BIODIVERSITY AND TROPICAL FOREST CONSERVATION, PROTECTION AND MANAGEMENT IN NICARAGUA: ASSESSMENT AND RECOMMENDATIONS

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Final Report
April 15, 2003

Evaluation performed for USAID/Nicaragua
with USDA Foreign Agricultural Service
International Cooperation and Development.
This work was done between March 17-31, 2003.

NICARAGUA

"Nicaragua has the largest tropical rain forest north of Amazonia, the most extensive seagrass pastures in the Western Hemisphere, the widest continental shelf, and stretch of coral reefs in the Caribbean, the longest river, largest lakes, richest volcanic soils, and least populous territory in Central America. Nicaragua has 100 species of freshwater fish, 200 species of mammals, 600 species of amphibians and reptiles, and 750 species of birds. It also has the most revolutions, civil wars, and foreign military interventions, and the longest reign of dictators of any country in Central America" (Nietshmann (1990).

To this list could also be added that Nicaragua was -- and possibly still is -- a site for a trans-isthmus canal, has suffered numerous damaging earthquakes, has the largest island in a freshwater crater lake, has a diverse flora with at least 7,000 vascular plants and a variety of forest types, contains the most southerly extension of lowland pine forest in the hemisphere, and has had a long history of indiscriminate forest exploitation. By all standards, Nicaragua is quite a place.

EXECUTIVE SUMMARY AND RECOMMENDATIONS

The Proposed USAID/Nicaragua Economic Growth Strategy

We were asked to address environmental concerns with the USAID/Nicaragua environmental strategy from 2004 to 2009. The major environmental concerns with the purported strategy are noted by topic below:

Increased production of fruits and vegetables: The major concerns, if proposed, would be the construction of new roads in forested areas, and the potential heavy use of chemicals (fertilizers and herbicides) that could ultimately enter water bodies.

Specialty coffee and coffee diversification: One concern would be the saturation of the specialty coffee market and a subsequent drop in prices. This could result in the future abandonment of shade coffee in favor of other activities, possibly open grown coffee production or pasture. USAID should formulate a regional strategy complete with future projections. Appropriate management practices are also required.

Livestock and dairy products: Much of the land where cattle are grazed is too steep, subject to erosion, or infertile. The major concerns would be clearing forests for new pastures, overgrazing, soil compaction, reduction of infiltration, greater runoff, negative impacts on water quality and regimen (flow during the year), and possible downstream sedimentation. Good rangeland management practices could alleviate some of these concerns but only if appropriate terrain is selected initially.

Forest products: There are several concerns regarding forest products. First, Nicaraguan wood products should not be sold without maximizing benefit to the country. Overexploitation today could deplete forest resources so that future industrial "clustering" or development of secondary industries within Nicaragua may not be feasible. Second, good forest management could avert massive cutting. Third, the prevention of post-harvest invasion of residual forest by landless peasants or clandestine timber merchants is the key to sustainable forest production. Finally, technical assistance to review the long-awaited forestry law is a good idea.

Cacao: One concern is that the emphasis of cacao production today in Nicaragua -- and presumably elsewhere in the region -- could result in a glut of cacao within a few years, a condition that, should it happen, could hardly be considered sustainable. USAID should formulate a regional strategy complete with future projections. Appropriate management practices are also required.

Ornamental plants: The main issues in ornamental plant production are probably not environmental but logistical (how to assure timely delivery to distant overseas markets). If this means road construction and the possible removal of additional forest cover, however, it will have environmental implications. Heavy applications of pesticides, especially in confined spaces, could have health implications.

Tourism: Before too much promotion for ecotourism is undertaken, available overnight facilities, enough outdoor attractions along certain routes (clustering), and determinations of carrying capacities must be addressed. Moreover, protected areas highlighting wildlife attractions must protect these resources immediately, with or without management plans, or there will be little reason for tourists to visit.

Biodiversity Assessment

Policy and Legislation: Basically, Nicaragua's laws are adequate; enforcement, however, is not. Moreover, INAFOR, the agency responsible for enforcement of forestry legislation, does not enforce the best logging or silvicultural practices outlined in approved management plans. A comprehensive environmental law should be fashioned to encourage the conservation of forested areas, including protected areas, through the use of incentives, low interest loans, and private management. It is possible that the long-awaited new forest law will achieve these objectives. The government of Nicaragua should make every effort to enforce all existing environmental laws and regulations and set the example for the nation through its field personnel.

Forest Conservation and Biodiversity: There is no place that combines geology, climate, wildlife, a diverse culture, and a friendly ambience like Nicaragua. However, exerting practically no control, the nation is losing its forests, wildlife, jobs, and future alternatives. Nicaragua has 244 species of fauna and flora on the CITES Appendices I and II. Little is known about the population sizes or current status of these species within the country; this information, however, is critical for management. Conservation (the wise use of resources) is the best means to protect terrestrial and aquatic fauna and flora; this means collecting information on and formulating strategies for the protection of at least 244 species.

Protected Areas: Whether at high or low elevation, in wet or dry climate, and with or without permanent inhabitants, Nicaragua's protected areas system is not well protected! Of the nation's 76 protected areas, many with less than 50 percent forest cover, seven are managed under arrangements with NGOs and community groups (co-management). The concept of the Atlantic corridor is well known. Nicaragua has two other corridors that are less well known: a rainforest to dry forest (rainfall) gradient along the southern border, and a lowland rainforest to cloud forest (altitudinal) gradient in the north central area. Lowland pine savanna, cloud forests, and oak-pine forests in the Central region are not well represented in the protected areas system. These gradients and forest types also require conservation through the establishment of protected areas and buffer zones. Carrying capacities are needed to assure that resources will not degrade through excessive use. They are also needed to establish appropriate limits (number of kills or captures) for hunting and fishing of all game species, terrestrial and aquatic, endangered or not, throughout the country, not just in the protected areas. Carrying capacities should also be established for tolerable levels of tourism (for example, use of facilities, trails) within the 76 protected areas.

Research and Education: Practical research is the key to good management; Nicaragua must use the enthusiasm of its students to answer environmental questions, and to develop a cadre of qualified future managers. Nicaragua needs to: create an environmental data base for all USAID documents, past and present, with a local NGO; assure that all major types of protected areas are represented in the system (protected area matrix); assure that all CITES species are being protected (endangered and threatened species matrix); develop a prioritized list of practical research topics dealing with protected areas and wildlife for Nicaraguan students and undertake the research accordingly; devise a small grants program for Nicaraguan students to investigate research topics; cooperate with multi- and bi-lateral entities, local and foreign universities, and the Peace Corps to develop a research program; and establish a national environmental library and begin collecting information from all donors (local and foreign universities, and forestry and environmental agencies).

Forestry and Management: Despite elaborate strategies, good land management is lacking. Forest management plans are developed but not implemented. Traditional logging opens a path and subsequent migratory agriculture depletes Nicaragua's forest resources. The cost to the nation is considerable: the loss of forest resources, soil fertility, farm productivity, water supplies, and wildlife. The forest resource is undervalued; moreover, secondary forest industries have not been fully developed to maximize value-added products and employment. Sound strategies are required in environmental documents (including forest management plans) to assure that biodiversity is not negatively impacted. Site specific surveys of wildlife species (fauna and flora) are needed before finalizing management plans. Forest certification for harvest in buffer zones could help guarantee sustainable operations and should be considered. Plantations need to be established for industry and to reduce pressures on natural forests. Funding (low interest loans) should be made available for investment in the purchase of forest land for sustainable production, and for plantation establishment, silvicultural operations, and the development of secondary forest industries. INAFOR needs to strengthen its enforcement of forestry regulations.

Tourism: Tourism is a potential gold mine for Nicaragua. Tourism has increased in the past decade and could grow considerably more. Several protected areas receive visitors and others currently isolated will one day be major attractions. Lack of access, infrastructure, and good marketing are drawbacks. Before major efforts are made to attract more tourists, however, INTUR and MARENA need to determine the status of existing resources and develop carrying capacities for allowable wildlife limits (kills or captures) and human use. Both groups also need to develop marketing strategies targeting particular audiences. A tourist bank could provide low interest loans for investments in tourism including infrastructure, facilities, and marketing. Efforts should be made to coordinate activities between foreign and Nicaraguan tourist companies. The National Museum should be consulted for the promotion of archeological sites. Visitor records must be kept. Finally, negative travel warnings could do serious harm to tourism and call for immediate corrective action.

Awareness and Communication: The secret to public support is to have the public on your side. Nicaragua, however, is a poor country. Experience has shown that enthusiastic presentations, both on television and directly in the field, can stimulate support. Promotional materials (brochures, movies, slides, calendars, and power point presentations) should be developed along novelty items (trinkets) for sale to tourists. "Believe it or not" television slots on protected areas and wildlife along with documentaries would attract some viewers. School programs that highlight themes such as protected areas and endangered or threatened species as part of Nicaragua's natural treasure could be presented by ambulatory groups that visit different parts of the country. A popular, easy-to-read newspaper (published 2 or 3 times per year) showing Nicaraguan students and professors doing investigations and field work, similar to articles in the U.S. publication the Natural Enquirer, could stimulate learning more about natural resources on the part of pre-university students.

Investments in Biodiversity: The wise use of available resources over the long-term is critical to sustained management; however, past political instability and current land tenure problems make Nicaragua a high risk environment. High risk translates into short-term investments. There is little incentive to protect biodiversity; moreover, financing for many projects initiated by donors or cooperators is programmed to terminate with the project. On the positive side, one of the strongest arguments to finance protected areas (and biodiversity) is that tourism generates more GDP than several other segments of the economy. Local NGOs should look into conserving limited resources where possible, by sharing facilities in a Managua NGO center (where some income could be generated) and by cooperating in promoting their cause (common web site). Another approach would be to stimulate an environmentally friendly ethic among Nicaraguan investors in the development of major projects -- "take pride in Nicaragua, the most beautiful Central American country!" Efforts should also be made to build the fund-raising capacity of local NGOs at the international level in order to sustain long-term projects. Finally, private enterprise should not be overlooked. The direct purchase of property (or possibly long-term leases of state property) by private investors for purposes of protected area management might be the most direct, safest, and surest way to protect biodiversity in the long run. All planning, development, and management of these areas, however, would be subject to regulation.

Summary: Section 8.0 is only 6 pages long. It provides more detail on background and recommendations and should be read along with this very brief executive summary.

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1.0 INTRODUCTION

Sections 118 (Tropical Forests) and 119 (Endangered Species) of the 1986 amendments to the Foreign Assistance Act require USAID missions to include the following in their 5-year strategic plan:

- a definition of actions to achieve sustainable management of tropical forests, and to conserve biological diversity; and
- an evaluation of how well the proposed actions to be supported by USAID actually meet country needs.

The basic purpose of this report is to assess how USAID's proposed 5-year country strategy does or does not support the conservation of Nicaragua's biodiversity, including its forests. The assessment also contains suggestions of how the country strategy may be improved. The specific objectives of this biodiversity assessment are to:

- review Nicaragua's policy, regulatory, and institutional framework for the protection of biodiversity (including the nation's forests), and the country's international treaties, institutions, and current plans that address biodiversity issues;
- provide an overview of environmental NGOs, their program priorities, and levels of financing;
- summarize the efforts (program highlights, priorities, and levels of financing) of donors other than USAID, including multinational and U.S. government organizations operating in Nicaragua;
- review the commercial private sector (for example, logging companies, tourism developers, and land developers) with regard to biodiversity conservation (norms and standards for use of forests and protected areas);
- review the status and management of the National System of Protected Areas (SINAP) including an inventory of all types of all declared and proposed protected areas, institutions responsible for management, establishment dates, areas, and status of each (extent of protection and management, major management challenges, and importance to economy);
- summarize the status of endangered species in Nicaragua and its territorial waters, including critical habitat areas, existing pressures on habitats and efforts to mitigate them, and compliance with CITES;
- summarize the status of conservation in Nicaragua's natural ecosystems (outside of protected areas) with regard to their economic, ecological, and social importance, and assess the relationship between current land tenure and effective conservation;
- summarize the potential impacts of major development projects on biodiversity, including an analysis of the current policy and regulatory framework for review of proposed impacts;
- review programs of ex-situ conservation, and the conservation of economically important species and germplasm including programs with natural history museums, zoos, herbariums, botanical gardens, and captive breeding programs, and include conservation data bases, gene banks, and other related efforts to protect commercially important wild plant and animal species;
- provide an assessment of the proposed USAID/Nicaragua 2004-2008 strategic plan with regard to how well it fills critical management gaps in the conservation of biological resources; and
- compile a report on USAID's future role in Nicaragua and to the extent possible prioritize issues and recommendations.

2.0 COUNTRY OVERVIEW

Nicaragua -- a land of lakes, rivers and volcanoes – covers 130,680 km^2 and is the largest of seven countries on the Central American isthmus. Lakes Managua and Nicaragua, along with other water bodies, occupy 8 percent of the country.

2.1 Climate and Human Settlement

The status of Nicaragua's forest cover today is influenced by many factors: volcanism; climate; occasional hurricanes; prolonged droughts and fires such as those associated with 1997 and 1998 El Niño event; and patterns of

human settlement. The volcanism that created the mountains in the western part of the country also impacted the forests surrounding them. One well-known example is the secondary vegetation in the vicinity of Volcán Masaya. Other examples include the exposed summits of many volcanoes throughout the country.

Nicaragua has a warm tropical climate dominated by moist easterly trade winds. A dry season extends from January through April; and a wet season from May through December. Topographic differences produce three main regional variations: a warm Pacific coastal region including the rift valley and west-facing mountain slopes with pronounced dry and wet seasons; more humid interior mountains with cooler temperatures; and the Caribbean lowlands and east-facing mountains slopes with a warm, wet climate. Rainfall ranges from 5000 mm/yr along the southeastern Caribbean coast, the wettest part of Central America, to 1000 mm/yr along the central Pacific coast. Because of orographic effects and topographic patterns, about 90 percent of all runoff in Nicaragua ultimately flows into the Caribbean.

Ten hurricanes and 15 tropical storms or tropical depressions, downgraded from hurricane force winds, have had trajectories over or close to Nicaragua during the past 110 years (**Cortés Dominguez and Fonseca López 1988**). Of the 21 events shown (**Figure 1**), 1 was in May, 2 in June, 1 in July, 0 in August, 7 in September, 6 in October, and 1 in December. Hurricane Joan of 1988 damaged 5,000 km^2 of forests along the Caribbean coast (**Boucher et al. 1994**). The amount of timber lost was estimated at 65 million cubic meters, of which 8.7 million had commercial value and 8.8 million had other uses (**Delgadillo 1990**). Typically, these storms create a patchy pattern of destruction. Post-hurricane growth is more rapid than in closed forest and soon after Joan, sprouts were prominent. Hurricane Mitch, a large and powerful storm (not shown because its trajectory was over Honduras), caused considerable damage in northwestern Nicaragua.

At the beginning of the 16th century, western Nicaragua was occupied by the Nicarao and Chorotega Indians (**Incer 1990**). The first conquistadores traveled overland from Panama, founding the cities of Granada and León (**Ryan et al. 1970**). Nicaragua's Pacific shore had the resources for shipbuilding at that time. The early colonists cut timber and initiated settlements. In the 17th century, Nicaragua's lower Caribbean slopes and shore were logged when the British occupied the Miskito coast. Big-leaf mahogany (*Swietenia macrophylla*) and Spanish cedar (*Cedrela odorata*) were the main timbers sought at that time (**Weaver and Bauer 2000**).

Nicaragua’s native population, estimated at 650,000 at the time of settlement, rapidly declined to 5,000 after the Spanish arrived (**Weaver and Bauer 2000**). Subsequently, the population grew to about 100,000 in 1700, 160,000 in 1800, 500,000 in 1906, 634,000 in 1920, 830,000 in 1940, 1,050,000 in 1950, 1,536,000 in 1963, and 2,049,000 in 1973. The total population was about 4,000,000 in the year 2000. In the mid-1990s, about 56 percent of the total population lived in the Pacific region, 32 percent in the Central region, and 12 percent in the Atlantic region.

More recently, the human impacts on Nicaragua's forests occurred in three waves: (1) from the 1800s until 1950, much land was cleared for coffee plantations; (2) from 1950 until 1980, considerable areas in the western part of the country were planted in cotton; and (3) during the 1970s and early 1980s, when cattle ranching and subsistence agriculture characterized the advance of the agricultural frontier toward the Caribbean. Deforestation was slowed by the internal conflict of the 1980s, but resumed again in the 1990s. The estimated deforestation rates between 1955 and 1985 averaged from 100,000 to 125,000 ha/yr (**Brautigan 1980**). Nicaragua, slightly more than one-half forested in 1950, was only one-third forested by 1990. If the 1990s pace continues, it was projected that it would take only 18 years to cut all forests outside of the reserves, and 25 years to completely eliminate all of Nicaragua's natural forests (**Maldidier and Antillón 1993**).

2.2 **Life Zones, Vegetation Types, and Biogeographic Regions**

Since the early 1960s, several studies have provided classifications of Nicaragua’s major vegetation types under names such as life zones, vegetation types (zonal and azonal), and biogeographic regions (**Table 1**). Two assessments have been made of Nicaragua’s protected area system to see how well different habitats within the country are represented within the protected area system. The first used biogeographic regions (**Gillespie et al. 2001**), and the second employed principal natural ecosystems (**Meyrat 2001**).

3.0 LEGISLATIVE AND INSTITUTIONAL STRUCTURE AFFECTING BIOLOGICAL RESOURCES

Nicaragua has several national laws and decrees as well as international accords that provide the fundamental legal authority to address issues of biodiversity and conservation (**Tables 2A and 2B; see also Appendix 10.5**). These laws date back to 1940. In addition, the Nicaraguan Constitution, reformed in 1987, has specific articles that directly or indirectly address biodiversity and conservation. Since the 1987 constitutional reforms several laws have been passed that address biodiversity, conservation, and sustainability.

