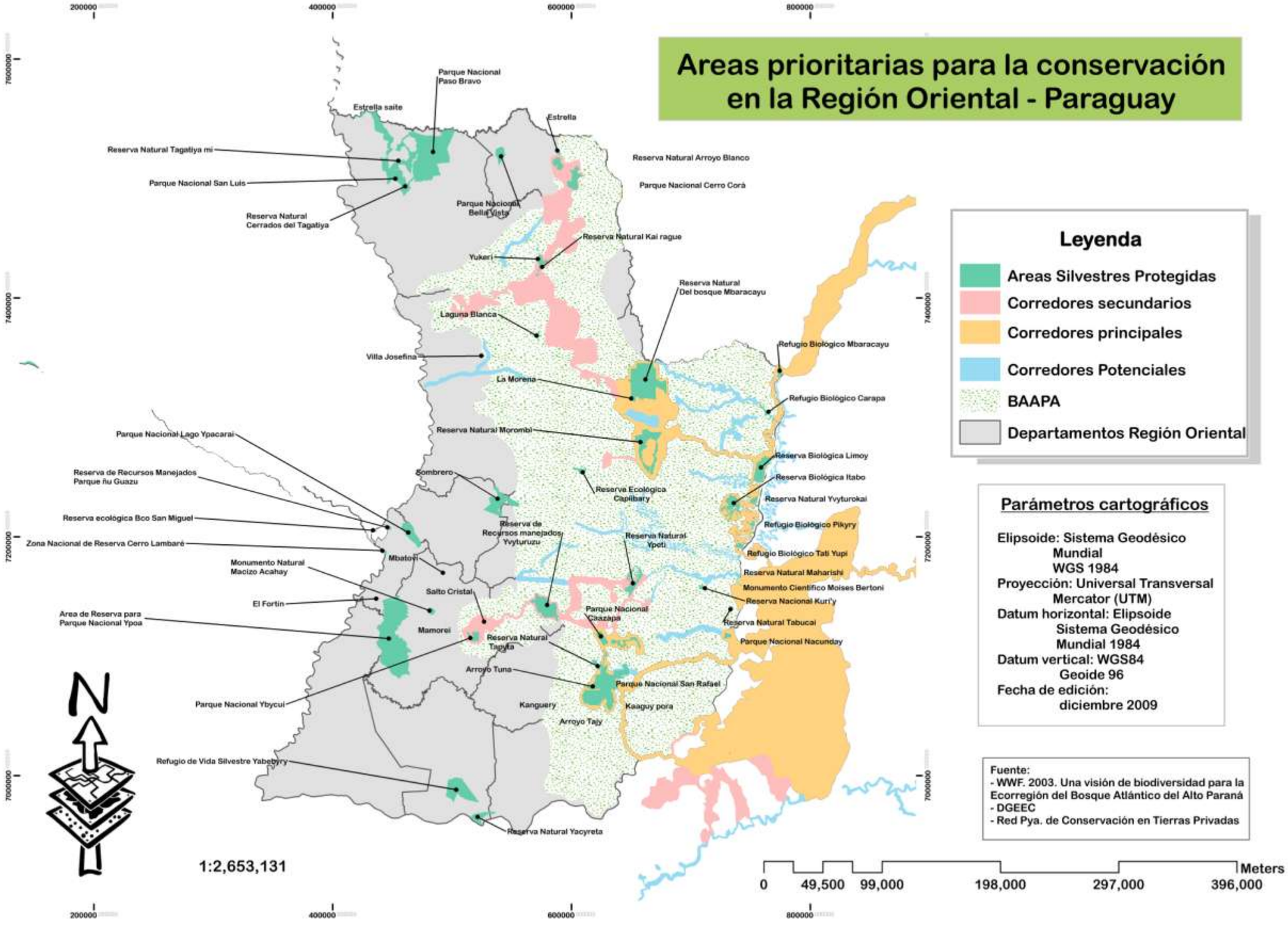
Datum vertical: WGS84 Geoide 96
Fecha de edición: diciembre 2009

Fuente:
- ENPAB, 2003
- SINASIP
- DGEEC
- Red Pya. de Conservación en Tierras Privadas

# Areas prioritarias para la conservación de Aves - Paraguay

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400000
600000
800000
7600000
7400000
7200000
7000000
Parque Nacional Paso Bravo
Estrella saite
Estrella
Reserva Natural Tagatiya mi
Parque Nacional San Luis
Reserva Natural Cerrados del Tagatiya
Reserva Natural Arroyo Blanco
Parque Nacional Cerro Corá
Parque Nacional Bella Vista
Reserva Natural Kai rague
Yukeri
Reserva Natural Del bosque Mbaracayu
Laguna Blanca
Villa Josefina
La Morena
Refugio Biológico Mbaracayu
Refugio Biológico Carapa
Parque Nacional Lago Ypacarai
Reserva Natural Morombi
Reserva Biológica Limoy
Reserva de Recursos Manejados Parque ñu Guazu
Sombrero
Reserva Ecológica Capibary
Reserva Biológica Itabo
Reserva Natural Yvyturokai
Reserva ecológica Bco San Miguel
Reserva de Recursos manejados Yvyturuzu
Refugio Biológico Pikyry
Zona Nacional de Reserva Cerro Lambaré
Reserva Natural Ypoti
Refugio Biológico Tati Yupi
Mbatovi
Monumento Natural Macizo Acahay
Reserva Natural Maharishi
Monumento Cientifico Moises Bertoni
Salto Cristal
El Fortin
Reserva Nacional Kuri'y
Parque Nacional Caazapa
Area de Reserva para Parque Nacional Ypoa
Reserva Natural Tabucai
Mamorei
Parque Nacional Nacunday
Reserva Natural Tayuta
Arroyo Tuna
Parque Nacional San Rafael
Parque Nacional Ybycui
Kanguery
Kaaguy pora
Arroyo Taiy
Refugio de Vida Silvestre Yabebyry
Reserva Natural Yacyreta
N
1:2,653,131
Leyenda
Areas Silvestres Protegidas
Corredores secundarios
Corredores principales
Corredores Potenciales
BAAPA
Departamentos Región Oriental
Parámetros cartográficos
Elipsoide: Sistema Geodésico Mundial WGS 1984
Proyección: Universal Transversal Mercator (UTM)
Datum horizontal: Elipsoide Sistema Geodésico Mundial 1984
Datum vertical: WGS84 Geoide 96
Fecha de edición: diciembre 2009
Fuente:
- WWF. 2003. Una visión de biodiversidad para la Ecorregión del Bosque Atlántico del Alto Paraná
- DGEEC
- Red Pya. de Conservación en Tierras Privadas
0
49,500
99,000
198,000
297,000
396,000
Meters

# Areas prioritarias para la conservación en la Región Occidental - Paraguay