3.1 Status of Policy, Regulatory, and Institutional Framework

The cadre of laws and regulations that address biodiversity and environmental conservation in Nicaragua. deal with several issues such as: the protection of cultural resources; requirements for environmental documentation; the development of management plans; and, general statements in the Nicaraguan constitution relating to the environment. Various governmental agencies are responsible for enforcement and oversight, among them the following:

- INAFOR of MAGFOR, for forestry programs;
- MARENA for overseeing Protected Areas;
- the National Museum of Nicaragua for cultural heritage; and
- INTUR for tourism programs.

Better coordination among the various ministries, agencies, and institutes would help to protect natural and cultural resources, and to enhance economic development without adversely affecting tropical forests or biodiversity.

Nicaraguan's laws, in general, are adequate to protect biodiversity and to conserve natural resources. Law enforcement by Nicaraguan agencies, for example, forest management plans by INAFOR or protection of the cultural heritage by the National Museum, falls short of expectations.

The proposed new forestry law, apparently designed to strengthen forestry, has been under consideration for about 5 years. The current draft of the law was discussed with MAGFOR and Nicaragua Plywood; both were very supportive. Industry feels that it would help bring about more confidence in long-term forestry development including the establishment and management of plantations. A review of the legislation by USAID might be appropriate to assure that biodiversity, forest conservation, and endangered species are adequately addressed.

Sound scientific management to allow sustainable harvest of fish and game are lacking. Studies of carrying capacities are needed to establish appropriate limits for hunting and fishing. With such information, tourist operators could provide guidance and MARENA enforcement.

3.2 Non-government Organizations (NGOs)

Many national NGOs operate in Nicaragua (**Table 3**). The NGO's vary in size from a one-person consultant to large international organizations. Only the major international players and their respective programs were reviewed for this report. International NGOs include Flora and Fauna International, Friends of the Earth, Conservation International, and the World Wildlife Fund.

TNC and WCS are two of the major U.S. based international NGO in Nicaragua. TNC is working in Bosawas Natural Reserve, mainly addressing environmental protection, deferring economic development issues to Nicaraguan institutions, multilateral organizations, and donors. TNC is in the process of developing a trust fund that will assure long-term funding of their programs in Bosawas. Sustainable funding is needed to assure that infrastructure and long term commitments are maintained. This approach contrasts with many other entities whose funding spans only the duration of the project. Many activities are designed without sustainable funding other than the stated intent that Nicaraguan institutions and other recipients will continue program initiatives when formal project funding terminates.

3.3 Donors and Multilateral Organizations

AID is the main U.S. Governmental agency working in Nicaragua with natural resource and economic development programs. The EPA, USGS, and NASA, working through PROARCA, have participated in projects such as:

- wastewater and solid waste training sessions conducted (EPA);
- technical help in developing environmental regulations and policy (EPA);
- assistance on pesticide issues when requested (EPA);
- some assistance on the study of toxic substances in Lake Managua (EPA);
- river monitoring (USGS); and
- GIS mapping (NASA).

Various donor organizations work on Biodiversity issues in Nicaragua. GEF is assisting MARENA, through World Bank funding, with the development of protected area management plans. Unfortunately, GEF does not have funding for implementation. IDB is financing MARENA in agroforestry, the mitigation of environmental impacts in project areas, and plantation establishment. With regard to plantations, IDB finances planting but not long-term management. Plantations also require a long-term strategy for silvicultural and harvesting activities.

Germany, with a long presence in Nicaragua, is financing a long-term manager to oversee the development and implementation of projects in the southeastern part of the country. Their main emphasis, working at the municipal level, is to deter encroachment into protected areas by developing sustainable financing and commerce. The Germans coordinate their work with colleagues from Spain, Denmark, and Austria, emphasizing complementary programs within the same geographic area.

3.4 Commercial Private Sector

Tourism is growing and with proper marketing, it could expand rural economies to the point that they would benefit more from protecting biodiversity than from initiating activities that would negatively impact it. Representatives of the government and the tourist industry (**Table 4**), however, need to agree on how to best increase tourism's role. Determination of carrying capacity is the critical factor for sustaining biodiversity and assuring the continued use of resources in protected areas. Whereas improved access is needed to facilitate tourism, at the same time, it could result in the overuse of resources and have negative impacts on soil, water and wildlife; moreover, it could also cause environmental pollution. Tourism, if properly developed, has the potential of enhancing economic development while having less impact on biodiversity than alternative land uses such as migratory agriculture or grazing.

At least one industry source believes that long-term investment in forestry is feasible in Nicaragua. This optimism is important since forestry requires a long-term investment strategy to realize sustainable economic benefits. Forest industry has shown an interest in pursuing green certification, at least at the level of the primary wood manufacturers. The interest is not related to perceived higher prices; rather, a European-based company, one of the largest wholesalers in Central America, will soon require that their suppliers be certified.

Certification could improve forest management and possibly benefit Nicaragua's small wood-using industries. These might expand in number or capacity, increasing employment and thus reducing the export of jobs to neighboring countries. Presently the Chileans and Danish have a project that is aimed at increasing secondary manufacturing facilities. If these efforts are accompanied with plantation establishment, particularly hardwoods on suitable lands, the demand for wood from native forests should decline. Costa Rica's plantations bordering southeastern Nicaragua have proved to be financially viable activities (**Salvador Mayorga, pers. comm.**). In conclusion, a sound, well-developed forestry program that addresses both the forest resource capacity and secondary manufacturing has the potential to develop viable economic growth while protecting biodiversity.

4.0 STATUS AND MANAGEMENT OF PROTECTED AREAS

4.1 The Mesoamerican Corridor

The 25 biodiversity hotspots cover only 11.8 percent of the planet yet contain 44 percent of the plants and 35 percent of the vertebrate animals as endemics (**Appendix 10.6).** The Mesoamerican corridor extends from Mexico to the border between Panama and Colombia and occupies 1,155,000 km^2, or 0.77 percent of the planet. Of the total area of Mesoamerica, 231,000 km^2, or 20 percent remains as intact forest. Of the intact forest, 138,437 km^2, or about 60 percent, is in protected areas, mainly as moist and wet tropical forests. Nicaragua's contribution to the Central American hotspot is 21,110 km^2 in 24 protected areas in the Atlantic region, much of which remains forested (**Gillespie et al. 2001**).

The diversity of Nicaragua's habitats and wildlife was succinctly stated by Nietshmann (1990): "Nicaragua has the largest tropical rain forest north of Amazonia, the most extensive seagrass pastures in the Western Hemisphere, the widest continental shelf, and stretch of coral reefs in the Caribbean, the longest river, largest lakes, richest volcanic soils, and least populous territory in Central America. Nicaragua has 100 species of freshwater fish, 200 species of mammals, 600 species of amphibians and reptiles, and 750 species of birds. It also has the most revolutions, civil wars, and foreign military interventions, and the longest reign of dictators of any country in Central America." To this list could also be added that Nicaragua was -- and possibly still is -- a site for trans-isthmus canal, has suffered numerous damaging earthquakes, has the largest island in a freshwater crater lake, has a diverse flora with at least 7,000 vascular plants (**Sutton 1989**) and a variety of forest types, contains the most southerly extension of lowland pine forest in the hemisphere, and has had a long history of indiscriminate forest exploitation. By all standards, Nicaragua is quite a place; unfortunately, not too many tourists know about it.

4.2 Types of Protected Areas

Nicaragua's first protected area, a wildlife refuge, was established in 1958, and its first national park was set aside in 1971 (**Harcourt and Sayer 1996**). Since then, 9 different types of protected areas have been established in 76 separate areas that occupy about 18 percent of the country (**Table 5, Figure 3**). The protected areas are defined as follows (**MARENA 1998**):

- Biological reserve – Undisturbed areas that contain ecosystems, habitats, or species of fauna and flora of scientific interest, and where ecological processes and diversity are protected. Low-impact ecotourism and scientific research are permitted.
- Biosphere reserve – Representative samples of biomes and biotic communities of global importance because of their natural and cultural resources. They are designed for conserving biodiversity, genetic resources, and biological integrity, and they are large enough to permit sustained use. The reserves are zoned for research, educational activities, environmental interpretation, tourism, recreation, and sustained use.
- Forest reserve – Conservation of forest resources containing select germplasm for plantings in depleted areas and for industrial plantations. Distribution and management of the reserves meets the needs of ecosystems and plant and animal communities, as well as socioeconomic objectives.
- Historic monument – Areas designated for protection and restoration because of its historic, archaeological, or cultural importance, such as ruins or historic buildings. Research, educational activities, tourism, recreation, and site interpretation are accepted uses.
- National monument – Areas designated for protection and management because of their superior natural or cultural characteristics and nationally or internationally recognized scenic beauty. Scenic restoration, research, educational activities, recreation, tourism, and environmental interpretation are permitted uses.
- National park – Relatively large areas that are occupied by important ecosystems, habitats, landscapes, scenic areas, and nationally or internationally important species. Research, environmental education, tourism, and recreation are permitted.

- Natural reserve – Areas designated to conserve geomorphological landscapes, scenic areas, representative habitat, biodiversity, water, and cultural remains. Research, educational activities, ecotourism, and sustainable use of resources by local communities are approved uses.
- Wildlife refuge – Areas set aside for protecting and managing wildlife habitat for one or more resident or migratory species. Uses may include manipulating species for research or population control, sustainable resource by local residents, and ecotourism under strict control.
- Genetic resource reserve – Habitats set aside to preserve and manage genetic resources of their flora and fauna. Research, educational activities, monitoring, and enrichment and selective use of the species for socioeconomic goals are permitted activities.

Several of Nicaragua's protected areas share borders with protected areas in adjacent countries. Honduras has the Patuca and Tawahka reserves in the Río Coco area, and San Bernando, El Jicarito, and Monticillos reserves in the Gulf of Fonseca region. Costa Rica has the Barra del Colorado, Lacustino de Tamborcito, La Coreña, and the Cerro de Jardín along the Río San Juan bordering Río Indio Maiz.

A review of the adequacy of the protected area system was undertaken recently (**Gillespie et al. 2001**). For purposes of analysis, three major biogeographic regions were recognized, the Pacific, Central, and the Atlantic (**Table 1)**. The conclusions were:

- the Atlantic region deserves and has received high priority for conservation with 23 percent of the area protected; in contrast, 12 percent of the Central region, and only 5 percent of the Pacific region has been set aside;
- 75 percent of all reserves have less than 50 percent forest cover; furthermore, less than 25 percent of the reserves in the Central region have more than 50 percent forest cover;
- the Central and Pacific regions may not be adequately protected;
- Nicaragua is located at the interface between the Nearctic and Neotropical regions in the western hemisphere, yet the country has received little research;
- lowland pine savanna is not adequately represented;
- cloud forest, and oak-pine forests in the Central region are not adequately protected based on the low amount of tree cover within the forests;
- coastal marine systems are important for the survival of turtles and manatees; and
- detailed information is urgently needed on the current status and management of the reserves.

Another assessment of protected areas was just completed in which 64 separate ecosystems were recognized (**Meyrat 2002**). In this study, protected areas were categorized as follows: poor representation, those with 0.4 to 5.0 percent of their total area set aside; fair representation, those with 6.0 to 12.8 percent; average representation, those with 16.0 to 16.7 percent; good representation, from 41.7 to 68.5 percent; and exceptionally good representation, from 73.2 to 100.0 percent of their total area.

Recent reports (**Zeas et al. 2002; Hurtado de Mendoza 2000; Table 5**) summarize the status of the protected areas as follows:

- only 9 areas have approved management plans (10 if the Volcán Masaya plan is included), 4 others are in process, and 14 others were at one time, or are now are being initiated;
- at least 94,200 people live within 23 protected areas;
- at least 19 additional protected areas have one or more near-by human populations capable of impacting the resources;
- only 14 areas receive tourism; and
- only 177 forest guards work in 18 areas with 44 percent of them in BOSAWAS.

In addition to the existing protected areas, another 19 sites totaling at least 84,180 ha have been identified as potential protected areas (**Table 6; Zeas et al. 2002**). Twelve of the sites belong to the state and the owners of seven have not been confirmed. The size of three of the sites has not been determined.

Co-management of protected areas, as practiced in Nicaragua, is defined as a model of administrative collaboration in which the national government cedes administration to an institution or other cooperators that may include private, local governmental, non-governmental, university, or scientific groups (**Zeas et al. 2002**). Since

1996, seven of the protected areas have benefited from co-management arrangements and several others from international support (**Barany et al. 2002**).

At least two other opportunities exist for the development of protected areas. A group of conservationists recently launched an initiative that combines the purchase of real estate with the conservation of tropical forests. The RESCUE Initiative (Real Estate for Conservation of Unique Ecosystems) helps investors buy valuable land with the condition that a conservation easement is incorporated into the legal title of the property. The purpose is to establish clear rules for the investors. Proponents of this approach are looking for governmental support to launch the initiative nationwide. This scheme could be used to create buffer zones of "friendly" neighbors for parks and reserves, to secure connectivity through biological corridors and, in the case of Nicaragua, to help land exchange inside of protected areas.

Carbon sequestration has proven to be a successful initiative for conservation when it is lead by the right agency, for example, as in Costa Rica. However, at present, the Government of Nicaragua has shown very limited interest of this initiative. Properly applied, it could help to preserve large tracks of public and private forest.

5.0 STATUS AND PROTECTION OF ENDANGERED SPECIES

Nicaragua's red list of endangered and threatened plant and animal species was published a few years ago **(Anonymous 1996).** Appendix I contained 28 species: 12 mammals, 7 birds, 7 reptiles and 2 plants; Appendix II contained 218 species: 11 mammals, 100 birds, 8 reptiles, 2 amphibians, 1 arachnid, 1 gastropod, 27 anthozoan corals, 9 hydrozoan corals, and 57 plants, virtually all of them cactuses or orchids (**Table 7**). The combined number of species on both lists was 244 species. MARENA periodically updates and publishes national norms (bans, or approved seasons for capture or kill) for select species (mammals, birds, reptiles, amphibians, fish, molluscs, and cretaceans) in compliance with CITES (**Gobierno de la Republica de Nicaragua 2003**).

The greatest majority of endemic vertebrates in Nicaragua are fishes (**UCA 2002**). Nicaragua´s crater lakes (lagoons) constitute a system of isolated and very limited environments in which the Midas cichlid complex has speciated. Several species have been identified so far and it is highly likely that others will be found (**UCA 2002**). The entire group needs protection; all species should be included on the IUCN red list.

6.0 CONSERVATION OUTSIDE OF PROTECTED AREAS

The national resources outside of the decreed protected areas include private protected areas, forests, agricultural and range lands, coastal and marine ecosystems, and wetlands of international importance.

6.1 Managed Natural Systems

6.1.1 Private reserves

The seven countries in the Central American corridor have about 190 private protected areas occupying at least 214,600 ha (**McCarthy et al. 2003**). In 2002**,** MARENA, working through CBM and in coordination with Fundación Esperanza (the group of private reserve owners), created a network of private reserves in Nicaragua. The norms are very broad, and virtually any farm at least 16 ha in size can be declared as a private reserve. At the moment, there are 23 private reserves totaling 5,856 ha in Nicaragua (**Table 8**). Attractions may include overnight facilities, vistas, coffee production, and tranquil rural surroundings.

6.1.2 Forests

During the 1990s, Nicaragua´s rain forests disappeared at a rate 10 times faster than those in Amazonia (**Barany et al. 2002**). Forestry, however, does not play a substantial direct role in Nicaragua´s economy; in the early 1990s, it represented only 2 percent of the country´s gross national product (**Harcourt and Sayer 1996**). Nicaragua

has relatively little state land and, at the moment, no forest concessions on state land (**Francisco Guerra, pers. comm.**). Permits are required to cut a single tree or for a large scale logging operation. Many companies, however, do not apply for permits, preferring to buy trees directly from land owners or squatters operating independently. Management plans are developed for private, municipal, and indigenous lands, including protected areas (**Lisa Gonzalez, pers. comm.).** Satisfactory management plans are presented to INAFOR through MARENA, and are approved; however, landless peasants often invade the tracts after harvest due to a lack of effective control (**Francisco Guerra, pers. comm.**). In addition, truck owners often purchase illegally felled timber and sell it clandestinely to local mills. INAFOR doesn't have sufficient resources to do field work including timber inspections. Municipal authorities can stop any logging operation; however, they too lack money to conduct field inspections. Finally, the vast majority of INAFOR employees work in Managua and other cities, far from the actual logging operation. The report entitled "Dynamics of the forestry sector in Nicaragua from 1960 to 1995" provides an overview of many of Nicaragua's forestry programs and problems (**Alves-Milho 1996**).

Forest inventories were reputedly not available today; however, in the past, at least eight forest inventories were conducted in Nicaragua covering nearly 2,250,000 ha (**Weaver and Bauer 2000**). Forest certification was introduced to Nicaragua in 1996 but as of April 2000, no forest operations were certified (**Guillén Vallejas 2000).** Literature on low impact logging with suggestions for annual work plans, tree selection, skid trails, log transport, and other norms (**Carrera and Pinelo 1995**) is available in local libraries. It is not know to what extent these techniques are used.

In 1990, a project entitled "Development of Forest Management Systems and Agroforestry for the Utilization of Humid Tropical Forests in Southeastern Nicaragua" was initiated (**Mejia Casco 1996**). The first line of inquiry included species composition and structure, the effects of liberation, and regeneration. The second line dealt with non-timber products; the third, with seeds and seedling development. An assessment of these techniques after 10 years or so could be informative. With regard to forestry in general, many of the suggestions made in the Forest Action Plan (**MEDE IRENA/ECOT-PAF 1994**) on policy, legislation, financing, land tenure, and human resources continue to be relevant, but are certainly more easily stated than implemented. Forest policy should address several issues (**Budowski 1998**):

- defining forest lands and their subsequent management;
- appreciating and valuing forest resources (environmentally, economically, and socially) and creating incentives for sustainable management;
- obtaining the greatest value added for forest products;
- promoting natural reforestation or plantations on denuded lands;
- integrating forest management with other land uses;
- implementing research with a long-term vision;
- educating and training at all levels;
- participating in international efforts (conventions, treaties, protocols, and bilateral or multilateral actions); and
- monitoring and periodically revising the policies in view of new developments and priorities.

Between 1962 and 1992, Nicaragua established 21,500 ha of forest plantations using at least 38 different species (**Centeno et al. 1994**); another report states that 51,267 ha were established by 1997 **(Silva et al. 1997**). There appears to be a conflict in these data unless the country had an extremely active program during the 1990s. Regardless, neither private nor public tree plantings are common in Nicaragua. Of the total areas planted, 67.6 percent were for timber, 26.0 for fuel, 3.9 for protection, 1.8 for seeds, and 0.7 percent for research and education. In a USAID funded report (**Ladrach 1996**), several areas with plantation potential were described. The biological potential of several areas was considered good with the only major drawbacks for commercial production being logistical -- transportation and land tenure. The recent bark beetle outbreak in Nicaragua's northern pine forests led to a degradation of soil and water resources in vast areas of the Nueva Segovia Department. Some timber operations have closed during the past couple of years. Given the variety of possible objectives for tree planting, including aesthetic purposes, reforestation may offer viable options for long-term income generation in some protected areas.

6.1.3 Agriculture and Rangeland

Most of Nicaragua´s forest destruction was due to past land clearing for agriculture and indiscriminate forest exploitation for timber and fuelwood (**Heiner et al. 1989**). After 2 or 3 years, agriculture was discontinued on much of the land when the depleted soils were abandoned to grazing. Despite current land use trends, only 34 percent of Nicaragua is suitable for agriculture. Of the remaining area, 44 percent is best adapted to forest production, and 22 percent to the protection of watersheds and conservation of important ecosystems. It is noteworthy that commercial extraction in advance of the agricultural frontier accounted for only 3 percent of the total volume. Another 15 percent was used locally. The remainder, 82 percent, was either burned or discarded!

Nicaragua´s best lands for permanent agriculture or grazing, settled early by the Spanish, are situated in drier western part of the country. Much of the mountainous Central region and humid Atlantic region could be best utilized under permanent tree cover. Ownership patterns are highly skewed; 40 percent of the farms are less than 3.5 ha in size (**Bathrick 2003**). Small farm size limits earning capacity. In contrast, large land owners are seldom able to exploit their productive potential due to capital constraints.

The cultivation of coffee is common in mountainous areas above 800 m. With the decline in coffee prices during the past 5 years, some farmers have sought complementary sources of income. Tourism combined with certification of specialty coffees allows some owners to collect a better price for their produce. Finca La Hamonia and Selva Negra Hotel have combined tourism and coffee production for over 30 years. Other coffee growers are tapping into the potential benefits of tourist from Cruise ships offering a variety of services for short-term visitors (coffee tours, horse back riding, and bird watching). These services often attract 40 or 50 visitors per tour. Some owners have been so successful that they are financing more infrastructure to provide services to a wider audience, including organized tours of foreign visitors. Through the efforts of CLUSA, USAID, and several European donors, the number of farms under organic production has increased steadily over the last 7 years.

CLUSA has been working for 7 years helping coffee producers to certify their crops as organic according to established standards. Other groups have also provided limited assistance. The Rainforest Alliance provides eco OK certification for farms that are managed in a sustainable manner. The amount of shade (forest corridors), the use and storage of pesticides, and water, are important factors in certification. In recent months, INTUR has been promoting a hiking route called “La ruta del café,” one of the first attempts to highlight agroforestry in Nicaragua. Visitors enjoy a series of haciendas in Jinotega during weekends. This pioneer effort is creating positive expectations among coffee growers in the largest and most productive coffee growing area in the country.

The owners of La Finca Los Alpes are offering monthly birdwatching tours that attract an average of 50 birders per trip. This interesting alliance between a local birding organization (Group de Observadores de Aves Guardabarranco) and the land owner also allows the birding group to sell a variety of souvenirs in three Managua coffee shops.

6.1.4 Coastal and Marine

In general, the Pacific coast is characterized by problems associated with the harvest of fuelwood and the production or capture of shrimp and lobsters; the Atlantic coast, in turn, faces pressures caused by traditional fishing. During the decade of the 1990s, the Nicaraguan government and industry tried to establish consensus regarding coastal areas (**Camacho Pacheco 2000).** The law in effect at the time was old and the general lack of resource information along with the potential for conflicts among interested parties made progress difficult**.** Specifically, some of the salient problems associated with the conservation of the marine environment and its species were:

- the excessive harvest of lobsters and shrimp and the need to determine harvest capacities to maximize sustained yield and to optimize income;
- the interruption of shrimp culture raising questions about the sustainability of operations;
- the excessive harvest of popular species by traditional fishing;
- the lack of harvest records for less popular fish species;
- the need to determine the best organizational arrangement and the best means to administer coastal resources; and

- the need for a regional research program and action plan for coastal zone management.

Recent studies have been conducted in the Miskito coast protected area including surveys of fish, coral reefs, sea grass meadows, botany, wetland birds, and manatees and dolphins. Surprisingly, few people in Nicaragua know about these surveys suggesting the need for better communication.

6.1.5 Wetlands of International Importance (Ramsar)

The Convention on Wetlands was implemented in Nicaragua on November 30, 1997. Nicaragua currently has eight sites with a total of about 400,000 ha (**Table 9**). The largest is the Bahía de Bluefields with 86,500 ha and the smallest the Apanás-Asturias lake (reservoir) with 5,415 ha.

6.1.6 Land Tenure

It has been said that legal irregularities affect 70 percent of Nicaragua's farm land (**Bathrick 2003**). At the moment, the number of legitimate registered land titles is greatest in the Pacific region where perhaps 10 percent of land owners have problems; in the Atlantic region, those with difficulties may approach 60 percent. During the 1980s, the Nicaraguan government implemented changes in land tenure that were later characterized as a disorderly distribution without technical or administrative help, or education for the recipients (**MEDE, IRENA, ECOT/PAF 1994**).

With regard to protected areas, the general environmental law states that inhabitants become the caretakers of the sites with all of the guarantees and rights enjoyed by other Nicaraguans (**Zeas et al. 2002**). However, all private property situated in protected areas of SINAP are subject to management conditions specified by law. Those land owners who do not accept the prevailing legal framework will have their properties subject to appropriation, purportedly with remuneration, for public benefit. All protected areas within the public domain must be registered in the name of the state (Nicaragua). The protected areas program has the means to protect the resources on private properties as long as they do not conflict with public rights. Owners may develop recreation and tourist activities with technical assistance and follow-up, providing that they are approved by the protected areas program.

The land reform programs outlined above have impacted many actual landowners and others who claim land. In addition, the settlement scheme or "advance of the agricultural frontier" toward the Atlantic coast was characterized by limited timber harvest, slash and burn agriculture, and squatting. There are also large tracts – RAAN and RAAS – that are claimed by indigenous groups; moreover, municipal governments (the state government) also have properties. If matters of land tenure are ever settled, it may be found that the state owns a limited portion of the total.

The uneasiness which prevails with regard to land tenure throughout Nicaragua does little to instill confidence in anybody, especially individuals or entities responsible for the management of protected areas. The issue of land tenure impedes the development of sound environmental and economic programs. Sound, long-term economic growth depends on resolution of the land tenure problem. Natural resource protection and sustainable economic growth requires long term investment security; however, in Nicaragua today, risks are so great that only short term ventures appear feasible to prospective investors.

6.2 Impacts of Development Projects

Major development projects that would require environmental impact statements could include hydropower plants, the introduction of *Tilapia* sp. into reservoirs, the construction of major new highways, major tourist developments, and other similar proposals (**Brenes Toribio, pers. comm**.). Information regarding current proposals for major projects is available by request from the Director de Regulación Ambiental in MARENA. General information is currently available at the following e-mail address -- ucresep@gob.ni.

Given the lasting impacts that characterize timber removal in the tropics, forest industry may be considered as a major development project, or perhaps more accurately, as a series of major development projects. During the early 1990s, Nicaragua had 75 sawmills with an installed capacity of about 300,000 m^3, but an actual production of only 90,000 m^3 (**IRENA 1992**). In 1995, the annual production remained about the same. In the Segovia region, the total annual mill capacity was 110,000 m^3; annual production for this same area was 60,000 m^3 while actual production was only 25,000 m^3 **(Alves-Milho 1996).** If full mill production capacity were attained in Segovia, it would have a devastating impact on biodiversity and long-term management of natural resources.

Other development projects that impact fauna and flora include the pet trade (ASOFAUNA) and the export of hunting trophies. The origin of all of the birds and most of the amphibians and reptiles exported in the pet trade are wild populations, even though the export permit states that the animals came from ranches. For this reason, the contribution of the pet traders to biodiversity is, if anything, detrimental for the conservation of native species, especially for parrots and some reptiles and amphibians. A similar situation occurs with non-timber plant exporters who sell Spanish Moss (*Tillandsia usneoides*) and orchids. More information is needed to quantify trade volumes. The current government, represented by MARENA, is slowly moving to ban wildlife exports and promote captive breeding. To date, this has not been very successful.

Today, tourism is probably the fastest growing sector in the Nicaraguan economy. Well-planned, sustainable tourist operations could greatly benefit surrounding natural areas. The tourism group INTUR maintains a database of all major tourist projects and also grants construction permits to investors who may then claim a 15 percent tax exemption according to the new tourism incentive law. The law, however, is intended for projects greater than $150,000 in rural areas and $500,000 in Managua. This quantity exceeds the capacity of most Nicaraguans, especially local investors who may be interested in building a few cabins in protected areas. Currently, there is great expectation for a major project, funded by the International Development Bank, to build a coastal highway from Chacocente Wildlife Refuge to the Costa Rican border. A project of this nature, however well-intended, could cause accelerated destruction of both marine turtles and coastal forests.

Construction of access roads in coastal areas is an environmental concern. Since roads are not considered as tourist projects, there are few environmental requisites for their construction. Recently, there has been a trend to privatize coastal roads, particularly along the southern Pacific coast. Theoretically, nobody can own coastal areas or river banks because of a 1910 law that states that land within 2 km of the coast or 500 m from a major stream belongs to the public. Municipalities have relied on this law from time to time to issue construction permits and proclaim use rights for particular activities.

During the past decade, parts of Nicaragua have become attractive to real estate developers. Beginning in Granada and along the numerous beaches in the southeastern part of the country, investors looked for large, colonial houses that could be converted into small hotels or restaurants. Earlier, investors were interested in timber concessions for large scale logging operations. Some of them viewed logging as a means to earn cash to finance infrastructure and other operations. Today, a growing number of foreigners are buying properties all over the country, including beaches and lowland rainforest, with an interest in ecotourism.

The last potential issue of concern under development projects would be that of expansion of major urban areas such as Managua, León, and Granada. Municipalities issue permits for construction projects. Environmental standards, however, rarely apply. Rural lands around the major cities are converted with little concern for deforestation or erosion. Urban planning, including such issues as urban forestry and greenbelts, especially in Managua where so much urban land remains undeveloped, could produce major benefits for future city residents.

7.0 CONSERVATION OF ECONOMICALLY IMPORTANT SPECIES AND GERMPLASM

The seed bank of INAFOR, which stores seeds of economically important tree species, is probably the only center in Nicaragua with a history of ex-situ germplasm conservation. The numbers of species and seed volumes being stored at the moment are unknown. In the past, some of the stored seeds showed low germination rates, possibly due to problems with seed handling or short dormancy periods.

Managua's Arboretum was founded in 1990. It occupies 3000 m^2 and contains about 200 different tree species. It is unlikely that records are being kept regarding the source of the trees. Although the value of this center for germplasm conservation is limited, its potential for education of urban students should not be underestimated.

Nicaragua has three herbariums of importance. The largest and best equipped is the National Herbarium at UCA; the next in importance is the herbarium at UNAN in León. Both are well managed. The third, at UNA, has good storage facilities. However, the specimen collection requires professional attention. None of these facilities store live germplasm but their collections are crucial for the identification of botanical specimens.

The national zoo, with a number of native and exotic species, is located 16 km outside of Managua. It is currently administered through a private foundation, the "Amigos del Zoológico Nacional." Recently short on finances, the managers initiated an aggressive fund raising campaign to pay the costs of feeding the largest animals. The national zoo does not have a certified captive breeding program for any of its species; however, it accepts donated animals, acting in part as a rescue center. The types of records that are kept are unknown. Nicaragua also has several private zoos where maintenance standards are lax; this is a concern for the well being of the animals, some of which are endangered. Neither MARENA nor the municipalities exert any real control.

Nicaragua, the main regional exporter of wild animals, works through an organized group of pet traders known as ASOFAUNA. Parrots, and several species of amphibians and reptiles, constitute the bulk of the trade. The pet traders claim that they are exporting animals that have been reared in captivity. This claim, however, seems unfounded for several reasons. First, most of the facilities do not meet the minimum standards for captive breeding. Second, control records of origin or animal pairing are not kept. Third, CITES officials are currently reevaluating the system that has been used to certify these facilities in the past because of many irregularities. For example, most traders capture parrots out of season. A recent dissertation disclosed a mortality rate of nearly 80 percent between the dates of capture by farmers and export from the country. Some reports suggest that the internal pet trade, which does not abide by the regulations, is greater than the international trade.

8.0 MAJOR ISSUES AND RECOMMENDATIONS IN FOREST CONSERVATION AND BIODIVERSITY

There are several reasons for the conservation of protected areas and endangered species (**Ruiz 2003**). Among the most important tangible benefits are to protect original food sources (in Nicaragua, basic grains), economic (supply of skins, and animals to the pet trade or zoos), scientific (quest for drugs and indigenous medicines), and environmental services (pure air and water, fishing, hunting, and outdoor camping). Among the intangible benefits are aesthetic and cultural values. A good specific example of the value of protected areas is the 20 ha parcel of private forest where the Rio Chiquito, Achuapa, arises (**Zeas et al. 2002**). The spring benefits 20 communities with clean water supplies.

USAID should make Nicaragua the place to observe with regard to protected areas. That means setting the standard for the entire agency by being innovative and taking calculated risks, particularly in the field. It might be helpful to recall that USAID's support for the Volcán Mombacho program developed by COCIBOLCA was considered risky. Today, the Mombacho program is viewed as one of the best in the country (**Weaver and Díaz Santos 2002**).

What are the main issues in biological diversity and forest conservation in Nicaragua? To answer the question, one approach might be to develop a laundry list of perceived necessities. On the other hand, it might be more useful to indicate a few major areas where a concerted effort could lead to success. To be effective in its forest conservation and biodiversity program, USAID should consider several complementary initiatives simultaneously. Moreover, and this is critical, USAID must contract a full time person to promote a coherent and dynamic biodiversity research program that highlights the importance of forests and protected areas for the well-being of Nicaragua.

8.1 Policy and Legislation

- **Laws and their Interpretation --** There appears to be a conflict with the law that prohibits timber management within the protected areas but simultaneously allows MARENA to approve timber harvest as an option. Moreover, the fees collected for logger's permits are used to help pay for the activities of INAFOR. This practice could be viewed as beneficial since it helps pay for the agency's work; however, at the same time, it could be considered a conflict of interest. Without repeating exact details, some of the stories told about illegal activities by field personnel (e.g., illegal hunting in protected areas) do not inspire much credibility in the agency's stated mission. Moreover, INAFOR, the agency responsible for enforcement, does not assure the implementation of the best logging or silvicultural practices outlined in approved management plans.

- **Private Reserves --** Some private reserves receive limited economic support from different donors and openly compete for funds with national parks and nature reserves. Land owners within national parks and reserves do not receive any incentives to conserve their land. This, in essence, constitutes discrimination between private reserve owners and land owners with property within protected areas. To avoid unfair competition within SINAP, a ranking system should be considered for determining funding priorities in private and public reserves.

- **Incentives and Taxes** -- There is little incentive to preserve forest in Nicaragua, even within the boundaries of protected areas. Currently, taxes to process and sell timber within Nicaragua are higher than the taxes paid to export the same product into neighboring countries and overseas. Also, INAFOR requires that tariffs on timber harvest be paid before the timber sale and not afterwards. The need for this requisite should be reviewed by INAFOR; past experience, however, may justify this measure.

A comprehensive environmental law should be fashioned to encourage the conservation of forested areas, including protected areas, through the use of incentives and low interest loans. It is possible that the long-awaited new forest law will achieve these objectives. The government should make every effort to enforce all existing environmental laws and regulations.

8.2 Forest Conservation and Biodiversity

- **Basic Problems --** The problems facing forest conservation and biodiversity in Nicaragua are numerous and include the advance of the agricultural frontier (accompanied by deforestation and forest fragmentation), illegal hunting and commercialization in the pet trade leading to the loss of animal populations, the negative impacts of exotic species, and environmental contamination (fertilizers, herbicides, and human and domestic animal wastes). In coastal areas, excessive fishing (favorite species, lobsters), turtle poaching and egg stealing, if not controlled, will deplete resources. The current status of wildlife populations is not being monitored in Nicaragua's terrestrial or aquatic protected areas; continued lack of attention could leave the country with disturbed habitats largely devoid of major wildlife.

- **Endangered species** -- Endangered species constitute many problems, not just one! The CITES I list for Nicaragua contains 28 species and the CITES II list has 216 species. Most researchers and managers in Nicaragua agree that there is insufficient information regarding the abundance and distribution of terrestrial wildlife species to formulate management guidelines. Moreover, among Nicaragua's greatest treasures are its numerous, attractive volcanoes, some of which contain lakes (or lagoons) and endemic fish species. Lakes Nicaragua and Managua also contain endemic fish including freshwater sharks. Current threats to fish in Nicaragua's lakes and lagoons come from wastewater pollution and the introduction of exotics like *Tilapia*. The major threats in coastal areas are from shrimp farming, excessive fishing, fuelwood harvest, and coastal development projects. To protect Nicaragua's wildlife, each species on the endangered list must be known along with its habitat requirements.

- **Some Possible Solutions --** Habitat (forest or aquatic) conservation is the best means to protect wildlife species; in short, curtail deforestation and overuse of aquatic resources. Once disturbed, forest recovery may be achieved in different ways. Secondary forest (that arising after abandonment of agriculture) provides better habitat than barren land or pasture; eliminating fires would encourage natural regeneration. Species of critical importance

within the respective ecosystems could be favored in thinning operations or through enrichment planting. Another option for improving habitats in protected areas would be to plant multi-purpose tree species for timber, aesthetics, fruits, fuel, or other forest products. Agroforestry programs that include permanent shade crops like coffee and cacao (but not to the point of saturating the market) might be another alternative. The establishment of capture seasons and harvest limits for aquatic species would allow use without depletion.

8.3 Protected Areas

- **Basic Problems** -- There are 76 individual protected areas and many have less than 50 percent forest cover. Their boundaries are not defined or patrolled, and forest guards are few and scattered. Illegal hunting and extraction are commonplace. Most do not have appropriate management plans. Several protected areas have people living within them or a short distance away presenting concerns about greater pressures in the future. Forests that are devoid of their principal tree species do not provide good habitat for wildlife. In addition, certain habitats are not well represented in Nicaragua's protected area system among them the lowland pine savanna, cloud forests, and the oak-pine forests in the Central region (the last because of the low amount of tree cover).

- **Corridors** -- The concept of the Atlantic corridor provides a positive approach to visualizing the idea of habitat connectivity throughout Central America, at least along a latitudinal gradient. The corridor, however, is highly fragmented, and in coastal areas, is beginning to experience the pressures of real estate development. Moreover, the Atlantic corridor is often the only gradient that is visualized. Two other terrestrial corridors exist: the cross-isthmus gradient, from dry lowland to wet lowland forest in southern Nicaragua; and an altitudinal gradient from lowland to cloud forests in north central Nicaragua. Both are critical to animal movements and migrations, especially after major climatic events such as hurricanes.

- **Possible Solutions** -- Co-management, a good idea, appears to be successful and is generally viewed with enthusiasm. Environmental education in public schools in the vicinity of protected areas, Project Base (Basic Education Program?), could prove influential in the future, especially if the program has an energetic staff and an engaging series of presentations and field activities. Some questions remain, however. Is co-management the only solution, or even the best solution (see incentives)? Other opportunities exist. Well-managed private reserves exist, and several other private sites are under consideration as potential protected areas, some of which would improve connectivity within corridors.

  Local populations need to be conscious of the importance of conservation so that they assume control in protecting these areas. This should be achieved through a combination of incentives for educational and economic activities. Sound scientific management guidelines should be developed to allow sustainable harvest of forest products, fish, and game. Studies of carrying capacities are needed to establish appropriate limits for hunting and fishing. Once such information is available, local co-managers, MARENA, and tour operators must highlight the importance of sustainable harvests (allowable harvest limits and established seasons), and provide satisfactory guidelines and enforcement for conservation purposes. Assistance in the development of hunting and fishing regulations may be available through cooperation with U.S. agencies

8.4 Research and education

- **Basic Problems** -- The information required for the sustained management of endangered or threatened species and protected areas in Nicaragua is insufficient. At the same time, educational opportunities for local biologists are severely limited. In a country where poverty is the main concern , voices favoring the wise use of natural resources are few and largely ineffective. This combination of circumstances suggests some possible approaches to improved resource management.

- **Possible Solutions** -- USAID should create a term appointment position for a qualified research manager realizing that practical research (that is, research aimed at answering questions needed for sustainable management) can play a role as important as management in the protection of natural areas, especially when both are virtually absent. The manager would as the expert on protected areas within Central America; assist in the development of local scientific capacity; meet with interested groups (local government, NGOs, USAID,

interested citizens) about environmental issues; supervise a multi-national small grant research program with local professors and qualified students; record protected area (research) benefits to society; maintain records on certified timber operations and CITES information; and help to manage baseline data on protected areas.

The research manager would be stationed in Nicaragua. Among the activities designated to this person would be:

- **Environmental data base** -- The research manager would compile a data base that would allow USAID and its clientele instant access to environmental information provided in all USAID/Nicaragua reports (current and past). If USAID does not want to have a library of U.S. government materials in its building, then it should pay an NGO to organize one and make its contents available to USAID consultants and interested people in Nicaragua -- in perpetuity, and at a cost.
- **Protected area matrix** -- The research manager would develop an "idealized matrix" of protected areas based on climate, geology, and soils information to determine how well represented the current protected area system represents the environmental possibilities within the country. Valuable initial work is already available on this topic. The amount of forest cover and economic activities (existing and potential) within protected areas would be of primary interest.
- **Endangered species matrix** -- The research manager would begin to deal with endangered species as if each species were endangered instead of lumping them into a category called endangered species. A matrix of what is known for each endangered species -- the size of remaining populations, adequate habitats, the level of management at protected areas and elsewhere, on-going research (this includes universities in the U.S. and Europe), and major threats. It is not sufficient to say nothing is known because, in most instances, that is not correct. Many USAID consultants aren't familiar with scientific information and tend to repeat the statements of uninformed individuals. There is information -- it needs to be made available!
- **Research and management needs list** -- The research manager would develop a priority list of studies and management activities for all of the protected areas within the country. Indeed, this list must be long; however, not everything is on the list. The purpose of research in Nicaragua is to answer practical questions for management purposes and not to pursue esoteric questions.
- **Small grants program** -- The research manager would initiate and manage a small grants program for local students working through qualified and reliable local or foreign university professors. The work, however, would always be conducted in Nicaragua and would be according to the needs list. Most likely, it would contain rapid assessments of species' populations and other resources. This research effort could be considered as the "eyes and ears" of conservation in the field, or, a source of information on existing management and current threats to maintaining the protected areas system. The major thrust would be to have Nicaraguan students help educate themselves by working in country on practical problems.
- **Local education** -- The research manager would help to develop local talent and a local voice for conservation through practical field research. Researchers, by their nature, are prone pursue topics of interest to them. Funding, however, must be directed at management questions.
- **Cooperating entities** -- The research manager would, where feasible, cooperate with: multi- and bi-lateral entities within Nicaragua, including the U.S. Peace Corps; local universities and their professors; and scientists (local, United States, and foreign).
- **Library** -- The research manager would help the current Nicaraguan library system in Nicaragua receive available literature (mainly in Spanish or English). Literature is available but there is no active program in Nicaragua to receive, categorize, protect, and make it available to users. It might be beneficial to approach a potential donor of space (university, national bank, other) and request facilities for the development of an environmental library. Materials would be available from U.S. government agencies, the United Nations, CATIE, and numerous researchers and governments throughout the hemisphere.

8.5 Forestry and Management

- **Basic Problems** -- Traditional logging has used only a fraction of the total timber volume within the forest despite the availability of technical information on major timber species. The forest, in general, is undervalued, both from the standpoint of the timber that it yields, and the environmental benefits it provides to society. The cost to the nation is considerable when soil fertility, farm productivity, water supplies, and wildlife and their habitats are destroyed. A large amount of timber is exported without processing (secondary products), losing

jobs and value-added products to the local economy. Management plans, required for logging permits, are elaborated, but subsequently are not enforced; moreover, biodiversity issues are not considered in the plans. Migratory agriculture follows logging and destroys the residual forest on which sustained forestry could have been developed. In summary, the future of the nation's forest resources (timber, biodiversity) and opportunities for sustained resource management are traded for virtually nothing.

- **Possible Solutions** -- Several alternatives are available for resources management. Sound strategies need to be elaborated in environmental documents so that they assure that endangered species and others of concern are not adversely affected. Site specific surveys of all wildlife species (fauna and flora) need to be carried out before finalizing management plans. Management plans need to assure that there is no adverse impact on the endangered species including the national tree (El Madrono) and the national bird (El Guardabarranco). Moreover, management plans need sufficient funding to be implemented.

  Certification of forestry operations in buffer zones could help guarantee long-term production. An assessment of the economic advantages of green certification should be addressed before supporting certification programs. At the moment, the potential advantages of certification are uncertain except that some potential markets prefer certified wood but apparently are unwilling to pay a premium for it. The establishment of timber plantations would reduce the remaining pressures to exploit natural forests. The development of secondary industries in Nicaragua could provide better use of existing forest resources, as well as more jobs and income to the nation.

  Industry and governmental agencies should cooperate to pass the new forestry law so that plantation incentives and investments can be strengthened. Funds should be made available for loans or investments in forest land purchases, plantations, thinnings, and secondary industry development. Moreover, INAFOR needs to strengthen its regulatory enforcement for the implementation of management plans. Any proposed forestry project that might suggest that local mills operate at full capacity must assure that forest resources are available for sustained production; a careful examination of available forest resources would not support such a program.

8.6 Tourism

- **Basic Problems --** Tourism is potentially the nation’s gold mine! During the past decade it has increased significantly in importance despite concerns regarding marketing and a few negative travel advisories from foreign embassies. Only a fraction of the protected areas, however, currently receive tourists. Seven of the most utilized areas are under co-management. Before encouraging a major influx of tourists, several issues should be addressed, among them: land tenure, to facilitate long-term investment; and carrying capacities, to assure that the resource base is not degraded by overuse. Carrying capacities would include the types and intensity of tourist impacts on ecosystems such as anticipated number of visitors, needs for infrastructure and services, trail use, hunting, fishing, waste disposal, and other requirements. Development should be carefully planned, based on carrying capacities, to avert degradation of the resource base. After such information has been used for the design of programs and facilities, INTUR and the tourist industry could develop strategies to target markets in their tourist promotions.

- **Possible Solutions** -- INTUR technicians need clear guidelines to evaluate the environmental impact of all proposed facilities (site plans, construction, and habitat restoration) in protected areas. These should include developing carrying capacities for tourism, recreation, hunting, and fishing. Once carrying capacities and infrastructure have been developed, INTUR, MARENA and the private sector should design a strategy to improve access (for example, roads, airports, boat docks). In addition, INTUR and MARENA should work closely in developing long-term strategies for the development and marketing of tourism. Each member of the tourist association represents different areas, and could highlight particular sites and activities. A tourist loan institute could provide low interest loans for investments in tourism including infrastructure, facilities, interpretative signs, and marketing. Efforts should be made to coordinate activities between U.S. and Nicaraguan tourist companies in the promotion of tourism. INTUR also needs to work with MARENA to keep data on visitor numbers, origins, preferences, and other useful information. The National Museum may also offer useful suggestions for the development and promotion of archeological sites including joint ventures highlighting areas of natural and archeological importance. One possible addition to tourism's programs could be an adventure tour following the 1849s gold route through Nicaragua: up the San Juan River and across Lake

Nicaragua to Granada by boat, and then on to Corinto by stagecoach. The gold route excursion could be offered in segments, or entirely. Importantly, INTUR and MARENA need to take seriously negative travel warnings. These indicate a deficiency in local service or protection that can only worsen if not addressed!

8.7 Awareness and Communication

- **Basic problems** -- Nicaragua is a poor country. Given its economic condition, it may be thought that little public support could be generated for protected areas and endangered species. However, public awareness is imperative if the Nicaraguan government is to generate support for its biodiversity programs. In the Lesser Antilles, an area with similar economic difficulties, a dynamic leader with an enthusiastic program was successful in protecting wildlife.

- **Possible Solutions** -- The well-tested approaches include the development of promotional materials (brochures, movies, slides, calendars, and power point presentations) for protected areas that are sold to visitors at a margin of profit for the management unit (MARENA, or NGOs). Also, TV breaks (commercials) sponsored by major Nicaraguan banks and businesses highlighting rare and endangered species, or possibly protected areas, in "Believe it or not" type of presentations, might prove catchy and successful. Visits to foreign embassies might help generate access to overseas markets. Educational programs on television could also prove effective.

  A more novel route might be through school programs where inexpensive promotional materials are made available to students, and indirectly, to their parents. An ambulatory group could also present programs on biodiversity or wildlife. A popular newspaper similar to the "Natural Enquirer" in the U.S. (published 2 or 3 times per year) could be produced. The Enquirer would highlight Nicaraguan scientists and their field activities in an easy-to-read fashion aimed at high school students. Another way to foster interest in biodiversity would be to develop school projects that highlight lesser known protected areas, and one or more of the plant or animal species that appear on the CITES Appendix I or II lists.

8.8 Investment

- **Basic problems** -- Given its past political instability and land tenure problems, Nicaragua is considered a high risk environment for investment. Moreover, there is a lack of incentives to protect biodiversity. The long-term funding mechanisms needed to sustain projects initiated by donors, multilateral organizations, or NGOs are usually lacking. The impact of numerous short-term projects on biodiversity can be negative since funds are only available for limited periods.

- **Possible Solutions** -- One of the strongest arguments for protected areas is that tourism generates more GDP than many other segments of the economy including forest industries. Moreover, some well-to-do tourists will travel great distances and spend considerable sums for activities like sport fishing or adventure tours. Several approaches are available to generate financial resources for protected areas management, including: spend less money on maintenance (pool NGO resources); generate income from sales of novelty items; search for local sponsors; search for international funding; and, turn to private enterprise for management.

  The first approach would be to request from the mayor of Managua a space for the operation of an attractive center where all environmental NGOs would be allowed to display information; the second, to sell items at the center. Space would be adequate to highlight the major attractions of the protected areas represented by the cooperators. An entrance fee (tourist vs. resident rates) would be charged to visit the center. Once inside, visitors would be allowed to see a free power point presentation of Nicaragua's protected area system. Slides, brochures, and novelty items could be sold for profit. A small counter for coffee and pastry might also be profitable. The NGOs might also sponsor a common web page with all sites included.

  The third approach would be to stimulate an environmentally friendly ethic among investors in Nicaraguan projects -- "take pride in Nicaragua, the most beautiful Central American country!" At the same time, the government could provide clear rules and guidelines for real estate owners who have property within protected

areas. All ecological information would be available to all interested parties. Conditions would be sought to attract investment in and around protected areas to build basic infrastructure to accommodate visitors. Overnight facilities, where appropriate, and services would be included.

The fourth approach would be to assist local NGOs to build fund-raising capacities at the international level. Funding is needed to develop long-term private investment in forestry and tourism; specifically, NGOs need funding mechanisms to carry out sustainable projects.

Finally, the direct purchase of property by private individuals, or the lease of long-term concessions (40-years?) on state properties, should be used to stimulate the development of the protected areas program. This could be a viable alternative to co-management -- and perhaps, a better one for conservation, especially if property boundaries are satisfactorily demarcated. If controlled appropriately by legislation, private ownership would be a simpler, more direct approach to management, and probably more likely to succeed in the long run. To be most effective, some control must be exerted on the uses of surrounding private or public properties (the buffer zone concept). All planning, development, and management in the private protected areas, however, would be subject to state law.

9.0 ASSESSMENT OF PROPOSED USAID/NICARAGUA 2004-2009 STRATEGIC PLAN

USAID produced a proposal (strategy?) for economic growth for Nicaragua for the period 2004-2009 (**Bathrick 2003**). The document appears more as a historical review with possible avenues of exploration than a country strategy. The following observations, comments, and concerns are limited solely for the items numbered 1 through 7 on pages 31 to 33:

Fruits and vegetables: The statement does not locate the proposed production sites. Soils and climate (rainfall, temperature) will be important in site selection. Pineapples are likely to be in the Pacific region; flowers, and possibly some vegetables, in the mountainous Central region. Many fruits have an ample range. The major concerns, if proposed, would be the construction of new roads in forested areas, and the potential heavy use of chemicals (fertilizers and herbicides) that could ultimately enter water bodies.

Specialty coffee and coffee diversification: Quality coffee would likely be grown in mountainous areas above 800 m in elevation, mainly in the Central region. Specialty brands possibly labeled as “organic, shade grown, or bird friendly” would depend on a market willing to pay the price. Usually shade grown coffee is: produced over a longer period of time; results in the production of some larger, reputedly higher quality beans; is better adapted to a family enterprise because of the prolonged production schedule; provides better ground cover and reduces soil erosion; and, favors bird species more likely to be found in tree canopies as well as some that are common closer to the ground. One concern would be the saturation of the specialty coffee market and a subsequent drop in prices. This could result in abandonment of shade coffee in favor of other activities, possibly open grown coffee production, or grazing. Regional strategies should be developed (see cacao below).

Livestock and dairy products: Although Nicaragua has some excellent rangelands, much of the land where cattle are grazed is too steep, subject to erosion, or infertile. The major concerns would be clearing forests or wetlands for new pastures, overgrazing, soil compaction, reduction of infiltration, greater runoff, negative impacts on water quality and regimen (flow during the year), and possible downstream sedimentation. Good rangeland management practices could alleviate some of these concerns but only if appropriate terrain is selected initially.

Forest products: There are several concerns regarding forest products. First, the lower costs for shipped woods is not explained -- that is -- is it due to lower production costs in Nicaragua than in other countries, or some other factor? If so, does this suggest that U.S. and Canadian interests would simply be purchasing tropical woods that are undervalued in price? Moreover, taxes are reportedly higher for operating local lumber yards than for exporting unprocessed timber. It would seem that both of these conditions would lead to a greater exploitation of Nicaraguan timber supplies but would not give the country the maximum benefit from secondary wood processing. Second, the introduction of portable sawmills will not avoid massive cutting practices; good management, however, could do this. Third, the introduction of “more sustainable systems” has little to do with “compute(r) technology,” or with new management systems. Many management systems have been around for years. Most of the current management

plans, complete with inventories, and approved by INAFOR, are informative documents, although the issues of forest regeneration and biodiversity may not be satisfactorily addressed. What precludes sustainable forestry is the post-harvest invasion of residual forest by landless peasants or clandestine timber merchants. Fourth, the secondary industries mentioned above should be developed; however, if all of Nicaragua's timber resources have been exploited for sale to furniture industries in Honduras, or the U.S. and Canada, there may not be sufficient resources to sustain industrial "clustering" or development of secondary industries within Nicaragua -- where the real money could be made on forest products. Finally, technical assistance to review the long-awaited forestry law is basically a good idea; however, if the law is not carried out after approval, it will be like many others that are already on the books but are not being implemented.

Cacao: The relationship between high cacao prices today and Nicaragua's exportation of cacao 30 years ago is not readily apparent. These are different times and presumably, different conditions of supply and demand. One concern is that the emphasis of cacao production today in Nicaragua -- and presumably elsewhere in the region -- could result in a glut of cacao within a few years, a condition that, should it happen, could hardly be considered sustainable. Perhaps before USAID promotes the expansion of cacao, it should formulate a regional strategy complete with future projections. Another point should be considered. Cacao is an understory tree that may be subject to recurrent outbreaks of pathogens. Any program devised to assist future farmers, possibly in buffer zones around protected areas, should be accompanied by appropriate management practices.

Ornamental plants: Ornamental plants could be a potential "gold mine." What is not mentioned, however, is how these plants will be grown, harvested, and sold. In Guatemala, palm fronds were traditionally harvested from within the forest, leading to a depletion of palms in readily accessible areas. In Nicaragua (Volcán Mombacho), and in western Panama, orchids are illegally removed from the forest for sale. The assumption is that plant extraction from native forests would not be tolerated; rather, the plants would be either nursery grown or produced in open fields. Another concern may be the heavy use of fertilizers or herbicides; heavy applications of pesticides, especially in confined spaces, could have health implications. The main issues, however, are probably not environmental but logistical (how to assure timely delivery to distant overseas markets). If this means road construction and the possible removal of additional forest cover, it may have environmental implications.

Tourism: Ecotourism comprises 5 percent of the GDP, could command more, but has not been well promoted. This is true; however, before too much promotion is undertaken, there are serious problems relating to available overnight facilities, enough outdoor attractions along certain routes (clustering), and determinations of carrying capacities that must be addressed. Moreover, protected areas highlighting wildlife attractions must protect these resources or there will be no reason whatsoever for tourists to visit. Tourism should be controlled to ensure a quality experience. Effort should be concentrated in and around protected areas to gain support for other conservation activities and to compensate land owners for limitations imposed on land use.

10.0 APPENDICES

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10..4 ACRONYMS USED IN TEXT OR REFERENCES

AED -- Academy for Educational Development
ANTUR -- Asociación Nicaragüense de Turismo Receptivo
ASDI -- Autoridad Sueca para el Desarrollo Internacional
ASOFAUNA -- Asociación de Exportadores de Fauna Silvestre
CANTUR -- Camara, Nicaragüense de Turismo Micro, Pequeno y Mediano
CATIE -- Centro Agronómico Tropical de Investigación y Ensenzanza
CBM -- Consolidación del Corridor Biológico Mesoamericano
CEDAPROD -- Central de Derecho Ambiental y Promoción para Desarrollo
CIDA -- Canadian International Development Agency
CITES -- Convention on International Trade in Endangered Species
CLUSA – Cooperative League of the USA
DANIDA -- Administración Danesa de Desarrollo Internacional
ECOT-PAF -- Estrategia Nacional de Desarrollo Sostenible, Ordenamiento Territorial y Plan de Acción Forestal
EPA -- Environmental Protection Agency
Fundación Esperanza -- Private Protected Areas Organization
GEF -- Global Environmental Facility
GIS -- Global Information Systems
IICA -- Instituto Interamericano de Cooperación para la Agricultura
IDB -- Inter American Development Bank
INAFOR -- Instituto Nacional Forestal
INTA -- National Institute for Agricultural Technology
INTUR – Instituto de Turismo
IRENA -- Instituto Nicaragüense de Recursos Naturales y del Ambiente
ISTF -- International Society of Tropical Foresters
IUCN -- The World Conservation Union
JICA -- Japan International Cooperation Agency
MAGFOR -- Misisterio Agropecuario y Forestal
MARENA -- Ministerio del Ambiente y Recursos Naturales
MEDE -- Ministerio de Economía y Desarrollo
NASA -- National Aeronautics and Space Administration
NGOs --Non-Governmental Organizations
OAS -- Organizations of American States
PANIF -- Programa Ambiental Nicaragua-Finlandia
PNUD -- Programa de las Naciones Unidas para el Desarrollo
PROARCA -- Programa Ambiental Regional para Centro America
RAAN -- Region Autónoma Atlantico Norte
RAAS -- Region Autómoma Atlantico Sur
SINAP -- Sistema Nacional de Areas Protegidas
SINIA -- Sistema de Información y Indicadores
TNC -- The Nature Conservancy
UCA -- Universidad Centroamericana
UNA -- Universidad Nacional Agraria
UNAN -- Universidad Nacional Autónoma de Nicaragua
USAID -- United States Agency for International Development
USGS -- United States Geological Survey
WB -- World Bank
WCS -- Wildlife Conservation Service
WWF -- World Wildlife Fund

10. 5 NOTES -- POLICY, REGULATORY, AND INSTITUTIONAL FRAMEWORK

This section is comprised of a series of notes as bullet statements -- data collected during interviews. Site visits were made to National Institutions. The intent was to review activities that addressed biodiversity and conservation of natural resources.

INAFOR

- The main responsibility is to approve forest management plans that all landowners are required to have before they can do any harvesting of forest products. The plans do not address the affects on biodiversity but do address best management practices needed to protect the existing resources of soil, water and timber.
- MARENA is responsible for forestry activity within the protected areas. Any landowner who wishes to harvest timber needs to first get approval from MARENA before INAFOR will approve their management plan. Supposedly this will only happen if MARENA has within their protected area management plan a timber harvesting component. The landowner needs to present a land title to INAFOR in order to get their plans approved creating problems for many landowners.
- INAFOR is responsible for the administration of approved management plans but lacks the strength to enforce the appropriate best management practices required. There is no bond held by the agency or enforcement strength for them to require implementation of the best management practices if the operator of the timber sale refuses to implement them.
- No national timber concessions are issued, only private, municipal, and indigenous concessions.
- The government receives, on a sliding scale, a tax per cubic meter for timber harvested. These monies are used to fund the agency.
- There is little secondary manufacturing of forest products which needs to be developed. A lot of timber is exported as cant (pine and hardwoods) to Honduras and El Salvador which have secondary processing plants. (industry, however, views this differently).
- 80 technical people throughout the country oversee the development and administration of management plans.
- More technical help and forest guards could be used to curtail illegal cutting.
- Sees an opportunity to improve the role forestry plays in the long term economic growth of the country.

INTUR

- INTUR doesn't keep records of visitors. A web site is being developed to promote tourism in protected areas.
- Companies who work in the tourist industry need to register in the register office of INTUR. They are cracking down on illegal operators who don't register. This year they began to classify tour companies registering under an eco-tourism category.
- The private sector is more involved with promoting tourism within the Nicaragua. INTUR did attend fairs in U.S., Europe, and Guatemala to promote tourism. Funding is lacking for this activity.
- Promoting tourism investment in Protected Areas through the Special Tourism Incentives Law.
- Would like to work with MARENA more in marketing the Protected Areas for tourism but due to lack of funding and problems due to recent changes in the political structure of the institutions this has not happened. MARENA would also like to work with INTUR more in marketing protected areas.
- MARENA sits on the board of directors of INTUR.
- Foreign visitors ranked by country are: Costa Rica and Honduras; USA; Canada; Europe (Germany and Italy).
- Reasons to visit Nicaragua: Costa Rica and Honduras -- mainly business; USA -- adventure, tourism, and fishing.
- Most important protected areas for tourism: Volcán Mombacho, Río San Juan, Isla Juan Venado, and Bosawas.
- Consider that the new road from Matagalpa to Puerto Cabeza will open up Bosawas to more tourism.
- Could use signs within protected areas.
- What should happen over the next 5 years: develop tourism promotional plans; develop the Gold Route theme route; determine local capacity to support tourism within protected areas.
- 5 areas with greatest tourism potential: Indio-Maiz, Volcán Mombacho, Isla Juan Venado, Bosawas, and Volcán Cosiguina.

MAGFOR

- The forestry sector within MAGFOR is organized with a forest policy component and an implementation component (INAFOR).
- The forest policy sector addresses laws, policy and regulations. The policy sector has developed several forestry strategy papers and presently is working on a long-term strategy which requires funding.

- From 1991-2006, the forestry sector financing received 94 percent from international groups (IDB, WB, GTZ and others); the Nicaraguan government financed only 6 percent. The total sector financing for this time period is $107,890,817. The major players in the international financing were: IDB (52 percent), WB (25 percent) and GTZ (15 percent).
- Some of the major problems within the forestry sector are: deforestation; the lack of capacity to implement needed policies; illegal extraction activities; poor incentive programs, lack of commercialization, communication, and marketing; lack of data and technical education; and the low valuation of forest.
- A new National Forest Law being developed; however, it has been under review for quite some time. The Ministry Forest Policy sector anticipates that, when passed, it would recommend the development of a foundation for funding forestry programs and initiatives. If so, this foundation would be called Fondo Competitivo Para el Desarrollo Forestal (FONADEFO).
- Green certification has been reviewed but not much is happening with it. The government isn't involved directly. Both plywood plants within the country are working on certification. There is no real economic advantage in certification since the prices received are the same whether wood is certified or not. The only advantage is the increased demand it may create through consumer preference.

MARENA

- MARENA is responsible for the management and development of management plans within the Protected Areas.
- Lands within the protected areas are composed of private, municipal, and indigenous lands. The national government does not have funding to purchase lands within the protected areas.
- MARENA does not write the management plans but gives directions and helps formulate them with local entities.
- MARENA is responsible for tourism within protected areas and would like to work more closely with the Tourist Institute to better promote tourism.
- Japanese are working on major watershed project for Managua and road system but not working directly with MARENA. Road construction would provide better access to protected areas making them easier to market. The potential impacts of road construction on protected areas has not been considered.
- As for forestry or logging within the protected areas, one interpretation is that the law doesn't allow it; however, the regulations for management of these areas allow MARENA to include it in the management plans and MARENA is including timber management in some of the areas. INAFOR gives permission to extract timber.
- Need to develop conservation consciousness amongst the local populations in order to get them to take ownership in the protection and conservation of these Areas.

National Museum of Nicaragua

- According to the 1982 National Cultural Heritage Protection law, all archeological finds are the property of the State. The law further prohibits the exportation of artifacts from the country. The National Museum is located at the National Palace in Managua. The museum has an accord with the U.S. to prohibit the importation of artifacts. The law further forbids the removal of finds from the site and requires the National Museum of Nicaragua be notified. The Museum can give custodian rights to the finder, or to other museums, to exhibit materials. The Museum is responsible for the enforcement of the National Cultural Heritage Protection law.
- There are over 1,200 archeological sites throughout the country. One is at Zapatera National Park in Lake Nicaragua. Other significant sites need to be investigated including the Río San Juan area.
- The Museum receives about 100,000 visitors a year. Most are local students but 20,000 foreigners visit each year. They work with INTUR to promote the museum.

TNC (NGO)

- The emphasis area is the Miskito Coast of Nicaragua (Bosawas Natural Reserve), and Honduras. The reserve is part of the regional Mesoamerican Biological Corridor and part of the Parks in Peril program. Program emphasis is on social-economic solutions with local communities to protect the Reserve. Local people are hired as guards to oversee and protect the reserve.
- Partnering is with USAID, the St. Louis Zoo, Alistar (U.S.), and CEDAPRODE (Nicaragua). The St. Louis Zoo is doing a carrying capacity study for hunting and live animal captures. The program also has a component for species inventories of species within the Reserve utilizing local student volunteers.
- MARENA initiated a plan that contained a general overview of management direction but it needs operational components before it can be finalized. TNC hopes to finish the plan this year. The plan also includes a minor

component for small indigenous timber cuts and gold panning. Ways are being sought to reduce impacts from timber harvest.

- Local populations will take ownership in protecting Bosawas to curtail invasions. The buffer zone will allow more commercialization of natural resources such as timber harvest.
- Since TNC plans long-term involvement, a trust fund is needed to finance management in perpetuity.
- Other groups include the OAS that is funding some agricultural projects within the area. The Danish are also funding some micro-economic agricultural projects.
- Not much is being done with eco-tourism since northern section of Bosawas is inaccessible. The southern section is more accessible by road. Bosawas has 6 indigenous territories within it. TNC is emphasizing the northern area due to the indigenous population located there.
- Apparently, a Canadian gold mining company is interested in this area and apparently is trying to purchase the mining rights from the local people (not verified, however).

WCS (NGO)

- WCS is working as part of a consortium on the Atlantic Biological Corridor which is being administered by MARENA and funded through the Wold Bank. The Corridor initiative is part of the Mesoamerican Biological Corridor regional initiative.
- Long standing focus has been on the protection of the Green Turtle.
- Management plans are being developed for: Cayos Miskitos, Cerro Wawashan, and Cerro Silva. The plans will include addressing the following parameters: non-commodity natural resource management, commodity management, eco-tourism, and sociological-land use by local farmers.

Donors and Multilateral Organizations and other U.S. Government Agencies

GEF

- Programs working with flora and fauna within Protected Areas only.
- Have 100 technical people throughout the country.
- Three emphasis areas: Miskito region (Cayos Miskitos, Waspan); Wawashan; and Cerro Silva. Only 12 people are working in the emphasis areas along with local municipalities in plan development.
- GEF administers the funds for World Bank and works through MARENA to administer programs. The general goal is to develop indigenous communities, plan and monitor programs, prioritize biodiversity areas and public relations.
- Illegal cutting is occurring on both a small scale from local farmers as well as on larger commercial scales.
- GEF only has funding for management plan development but not for implementation.

IDB

- Assisting in Datanli-el Diablo & Chacocente Areas.
- Working with agro-forestry, plantations and mitigation of impacts.
- The plantation projects are not addressing future management of these plantations.
- Concern that in order to be classified as organic the soils have to be free of chemicals. However, most lands have had chemical use for so long it is hard to convert them to organic classified lands due to residual chemicals.
- Financing coffee above 900 meters. They are not sure of sustainable marketability of organic coffee.
- Involved in helping to develop timber management plans required by INAFOR. These plans do not address the biodiversity issue. They are not involved in forestry extraction.
- Feels that much illegal cutting is a result of the difficult process of forest management plan approvals. They work with local communities in getting their plans developed.
- The Nicaraguan agencies personnel are static even when a political party change occurs through elections. This is a stabilizing factor unlike other countries where with a new party there are new technical employees within the agency. But the institutions policies are not static, causing concern..
- One of the major problems is the level and availability of funding of Nicaraguan agencies.
- There is a concern with invasion of Protected Areas due to economic factors.

Canada (CIDA)

- Water and sanitation projects in Bluefields.

- Working with economic development projects with Miskito population of the Atlantic Coast.
- Spending levels of about $5.0 million CND per year.
- Project plan to continue through 2007.

Germany (GTZ)

- Working in the southeastern section of the country (Nueva Guinea) in conjunction with MARENA. The 6 regions within the southern region are being managed by various donors and multilateral organizations. The areas have been subdivided to complement activities among the various organizations. Activities are being coordinated with Spain, Denmark, GEF, and Austria.
- The major emphases are: manage protected areas; develop sustainable financing; row and sell produce; and, organize the management of natural resources at the municipal level. Work is mainly in the buffer zone with pasture, cocoa, reforestation, and agro-forestry. This is to curtail encroachment.
- Photo interpretation of long term trends in cover changes has been completed.
- This is a long-term program with a long-term manager. The manager works on site which is critical to program success. The program will continue for another 8 years (5 years are already completed).
- Utilize food for work program.

Finland and Chile

- Development of exportation program for Nicaraguan made furniture (Proyecto NICAMUEBLE)

Denmark and Austria

- Working in El Castillo area of Río San Juan. Programs are: protection system within Rio Indio-Maiz Protected Area; land tenure; social infrastructure; and sustainable forest management.

Commercial private Sector

- **ANTUR**
- Family owned business for over 40 years catering to eco-tourism adventure tours and hunting and fishing
- 95 percent of tourist businesses are family owned.
- Estimates that his business is 80% Americans with few Europeans; the remainder is from Central America.
- Between Hurricane Mitch and 9/11, tourism has declined. Before hurricane and 9/11 some 50,000 tourist came to Nicaragua per year. Half were for eco-tourism and the other half were for conventions and seminars.
- Has strong business in dove and duck hunting, migratory populations.
- Can set-up any type of trip. Use to hunt jaguars but now do photo safaris instead.
- Feels that dove hunting is a service to locals due to money they pay for help in fetching birds, as well as giving locals the birds for food. This area has a lot of agricultural crops. The farmers use poisons to kill doves and ducks; however, the locals collect the killed birds and eat them resulting in the ingestion of poisons.
- Fishing is a catch and release program except for a few fish they eat on site.
- Earlier the U.S. Fish and Wildlife Service did come down to review hunting of migratory populations, but since then no one has really looked at the carrying capacity or hunting limits.
- The operators set their own limits, but they are not based on any studies. The operator has set hunter limits at a 100 birds/person, which he feels is well below what Argentina shoots (1,000-2,000 birds/person)
- There are species similar to sand and tiger sharks in the lake but less than before.
- Believes Tipitapa River between Lake Managua and Lake Nicaragua is a wealth of biodiversity.
- The industry has talked about carrying capacity studies but none have been done. Industry would be open to work with biologist in designing carrying capacities studies and setting limits.
- He has seen dramatic drops in parrot populations at Santiago Crater at Masaya.
- The U.S. doesn't help out tourist industry with negative State Department Travel warning. European (Spain) has the same negative warnings. They feel they are unwarranted and based on a few isolated incidents.
- The Nicaraguan government needs to spend more money promoting eco-tourism. They are not doing enough and are spending the money on studies that aren't needed.
- Need financial assistance through loans. Interest rates are 18-22 percent. Suggest a tourist bank that would help finance the industry to grow.

- Would like to work with U.S. Embassy economic sector to partner with U.S. tourist companies to set-up more eco-tourism and fishing and hunting trips.
- Concern with agricultural frontiers encroaching on natural habitat areas.

CANTUR

- CANTUR, a group of small tourist related industries (hotels, restaurants).
- Concerns: they need to do better marketing of what is available in Nicaragua for tourism.
- They are looking at developing web site and looking for funding for it.
- They also have large power point presentation on theme trips (coffee and archeology tours).
- They need to target (economic, age) tourists and then find where and how to best market to that group.

Forestry

- Two plywood plants in the country. Tititapa, and Prada located in north Atlantic coast region.
- Uses about 15% pine; 55% ceiba; 25% jobo; 5% other tropical species.
- Not utilizing mahogany or cedar due to the cost. In addition, clients don't want to pay the additional price, which can be 40% higher than other plywood species products.
- They have sufficient logs coming into the mill, mainly from San Juan and western Pacific coast areas.
- Utilize water storage ponds to prevent staining and checking.
- Export markets are mainly Central America, Mexico and the Caribbean. Have looked into U.S. markets but feel can't compete price wise and are not in European markets at all.
- Sell products in Nicaragua directly to retailers, builders, or wholesalers. Will also sell directly to customers even if it's only one sheet of plywood.
- Mill exports about 80% of their 27,000 m^3/yr production. Remainder is sold within Nicaragua.
- Plant infrastructure: 3 peelers; 4 dryers; 5 presses.
- Secondary manufacturing plant infrastructure: 2 small circular saws; 1 kiln dry.
- Secondary manufacturing of doors (including door frames) and wooden fruit boxes.
- Capacity: 65 m^3 /day; Production: 55m^3/day.
- Employees: plywood plant: 250; secondary manufacturing plant: 50
- Average employee wages: $80U.S./month; more skilled labor such as peeler operators and kiln dry operators receive more.
- Use poorer graded material or Eucalyptus for plywood core.
- Re-saw peeler cores to use in secondary manufacturing.
- Use the American National Standard Institute (ANSI) Plywood and Veneer Associations grading standards.
- Strong interest in plantation development.
- Costa Rica has developed Teak plantations along the southwestern boundary of Nicaragua and is getting close to $600U.S./$m^3$. Feels with cheaper land values and cheaper labor rates in Nicaragua that this is a good investment. Estimated that the first cut would be within 15-20 years. This rotation is optimistic.
- Potential for Eucalyptus plantations to utilize as plywood core. Estimates that production would start in 9 years.
- Large Eucalyptus plantation near the mill for firewood production. The plantation has various age classes and the recently cut trees were coppicing. Due to recent land tenure problems, the plantation isn't being managed.
- Is interested in working with Smartwood on certification (chain of custody). Reason behind this is that the largest wholesalers within Central America, Amanco, politically needs to deal with certified wood. Thus this company is working toward getting their suppliers certified. The coast of certification has also come down (due to Smartwood using local Nationals in the certification process) thus making certification a good move now.
- There is some thought in getting pine forest cooperatives in Ocotal of Nueva Segovia region certified also.
- Very supportive of the new forestry law being proposed and is optimistic that it will be passed soon. Feels the law will consolidate all the various forestry laws into one and be supportive for plantation development.
- If the country passes the proposed new forestry law he will be very optimistic in developing long-term investments in Nicaragua, especially in plantation developments.
- There are several secondary wood products manufactures. Especially in furniture. These furniture producers though can't seem to compete in the export market.
- There are problems in the system that is being utilized by INAFOR in getting management plans approved. The present systems require forestland owners to put up all the cost of developing a management plan ($1U.S./$m^3$) and paying INAFOR the tariffs on the timber before they get any money from the sale of their timber. Thus most

landowners do not have these kinds of funds available and as such this is one of the biggest reasons he sees for much of the illegal cutting.

10.6 ENDEMIC PLANTS AND ANIMALS IN MESOAMERICA AND IN BIODIVERSITY HOTSPOTS ELSEWHERE ON EARTH.

Group	Species in Mesoamerica			Species on the planet		
	Total	Endemic	%	Total	Endemic	%
Amphibians	460	307	66.7	4,780	2,570	53.8
Reptiles	685	391	57.1	7,823	2,957	37.8
Birds	1,193	251	21.0	9,875	2,854	28.9
Mammals	521	210	40.3	4,814	1,319	27.4
Total	2,859	1,159	40.5	27.298	9,702	35.5
Vascular plants	24,000	5,000	20.8	300,000	133,500	44.5

Table 1. Forest types (ecological units) in Nicaragua (130,680 km^2)

System (author, date)	Units	Comments

Holdridge Ecological Life Zones (Holdridge 1962) -- The moist, wet, and rain forests lie in the eastern 60 percent of the country and the dry forests in the west.

Tropical moist forest
Tropical wet forest
Tropical dry forest
Tropical very dry forest
Subtropical rain forest
Subtropical wet forest
Subtropical moist forest
Subtropical dry forest
Lower montane wet forest

Zonal forest formations and azonal communities (Taylor1963)

Zonal

Lowland evergreen rainforest
Lower montane rain forest
Seasonal evergreen rain forest
Semi-evergreen seasonal forest
Deciduous seasonal forest

Azonal

Riverine and swamp communities
Mangroves
Salt meadows
Beach communities
Upland pine and oak communities
Pine savanna

Biogeographic regions (Gillespie et al. 2001)

Pacific Region -- quaternary volcanic ranges, the central depression, and eastern foothills, all below 400 m in elevation. Vegetation types include:

tropical dry forest
savanna

Central Region -- tertiary ranges and quaternary volcanoes above 400 m in elevation Vegetation types include:

Upland pine-oak forest
Montane forest
Cloud forest
Volcanic successional types

Atlantic Region -- lowlands of eastern Nicaragua

Lowland rainforest
Pine-savanna

Principal natural ecosystems (Meyrat 2001)

64 systems throughout Nicaragua

Table 2A. Nicaraguan laws pre-1987, constitutional direction, and international accords.

Pre-1987 laws affecting biodiversity:

- Law 688, Animal Protection Code, 1941
- Law 101, Animal Health, 1954
- Law 206, Hunting, 1956
- General Law, For the Exploitation of Nicaraguan Natural Treasures, Legislative Decree No. 316, 1958
- Law 344, Vegetable Health, 1958
- Law 372, Exploration and Exploitation of Petroleum, 1958
- Law 10-67, Exploration and Exploitation of Mines and Quarries, 1965
- Law 547, Direction for the Conservation of the Green Iguana and Garrobo, 1980
- Law 282, Decree 1142, National Cultural Heritage Protection Law, 1982

Constitutional direction:

- Article 60: It is the obligation of the State for the preservation, conservation and reclamation of the environment and natural resources.
- Article 89: The State recognizes the right of the Atlantic coastal peoples to use and enjoy the forest and waters of their communal lands.
- Article 102: The natural resources of the country are paramount to the nation. The State has the right for the preservation and conservation, rational development and exploitation of the natural resources belonging to the State and may issue contracts for the development of these resources.
- Article 177: The State must consult with Municipal governments before authorizing any Natural Resource developments within a Municipality.
- The State must protect the archeological, historical, linguistic cultural and artistic heritage of the country.

International accords:

- 1940 Convention for the Protection of Flora, Fauna and Scenic Beauty of Countries of the Americas (Washington, DC)
- 1971 Convention on the Important International Wetlands, especially aquatic bird habitat (Ramsar, Iran)
- 1972 Convention on the Protection of World Cultural & Natural Heritage (Paris)
- 1973 Convention on the International Commercial Threatened Wildlife Fauna & Flora Species (CITES) (Washington, DC)
- 1992 Conference on Biological Diversity (Rio de Janeiro, Brazil)
- 1992 UN Conference on Climatic Changes (Rio de Janeiro, Brazil)
- 1994 Central American Conference on Sustainable Development (Managua, Nicaragua)
- 1994 Conference for the Conservation of the Biodiversity and Protection of Priority Wild Areas of Central America (Masaya, Nicaragua)
- 2000 Signing in Nairobi, Kenai Protocol of Biosecurity (as of 11/01, still awaiting ratification by the National Assembly)

Table 2B. Laws, decrees and regulations enacted in Nicaragua after 1987.

Legal Document	Year	Objective	Responsible Agency
Decree 45-93	1993	Forestry Regulations	INAFOR
Decree 45-94	1994	Regulations and procedures for projects requiring environmental impact studies	MARENA
Decree 45-95	1994	Regulations & evaluations of environmental impacts	MARENA-DGCA
Decree 9-96	1994	Transferring IRENA to MARENA	MARENA
Decree 33-95	1995	Regulatory oversight for residential, industrial and agricultural waste water discharge	MARENA-DGCA
Law 217, General Environmental Law	1996	Establishes direction for the conservation, protection, preservation, improvement & restoration of Natural Resources	MARENA
General Environmental Law Regulations	1996	Established the direction for environmental management and sustainable use of natural resources	MARENA
Minister Policy of prohibitions for Iguana, Garrobo and other wildlife species	1996	Set the specifics prohibition of 14 different species	MARENA-DGBRN
Law 222	1996	Suspension of concessions and contracts for natural resource contracts	
Decree 30-97	1997	Regulation for the extraction of mahogany & cedar	
Decree 37-98, Forest Fire Prevention Measures	1998	Measures to prevent and fight forest fires	
Law 280, Law & Regulation for the production & commercialization of seeds.	1998	Regulate the activities in relation to the study, production & commercialization of seed & plants in nurseries.	MAGFOR
Decree 14-99, Regulations of Protected Areas	1999	Regulations of Title II of the General Environmental Law, relative to Protected Areas	MARENA-DGAP
Law 360, Incentives for tourist industry in the Republic of Nicaragua	1999	Provides incentives for investors in tourism.	
Regulations for Forest Fire Protection		Regulations forest fires that affect both national and private lands	

Source: Estrategia Nacional de Biodiversidad Nicaragua.

Table 3. Principle Environmental Sector: NGOs in Nicaragua.

NGO	REPRESENTATIVE	ADDRESS	PHONE	PRESENCE
Asociaciòn Esperanza del Futuro	Loida Garciìa Obando	Tola, Rivas	045-30482	Tola, Rivas
Fundaciòn Jinotega para el Desarrollo Sostenible **(FUNJIDES)**	Miguel Sequeira Pineda	Casa del Pueblo 1c, al este, Jinotega	063-23636	Jinotega
Fundaciòn para el desarrollo Integral de Occidente **(FDIOC)**	Guillermo Parajòn Vallejos	Leòn, Hotel Europa 2c, al este, 75 vrs, al norte	033-114437	Leòn
Fundaciòn para el Desarrollo Sostenible **(FUNDESO)**	Orlando Duerte Madrigal	Puente Lareynaga 3c. Abajo 3c. al sur	248-7200	Managua
Club de Jòvenes Ambientalistas **(CJA)**	Sr. Raomir Manzanares	Bello Horizonte, Rotonda 2c. al sur 2c. abajo , ½ c. al sur Casa Nº 1-II-11	249-8042	
Movimiento Ambientalista de Nicaragua **(MAN)**	Lic. Danilo Sarmiento	Frente a la Ruta Maya	2480050	
Fuandaciòn de Reserva Esperanza Verde **(FUNDEVERDE)**	Dr. Josè Leòn Talavera	Complejo Judicial Plaza el Sol 75 vrs. al sur, edificio Sierra de Paz	277-3482 278-1021	
Fundaciòn para la Protecciòn y el Desarrollo y Sostenible del Istmo de Rivas **(USTMO)**	Lic. Ròger Palma Rojas	Frente a Escuela Internacio- nal de Agricultura y Ganaderìa, Rivas		
Fundaciòn Josè Nieborowski	Lic. Jenny Reyes A.	Contiguo al Banco Nacional, Boaco	084-22761 084-22399	
Fundaciòn del Rìo **(FUNDAR)**	Lic. Fabio Buitrago Vannini	Frente Albergue ENACAL, Rio San Juan	028-30035 028-30393	
Sociedad AUDUBON	Lic. Renè Pèrez	Bello Horizonte, Rotonda 1c. al sur,2c. al este, ½ c. al sur. Casa Nº, B-IV-41, Contiguo a Farmacia Divina, Managua.	244-3239	
Fundaciòn entre Volcanes **(FEV)**	Ing. Josè Luis Sierra	Frente a Telcor, Moyogalpa, Isla de Ometepe	045-94118	

NGO	REPRESENTATIVE	ADRESS	PHONE	PRESENCE
Fundaciòn para el desarrollo Socioeconòmico y sostenible ambiental(**FUNDES XXI**)	Ramòn Antonio Villafranca V.	Tenderì, casa e-266 de donde Fue el Restaurante Madroño 4c. al lago 25 vrs. abajo	08824510 240-1468	Managua
Movimiento Comunal Nicaragüense Palacaguina	Mayra Montenegro Cruz	Del MECD, 2c. al norte Palacaguina	072-22354 072-22669	
Agencia de Desarrollo Econòmico Local de Jinotega (**ADEL-JINOTEGA**)	Luis Humberto Zeledòn	De la Texaco 1c. al oeste ½ c. al sur	063-22043	Jinotega
Asociaciòn de Promociòn y Desarrollo Rural (**APRODER**)	Adrìan Hernàndez Sànchez	Fremte a cada de Justicia Jalapa, Nueva Segovia	073-72501 073-72500	Nueva Segovia
Asociaciòn de Desarrollo Forestal Campesino(**ADEPROFOCA**)	Wilfredo Martìnez Izaguirre	De la Alcaldia, 1c. al oeste,1c. al norte, Dipilto Nueva Segovia	073-23561	Nueva Segovia
Asociaciòn de Productores Forestales Campesinos (**APROFOSC**)	Fabio Lòpez Midense	Costado Oeste de la Iglesìa Catòlica Santa Clara, Nueva Segovia	073-52242	Nueva Segovia
Central de Cooperativa Forestales (**CECOFOR**)	Vicente Trochez	Frente al Juzgado Local de Jalapa, Nueva Segovia	073-72500	Nueva Segovia
Ayuda en Acciòn	Eduardo Reneses de la Fuente	Del BDF, 25 vrs. al sur. Nueva Segovia. / De la Rotonda el Guegüense 3c. abajo 25 vrs. al sur,	073-22472 266-3189 266-3932 268-5823	
Asociaciòn de promotores Salud y Parteras en Nueva Guinea(**APROSAPANG**)	Sr. Bernabè Gonzàlez	Contiguo a la Iglesìa Catòlica		Comunidades: San Sabastìan,San Pedro la Concepciòn, y Pijibay (Nueva Guinea y la Reserva Natural Punta Gorda Municipio de Blufields.)

NGO	REPRESENTATIVE	ADRESS	PHONE	PRESENCE
Organizaciòn formada por Pequeños productores y pro- Ductoras de todo el sureste, **SANO Y SALVO**	Sr. Oscar Guadamuz H. Vicepresidente	Nueva Guinea, RAAS.	0285-0174	Comunidades que trabajan La Fonseca, en San Franciscode Aguas Frìas, El Paraìso de Aguas Zarcas, San Pedro y Concepciòn de Piedras Finas, San Sebastìan, Montes Verdes, La Gloria y Salto Leòn I y II (Nueva Guinea, y la Reserva Natural Punta Gorda municipio de Bluefields.)
Asociaciòn de Mujeres por la Paz y el Desarrollo de Estelì **(AMPYDE)**	Amanda Torrez Ayestas	De Gobernaciòn ½ c. al sur 75 vrs. al este, Estelì	0713-7551	Estelì
Asociaciòn de profesionales Para el Desarrollo Agrarios **(APRODESA)**	Sabrina Leal Tijerino	De la Alcaldia de Pueblo Nuevo 2 ½ c. al oeste. Estelì. /Del portòn principal delaPolicia Linda Vista esta- ciòn #2, 20 vrs. al norte casa Nº151, Managua	0719-2344 073-52241 266-7028	Estelì
Movimiento Pro defensa del Medio Ambiente **(MOPRODEMA)**	Ramòn Alberto Estrada	Ministerio de Gobernaciòn ½ c. al este. Estelì	0713-7365 0713-2386	Estelì
Coordinadora de Desmovilizados de Guerra por la Paz, la Reconciliaciòn y el Desarrollo. **(CODEPARD)**	Josè Francisco Blandòn Rizo	Hotel el Mezòn 1c. al sur	0713-2059	Estelì
Fundaciòn para el Desarrollo Empresarial de Matagalpa **(FUDEMAT)**	Horacio Manuel Brenes	Edificio Catalina, Planta alta Mòdulo Nº 4	061-22372	Matagalpa
Asociaciòn de Educaciòn y Comunicaciòn **(La Cuculmeca)**	Rita Muckenhim	Contiguo a Taller Luna salida al Guayacàn	063-23679 063-23578	Jinotega
Cooperaciòn Nicaragüense para el apoyo agropecuario y La Transferencia Tecnològica **(CONAAT)**	Martha Yadira Zeledòn	De donde fuer el BANIC 2c. al este 1c. al norte.	063-22670	Jinotega
Centro de Acciòn y Apoyo al Desarrollo Rural **(CENADE)**	Lic. Javier Matus Director Ejecutivo	Del cine Altamira 3c. arriba Casa Nº 423	2706074 2706074 2783711	

NGO	REPRESENTATIVE	ADRESS	PHONE	PRESENCE
Fundaciòn Nicaragüense para la Conservaciòn y el Desarrollo **(FUNCOD)**	Lic. Juan Josè Montiel Director Ejecutivo	De Olaza del Banco del Cafè 1c. al norte y 1c. al oeste, Altamira de Este, #774 Apto. 1009, Managua	2785204	R. N. Isla Juan Venado.
Asociaciòn Somos Ecologistas en la Lucha por la Vida y el Ambiente. **(SELVA)**	Ing. Byron Martìnez Director Ejecutivo	Del Mercado Central 6c. al Oeste, 1c. al sur ½ c. al oeste Viejo Chinandega	08849156	R. N. Estero Padre Ramos
Fundaciòn Cocibolca	Lic. Octavio Escobar Director Ejecutivo	Del Hotel Colòn 1c. al sur ½ arriba contiguo a oficinas del Matadero Nandaime # 26	2783224	R. N. Volcàn Mombacho y R. V. S. Playa la Flor.
Fundaciòn de Investigaciòn y Desarrollo Rural **(FIDER)**	Lic. Norman Padilla Director Ejecutivo	Rotonda Bello Horizonte, 4c. al sur, 3c. al este y 2c. al norte Managua. / Del Semàforo 1 ½ c. al sur, Estelì	2496039 07133918	Rivas, Carazo, Estelì y Managua.
Fundaciòn Nicaragüense para el Desarrollo Sostenible **FUNDENIC, SOS**	Dr. Jaime Incer Barquero	Mansiòn Teodolinda 2 ½ c.al lago, Edificio La Merced Clinica Nº 2	222-3969	Rio Blanco / Managua
Luchadores Integrados al Desarrollo de la Regiòn **(LIDER)**	Ing. Evert Caballero	Del Mercado Central 3 ½ c.al norte, Viejo Chinandega	0344 2335	R. N. Volcàn Cosiguina.
Fundaciòn ALISTAR / Slogan Preparado y listo para Ayudar.	Lic. Anuar Murrar Garay	Del Hospital Militar 1 c. al lago 2c. abajo	2665171 2668667	Waspàn, Wiwilì y Cuà Bocay.
Centro HUMBOL	Ing. Victor Campos	Bello Horizonte, Rotonda 4c. al sur, 1c. arriba, 1c. al lago ½ arriba, Managua	249-2903	Wiwilì, Cuà Bocay, Siuna y Bonanza.
Centro de Desarrollo Ambiental y Promociòn para el Desarrollo **(CEDAPRODE)**	Lic. Erick Ramirez Avendaño Director Ejecutivo. Dra. Lilliam Jarquìn Presidente Represente Legal	De la Farmacia Vida 1c. al sur, 20 vrs. arriba a mano derecha, Casa D-229, Colonia Centroamèrica.	278-2669 278-5952	
Forestadores Asociados de Nicaragua . **(FORESTAN)**	Ing. Holmes Aguilar	Esquina opuesta Shell Plaza el Sol	270-1681 270-0572	Managua
Sociedad para la Conservaciòn de la Naturaleza y la Restauraciòn Ambiental **(NICA-AMBIENTAL)**	Jaime Guillen	De la Viky 8 ½ c. al norte Nº 500 Altamira D`Este.	270-5528	Managua

NGO	REPRESENTATIVE	ADRESS	PHONE	PRESENCE
Fundaciòn para el Desarrollo Sostenible. **(FUNDESO)**	Ing. Orlando Duarte Madrigal	Puente Lareynaga 3c. abajo, 3c. al sur	248-7200	Managua
Asociaciòn de Profesionales Para el Desarrollo de Nicaragua **(APRODENICA)**	Rev. Josè Mena Vicepresidente Fundador. Miguel Àngel Mena Presidente	De los semàforos de Linda Vista 1 ½ c. abajo Casa D-21 Managua	08600971 2663114	Managua
Fundaciòn para el Desarrollo Socioeconòmico Rusal. **(FUNDESER)**	Ing. Renè Romero Arechavala	Km. 14 carretera sur entrada de la muela 200 mts. Arriba quinta. El Cazador	2657238 2657068	Managua
Asociaciòn para el Desarrollo Comunal del Dpto. de Carazo **(ADECA)**	Lic. Fernando Fernàndez Mendieta	Del BDF 1c. al oeste, 1/2c. al Norte, Jinotepe Carazo	041-22413	Carazo
Sociedad para el apoyo al Desarrollo Econòmico Social Comunitario. **(SADESC)**	Ing. Gustavo Bendaña	Centro de Salud 300 mts. Al Sur Colonia CEPAD, Diriamba, Carazo	042-24052	Carazo
Movimiento por la Paz, la Acciòn forestal y el medioAmbiente. **(MOPAFMA)**	Dr. Salvador Pèrez	Shell Plaza el Sol 1c. al sur, 1c. abajo, casa C-109 frente a PROFAMILIA	270-1379	Carazo
Fundaciòn para el Desarrollo Rural. **(FUDER)**	Lic. Julio Cèsar Ruìz	De la policia de Tràsito 2c. al este	0713-6587	Estelì
Asociaciòn de Desarrollo Municipal de Wiwilì **(ADEM-WIWILI)**	Francisco Acevedo Osorio		260-0082	Wiwilì
Movimiento Comunal Nicaragûense Somoto	Roger A. Ramìrez Jimenea	Frente a INATEC, Somoto	072-22354 072-22669	Somoto
Asociaciòn Nuevo Amanecer	Marìa Josè Chevez Urcuyo	Bello Horizonte Y-IV-1	2441663	Managua
Asociaciòn de Mujeres Indigenas de la Costa Atlàntica. **(AMICA)**	Elizabeth Henriquez James	Barrio Libewrtad, Puert Puero Cabezas. RAAN	028-22219	Puerto Cabeza
Asociaciòn para la Investigòn y el desarrollo de los Pueblos **(ANDES)**	Norman Castro Espinoza	Rivas, de la Rotonda 500 mts.al norte.	088-5898	Rivas

Source: MARENA – Planning Division, May 2002.

Table 4. ANTUR tour operators.

Company	Contact	Phone
Careli Tours	Lic. Luis Canales	278-6919/2572
Eco Expedition Tour	Lic. Alejandro Coiston	278-1319
Eco Tours	Lic. Luisa Amanda Madrigal	266-8523
Estaciòn Biològica	Lic. Antonio Molina	278-3915
Gutièrrez Tours	Lic. Alfredo Gutièrrez	278-4742
Tours	Lic. Grace March	270-4320
Milestone	Lic. Enrique Ruìz Mendoza	270-1588
Millennium Tours	Lic. Marìa Ofelia Sanabria	278-9759
Momotombo	Lic. Juan Gaitàn	277-2062
Montecristo Aventure	Lic. Agustin Llanes	276-0283/59
Munditur Tours	Dr. Adam Gaitàn J.	278-5716
Nicaragua Aventures	Lic. Pierre Gedeon	277-3893
Nicaragua Cesar Tours	Lic. Juan Ivan Bugna	265-2728
Nicarao Lake Tours	Lic. Sandra Zamora	266-1237/1694
N-Tur	Lic. Sandra Mejia	268-6692
Oro Travel	Lic. Pascal Picot	0552-4568
Schuvar Tours	Lic. Esmeralda Vargas	266-3588
Servi Tours Travel tip	Lic. Martha Lisseth Acuña	265-0807
Sol Tours Nicaragua	Lic. Mayda D`nueda	266-7164
Solentiname Tours Nicaragua	Lic. Inmanuel Zerger	265-2716
Tour Caribe	Lic. Frankin Muñoz	270-4666/278-4967
Tours Nicaragua	Lic. Mike Newton	270-8417
Tours Nicarao	Lic. Zenelia Martìnez	045-34157

Source: Nicaraguan Tourist Association.

Table 5. Inventory of decreed protected areas in Nicaragua.

Protected Area Class No. Name	Decree	Date	Area ha	%	MGPL	CO	FOGU	RESI	VIST
Biological Reserve									
01 Río San Juan Indio Maiz	66-99	May-99	263,980		1--3		36		V
02 Cayos Miskitos	43-91	Nov-91	50,000		3				
National Park									
03 Volcán Masaya	79	May-79	5,100		1		11	X	V
04 Archipiélago Zapatera	1194	Feb-83	5,227		3		1	X	
05 Saslaya	1789	Sep-71	15,000						
National Monument									
06 Archipiélago Solentiname	66-99	May-99	18,930		3				V
Historic Monument									
07 Fortaleza La Inmaculada	66-99	May-99	375		3				V
Wildlife Refuge									
08 Río Escalante-Chacocente	1294	Aug-83	4,800		1		4	3,908	V
09 Playa La Flor	217	May-96	800		3		4	2,614	V
10 Los Guatuzos	66-99	May-99	43,750		1				V
Genetic Reserve									
11 Forestal Yucul	526	Apr-90	4,826		3			3,000	
Nature Reserve									
12 Chocoyero-El Brujo	35-93	Jun-93	184		2	CO	6	X	V
13 Volcán Cosiguina	13	Sep-58	12,420		3	CO	4	X	V
	1320	Sep-83							
14 Estero Padre Ramos	1320	Sep-83	8,800		1	CO	3	X	V

15	Delta Estero Real	1320	Sep-83	55,000				X	
16	Isla Juan Venado	1320	Sep-83	4,600	1	CO	4	X	V
17	Complejo Volcánico San Cristobál	1320	Sep-83	17,950				X	
18	Complejo Volcánico Telicia-Rota	1320	Sep-83	9,088				X	
19	Complejo Volcánico Pilas-El Hoyo	1320	Sep-83	7,422				X	
20	Complejo Volcánico Momotombo	1320	Sep-83	8,500				X	
21	Peninsula de Chiltepe	1320	Sep-83	1,800				X	
22	Laguna de Tiscapa	42-91	Nov-91	40	3				
23	Laguna de Asososca	42-91	Nov-91	140				X	
24	Laguna de Nejapa	42-91	Nov-91	220				X	
25	Laguna de Tisma	1320	Sep-83	10,295				X	
26	Laguna de Apoyo	42-91	Nov-91	3,500			1	X	V
27	Volcán Mombacho	1320	Sep-83	2,487	2	CO	6	O	V
28	Laguna de Mecatepe	1320	Sep-83	1,200				X	
29	Río Manares	1320	Sep-83	1,100					
30	Volcán Concepción	1320	Sep-83	2,200				1,800	
31	Volcán Maderas	1320	Sep-83	4,100	3			1,800	V
32	Cordillera Dipilto y Jalapa	42-91	Nov-91	41,200				O	
33	Tepesmoto Pataste	42-91	Nov-91	8,700				3,900	
34	Cerro Quiabuc-Las Brisas	42-91	Nov-91	3,630				1,800	
35	Cerro Tisey-Estanzuela	42-91	Nov-91	6,400	3	CO	3	3,580	
36	Cerro Tomabú	42-91	Nov-91	850				3,500	
37	Meas de Moropotente	42-91	Nov-91	7,500				2,800	
38	Volcán Yalí	42-91	Nov-91	3,500				X	
39	Kilambé	42-91	Nov-91	10,128				X	
40	Macizo de Peñas Blancas	42-91	Nov-91	11,308				4,000	
41	Cerro Dantalí-El Diablo	42-91	Nov-91	2,216	1		13	1,200	
42	Cerro El Arenal	42-91	Nov-91	575	1			4,500	
43	Cerro Frio-La Cumplida	42-91	Nov-91	1,761				7,000	
44	Salto del Rio Yasica	42-91	Nov-91	445				200	
45	Apante	42-91	Nov-91	1,230	1		1	3000	
46	Guabule	42-91	Nov-91	1,100				8000	
47	Cerro Pacasan	42-91	Nov-91	330				700	
48	Cerro Kuskawás	42-91	Nov-91	4,760				5,000	
49	Sierra Quirragua	42-91	Nov-91	8,087				6,000	
50	Cerro Musún	42-91	Nov-91	4,142	2	CO	3	3,500	

51	Cerro Cumaica-Cerro Alegre	42-91	Nov-91	5,000				
52	Cerro Mombachito-La Vieja	42-91	Nov-91	940				
53	Fila Masigüe	42-91	Nov-91	4,580				
54	Sierra Amerrisque	42-91	Nov-91	12,073				
55	Cerro Cola Blanca	42-91	Nov-91	22,200				
56	Cerro Bana Cruz	42-91	Nov-91	10,130				
57	Tala Sulama	43/91	Nov-91	37,200				
58	Cabo Viejo	43/91	Nov-91	37,200				
59	Laguna Bismuna-Raya	43-91	Nov-91	11,800				
60	Laguna de Pahara	43-91	Nov-91	10,200				
61	Yula	42-91	Nov-91	1,000				
62	Kligna	42-91	Nov-91	1,000				
63	Laguna Yulu-Karata	43/91	Nov-91	25,300				
64	Laguna Kukalaya	43-91	Nov-91	3,500				
65	Laguna Layasica	43-91	Nov-91	1,800				
66	Alamikamba	42-91	Nov-91	2,100				
67	Limbaika	42-91	Nov-91	1,800				
68	Makantaka	42-91	Nov-91	2,000				
69	Llanos de Karawala	42-91	Nov-91	2,000				
70	Cordillera Yolaina							
71	Miraflor	217	May-96	5,674	3		1	2,200
Biosphere Reserve								
72	BOSAWAS	44-91	Nov-91	730,000	2		77	20,500*
Forestry Reserve								
73	Cerro Wawashan	42-91	Nov-91	231,500	3			
		38-92	Jun-92					
74	Cerro Silva	66-99	May-99	339,400	3			
Additions of Previously Missing Sites to the List)								
75	Punta Gorda	66-99	1999	64,900	1			
76	Apacunca	217	?	1,400				
Totals					28	7	177	94,202

Sources: Hurtado de Mendoza 2000; Gillespie et al. 2001; McCarthy et al. 2003.
The numbers in this table are not coded to the location numbers in Figure 3.
% refers to the percentage of the protected area that is forested (information not currently available).
MGPL refers to a management plan: 1 = approved; 2 = in process; and 3 = being initiated.
CO = MARENA has a co-management arrangement with another entiry.
FOGU refers to the number of forest guards employed.
RESI = number of residents on site; X = presence of populations nearby; 0 = no population; blank = no information.
VIST: x = site receives visitors; blank = site does not receive visitors.
VIST: V = site receives visitors; blank = no information provided.
* BOSAWAS: in addition, 242,000 persons live in the the buffer zone.

Table 6. Natural areas with potential for incorporation into the protected areas system.

Natural area name	Area (ha)	Environmental Values
Rio Kuanwatla	2,500*	tropical moist forest; mangroves; swamps;
Laguna Lauwira	5,200*	tropical moist forest; lagoons;
Laguna Grande	7,500*	tropical moist forest; littoral lagoons; mangroves
Laguna de Wankarlaya	23,000*	tropical moist forest; lagoon system; bamboo; aquatic avifauna
Laguna de Nocarime	1,700*	freshwater lagoon; mangrove; aquatic avifauna
Laguna de Moyua	480*	aquatic avifauna; swamp lands
Estero de Junquillo	2,750*	resident & migratory aquatic avifauna; grasses; mangrove
Apanas	3,200*	aquatic avifauna
Laguna Maderas	30	cloud forest; crater lagoon
Desembocadura Rio Viejo	1,800	river system and asociated forest
Isla Nancital	2,200*	archipelago of 20 islands; aquatic avifauna
Cayos Perlas (abajo)	2,300*	archipelago; cayes; coral reefs; mangrove
Desembocadura Rio Escondido	18,600	mangroves; low hardwood forest
Ensenada El Pato	5,300*	mangroves
Laguna Baca Day	6,700	mangroves; lagoon system
Estero Las Marias	920*	group of estuarine areas; aquatic avifauna
Cerro Guisisil	?	no details available
Saupuka	?	no details available
Sin Sin	?	no details available
Total	84,180	

Source: Zeas et al. 2002.
* Lands belong to the state; ownership of the remaining properties is uncertain.
? Size of property yet to be determined.

Table 7. Species of plants and animals on the Nicaraguan Red List.

Scientific name	Common name	Status of Knowledge					
		1	2	3	4	5	etc.
	APPENDIX I						
MAMMALS							
Alouatta palliata	Mono congo						
Ateles geoffroyi	Mono araña						
Felis concolor	Puma						
Felis pardalis	Trigrillo						
Felis tigrina	Caucelo						
Felis wiedii	Gato de monte						
Felis yagouaroundi	Leoncillo						
Lutra longicaudis	Nutria						
Panthera onca	Tigre						
Sotalia fluviatilis	Delfin, Bufo negro						
Tapirus bairdii	Danto						
Trichechus manatus	Manatì						
BIRDS							
Ara ambigua	Lapa verde						
Ara macao	Lapa roja						
Chondroierax uncinatus	Milano pico de garfio						
Falco peregrinus	Halcon peregrino						
Harpia parpyja	Aguila real						
Jabiru mycteria	Pancho galàn						
Pharomachrus mocinno	Quetzal						
REPTILES							
Caretta caretta	Tortuga caguama						
Chelonia agassizi	Tortuga torita						
Chelonia mydas	Tortuga verde						

Crocodylus acutus	Lagarto
Dermochelys coriacea	Tortuga tora
Eretmochelys imbricata	Tortuga carey
Lepidochelys olivacea	Tortuga paslama

FLORA

Cattleya skinneri	Orquìdea
Phragmipediumm spp.	Orquìdea

APPENDIX II

MAMMALS

Bradypus variegatus	Perezoso trigarfiado
Cebus capucinus	Mono cara blança
Globicephala macrorhynchus	Delfin calderòn negro
Mirmecophaga tridactyla	Oso hormiguero gigante
Stenella attenuata	Delfin punteado
Stenella clymene	Delfin
Stenella longirostris	Delfin tornillo
Stenella plagiodon	Delfin manchado del atlàntico
Tayassu pecari	Jabalì labiblanco
Tayassu tajacu	Jabalì de collar
tursiops truncatus	Delfin pez merlìn

BIRDS

Abeillia abeillei	Colibrì gorgiverde
Accipiter bicolor	Gavilàn bicolor
Accipiter chionogaster	Gavilàn pecho blanco
Accipiter striatus	Gavilàn tarso afiliado
Accipiter superciliosus	Gavilancito
Aegolius ridwayi	Tecolotito volcanero
Amazilia amabilis	Colibrì pechiazul
Amazilia cyanocephala	Colibrì frentiazul
Amazilia cyanura	Colobri coliazul
Amazilia tzacatl	Colobrì rabirrufo
Amazona albifrons	Cotorra frente blanca

Amazona auropalliata	Lora nuca amarilla
amazona autumnalis	Lora frente roja
Amazona farinosa	Lora corona azul
Anthracothorax prevostii	Colibrì manguito colipùpura
Aratinga canicularis	Chocoyo frente naranja
Aratinga finschi	Chocoyo frente carnesì
Aratinga holochlora	Perico verde, jalacatero
Aratinga nana	Perico frente oliva
Archilochus colubris	Colibri garganta rubi
Asio clamator	Bùho listado
Asio stygius	Bùho oscuro
Bolborhynchus lineola	Chocoyo listado
Brotojeris jugularis	Chocoyo zapoyolito
Bubo virginianus	Bùho grande
Busarellus nigricollis	Gavilàn pescador
Buteo albicaudatus	Gavilàn cola blanca
Buteo albonotatus	Gavilàn cola listada
Buteo brachyurus	Gavilàn pollero
Buteo jamaicencis	Gavilàn cola rojiza
Buteo magnirostris	Gavilàn de la rondas
Buteo nitidus	Gavilàn gris
Buteo platypterus	Gavilàn cola ancha
Buteo swainsonii	Gavilàn de swainson
Buteogallus anthracinus	Gavilàn cangrejero
Buteogallus urubitinga	Gavilàn negro
Campylopterus hemileucurus	Colibrì sable violaceo
Chalybura urochrysia	Colibrì patirrojo
Chlorostilbon canivetti	Colobri esmeralda cola de tijera
Ciccaba nigrolineata	Bùho negriblanco
Ciccaba virgata	Bùho cafè
Circus cyaneus	Gavilàn de las marismas
Colibrì delphinae	Colibrì orejiviolaceo pardo
Colibrì thalassinus	Colibri orejiviolaceo verde
Daptrius americanus	Caracara avispero
Elanoides forficatus	Milano cola de tierra
Elanus leucurus	Milano cola blanca

Eugenes fulgens	Colibrì gorriviolaceo
Eupherusa eximia	Colibrì colirrayado
Falco columbarius	Gavilancito, melìn, esmerejòn
Falco deiroleucus	Halcòn pechicanelo
Falco femoralis	Halcòn plomizo
Falco rufigularis	Halcòn murcielaguero
Falco sparverius	Cernìcalo americano
Florisuga mellivora	Colibrì jacobino nuquiblanco
Gampsonyx swainsonii	Milano pardo pecho blanco
Geranospiza caerulescens	Gavilàn ranero
Glaucidium brasilanum	Mochuelo pigneo
Glaucidium minutissimun	Mochuelo centroamericano
Glaucis aenea	Colibrì ermitaño bronceado
Harpagus bidentatus	Milano bidentado
Harpyhaliaetus solitarius	Agulia solitaria
Heliomaster constantii	Colibrì pochotero
Heliomaster longirostris	Colibrì piquilargo
Heliotryx barroti	Colibrì enmascarado
Herpetotheres cachinnas	Guas cagòn
Hylocharis eliciae	Colibrì zafiro colidorado
Hylocharis leucotis	Colibrì zafro oìdos blancos
Ictinia plumbea	Gavilàn palomero
Klais guimeti	Colibri cabeciazul
Lampornis sybillae	Colibrì gorgipùrpura
Leptodon cavannensis	Milano cabeza gris
Leucopternis albicollis	Gavilàn blanco
Leucopternis semiplumbea	Gavilàn semiplomizo
Lophornis helenae	Colibrì crestinegra
Lophostrix cristata	Bùho penachudo
Michrochera albocoronata	Colibrì copete nevado
Micrastur semitorquatus	Guas selvàtico
Morphnus guianensis	Aguila crestada
Otus cooperi	Tecolotito sabanero
Otus trichopsis	Tecolotito manchado
Otus vermiculatus	Tecolotito vermiculado
Pandion haliaetus	Aguila pescadora

Parabuteo unicinctus	Gavilàn crepuscular
Phaeochroa cuvierii	Colibrì pechiescamoso
Phaethornis longuemareus	Colibrì ermitaño enano
Phaethornis superciliosus	Colibrì ermitaño colilargo
Pionopsitta haematotis	Loro capucha cafè
Pionus senilis	Cotorra corona blanca
Polyborus plancus	Caracara crestado
Pulsatrix perpicillata	Bùho de anteojos
Ramphastus sulfuratus	Tucàn pico aquillado
Rosthramus sociabilis	Milano caracolero
Spizaetus melanoleucus	Aguilucho blanquinegro
Spizaetus ornatus	Aguilucho de las sierras
Spizaetus tyrannus	Aguilucho negro
Tenetes ruckeri	Colibrì barbudo
Thalurania colombica	Colibrì ninfa violeta y verde
Tilmatura dupontii	Colibrì gorgiazul
Tyto alba	Lechuza de los campanarios

REPTILES

Boa constrictor	Boa comùn
Caiman crocodylus chiapasius	Cuajipal
Clelia clelia	Zopilota
Corallus annulatus	Boa arborìcola
Corallus enhydris	Boa arborìcola
Iguana iguana	Iguana verde
Loxocemus bicolor	Culebra chatilla
Ungaliophis panamensis	Boìta de Panamà

AMPHIBIANS

Dendrobates auratus	Ranita dorada
Dendrobates pumilio	Ranita de sangre

ARACHNIDS

Brachipelma albopilosa	Araña pica caballo

GASTROPODS

Strombus gigas	Caracol gambute

MARINE CORALS (ANTHOZOA)

Acropora cervicornis	Coral cuerno de alce
Acropora palmata	Coral cuerno de alce
Agaricia agaricites	Coral
Agaricia tenuifolia	Coral
Antipatharia spp.	Coral
Antiphathes lenta	Coral negro
Antiphathes penaceae	Coral negro
Antiphathes tanacetum	Coral negro
Aphanipathes abietina	Coral negro
Colpophillia natans	Coral
Dendrogyra cylindrus	Coral
Dichoconia spp.	Coral
Diploria labrinthibris	Coral cebrero
Diploria strigosa	Coral cerebro
Euismilia fastigiata	Coral
Favia fragum	Coral
Leptoseris cucullata	Coral
Madracis formosa	Coral
Madracis pharensis luciphila	Coral
Meandrina spp.	Coral
Monastrea annularis	Coral
Monastrea cavernosa	Coral
Mycetophillia ferox	Coral
Oculian spp.	Coral
Sleractinia spp.	Coral
Stephanocoenia nichelimii	Coral
Tubastraea spp.	Coral

MARINE CORALS (HYDROZOA)

Eusmilia fastigiata	Coral
Millepora coplanata	Coral
Millepora squarrosa	Coral

Milleporidae spp.	Coral
Porites astreoides	Coral
Porites branneri	Coral
Porites porites	Coral
Siderastrea porites	Coral
Siderastrea radians	Coral

FLORA

Swietenia humilis	Caoba del Pacifico
Aloe spp	Sàvila
Euphorbia spp	Euforbias
Acanthocereus tetragonus	Cacto
Epiphyllum hookeri	Cacto
Epiphyllum oxypetalum	Cacto
Epiphyllum pitieri	Cacto
Epiphyllum thomasianum	Cacto
Heliocereus auranticus	Cacto
Hylocereus costaricensis	Cacto
Hylocereus polyhizos	Cacto
Mammillaria eichlamii	Cacto
Mammillaria ruestii	Cacto
Melocatus curvispinus	Cacto
Nopalea lutea	Cacto
Opuntia cochenillifera	Cacto
Opuntia decumbes	Cacto
Opuntia ficus-indica	Cacto
Opuntia guatemalensis	Cacto
Peniocereus hirschtianus	Cacto
Pereskia lychnidiflor	Cacto
Pilosocereus leucocephalus	Cacto
Pseudorhipalis ramulosa	Cacto
Rhipsalis baccifera	Cacto
Selinicereus grandiflorus	Cacto
Selinicereus testudo	Cacto
Sternocereus eichlamii	Cacto
Webocereus bioleyi	Cacto

Encyclia fragans	Orquìdea
Encyclia chacaoensis	Orquìdea
Epidendrum radicans	Orquìdea
Epidendrum stanfordianum	Orquìdea
Laelia rubescens	Orquìdea
Maxillaria alba	Orquìdea
Maxillaria densa	Orquìdea
Maxillaria curtipes	Orquìdea
Myrmecophila brysiana	Orquìdea
Myrmecophila tibicinis	Orquìdea
Myrmecophila wendladii	Orquìdea
Oncidium altisimun	Orquìdea
Oncidium cebolleta	Orquìdea
Oncidium sphacelatum	Orquìdea
Stanhopea cirhata	Orquìdea
Stanhopea oculata	Orquìdea
Stanhopea ruckeri	Orquìdea
Trigonidium egertomianum	Orquìdea
Vanilla planifolia	Orquìdea
Vanilla pompona	Orquìdea
Vanilla helleri	Orquìdea
Gongora cassidea	Orquìdea
Gongora armeniaca	Orquidea
Gongora quinquenervis	Orquìdea
Cytopodium punctatum	Orquidea
Dichea glauca	Orquìdea
Dichea morrisii	Orquìdea
Dichea neglecta	Orquìdea
Bletia purpurea	Orquidea

1 = separate populations (no.)
2 = protected area populations (no.)
3 = estimate total individuals in country (no.)
4 = estiamte total individuals in protected area (no.)
5 = major threats

Table 8. Inventory of private protected areas in Nicaragua.

No.	Reserve name	Area (ha)	Resolucion (no.)	Representative (location)
1	Domitila	108.3	06--2001	Empresa Agroindustrial Mecatepio S.A./Silvio Mejia Arellano (dista 10 km de la cuidad de Nandaime, municipio de Nandaime, Grenada)
2	Greenfield	114.3	08--2001	Rato Heinz Pfranger Stury (1 km al sur del Puerto de Kukra Hill, Regiòn Autonoma del Atlàntico Sur)
3	Toro Mixcal	167.7	07--2001	Nicholas Jonn Cooke / Martha Cecilia Zamora (Las Marìas, Municipio de San Juan del Sur , Rivas)
4	La Màquina	158	11--2001	Felipe Maranhao (km 58 1/2 Carretera a la Boquita Municipio de Diriamba Carazo)
5	Carlos Augusto	69.9	14--2001	Augusto Cesar y Jairo Alfredo Lòpez Gonzàlez (Comarca Lipululo, Municipio de Jinotega, 14 kms. al noroeste de la Ciudad de Jinotega)
6	Montibelli	153.8	24--2001	Belli & Cìa. Ltda. / Carlos Belli Alfaro (Municipio de Ticuantepe)
7	Las Brumas	17.5	20--2001	Ramòn Abelino Pineda (Comarca Carcagrande, Santo Domingo, Depatamento de Chontales)
8	Valle Encantado	97.8	22--2001	Marcos Tèllez (130 kms.al noroeste de la Ciudad de Juigalpa, Departamento de Chontales)
9	Las Cumbres	28	23--2001	Santiago Rivas H. / Antonieta Leclair de Rivas (Comarca Santa Lastenia, a 7 kms.de la Ciudad de Jinotega, Departamento de Jinotega)
10	Egon Borucki	153.8	02--2002	Francis Leticia Berenica Borucki / Laurindo Maranhao Vieira (La Trinidad, poblado de Santa Lucia, Departamento de Carazo)
11	Nawawas	181.7	04--2002	Sr. Gustavo Bendaña Jerez (Comarca Nawawas, Santo Domingo, Chontales)
12	San Pedro	137	05--2002	Carmen Llanes Guerra (Escuela de Agricultura 300 m al sur, 3 km. al oeste, camino a la Chocolata Carretera vieja a San Juan del Sur)
13	Isabel Grande	777	09--2002	Rogerio Palazio de Colle / E. Palazio y Cìa. Ltda. (El Crucero, antiguo Hotel Casa Colorada, 5 kms al este)
14	San Josè	79	11--2002	Miguel Angel Chavarrìa Gòmez (San Donisio, Matagalpa)

Table 8. Inventory of private protected areas in Nicaragua (continued).

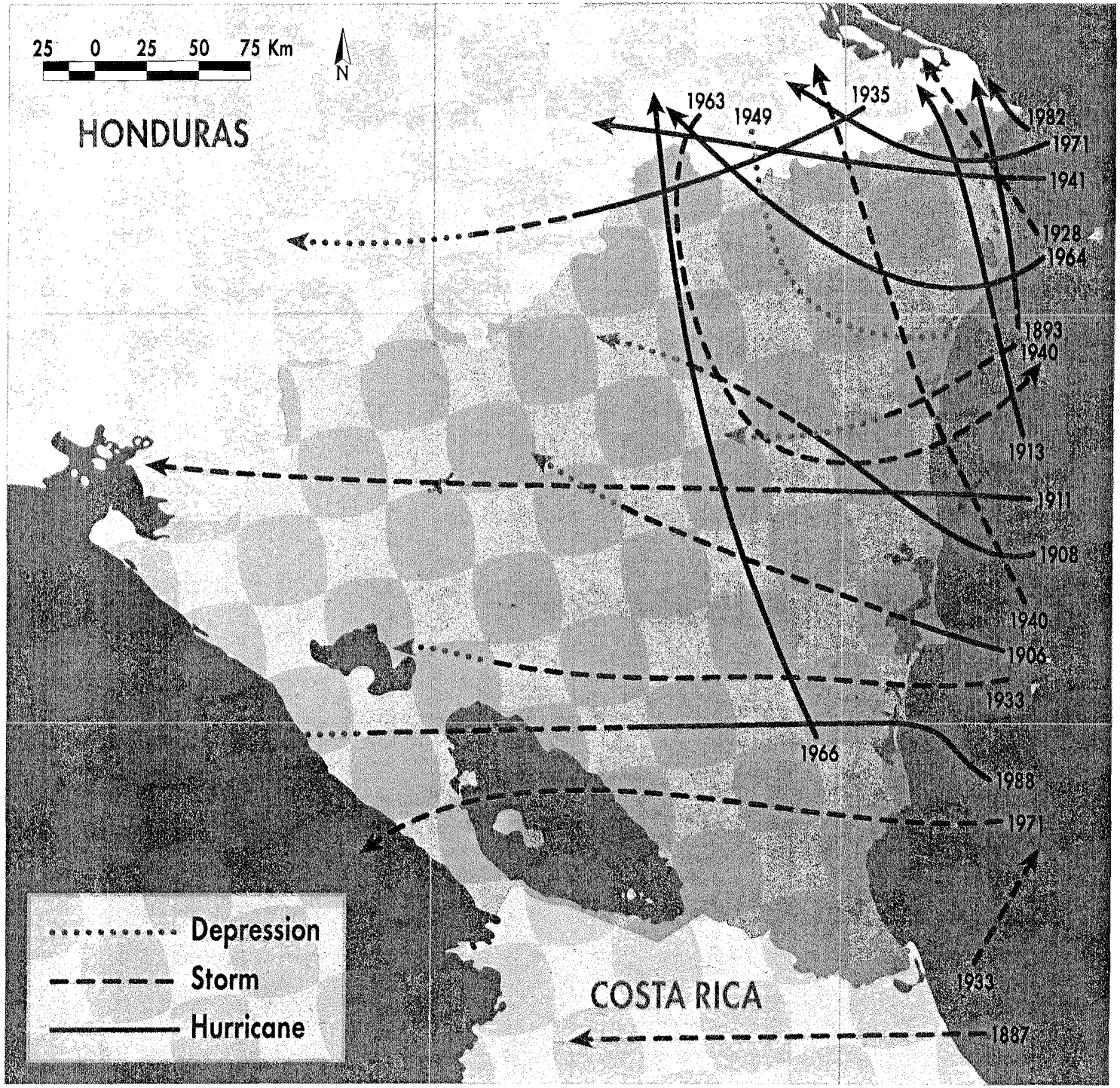
No.	Reserve name	Area (ha)	Resolution (no.)	Representative (location)
15	El Edèn	307.5	13--2002	Clemente Poncon Guillot (Nagarote, Leòn)
16	El Aguacate	1,328	12--2002	Sociedad Promotora de Desarrollo Ecoforestal S.A. (San Juan del Sur, Rivas)
17	El Carmen	117.4	21--2002	Salvador Pèrez Arevalo y Yolanda Alemàn (Municipio El Jicaro, Telpaneca , Nueva Segovia, Madrìz)
18	La Primavera	34.2	22--2002	Bernd Kruzinna y Susanne Betina Hubner (Municipio de San Juan del Sur, Rivas)
19	Estancia	100	36--2002	Freddy Josè Cruz Cortès (Municipio de San Juan del Sur, Rivas El Congo)
20	El Escanbray	29.8	37--2002	Adriana Marina Molina Fajardo (Jinotega)
21	La Palmera	139,8	38--2002	Julio Gustavo Lòpez Chavarrìa (Jinotega)
22	Finca Dinamarca	63.6	39--2002	Pedro Josè Lòpez Chavarrìa (Jinotega)
23	Escameca Grande	1,493	03--2002	Sociedad Anònima Escameca Grande, S.A. (Municipio de San Juan del Sur, Rivas)
	Total	5,856.30		

Source: Zeas et al. 2002.

Table 9. List of wetlands of international importance (Ramsar) in Nicaragua.

Name (Ramsar site no. -- Area in ha)	Ecological importance
Cayos Miskitos y Franja Costera Inmediata (site no. 1135 -- 85,000 ha) -- The Cayos is a marine biological reserve comprised of offshore Caribbean islands and shoals, and adjacent coastal areas. The wetlands include flooded areas dominated by shrubs, riverine systems with gallery forests, and estuaries with mangroves., The extensive sea grass and coral reefs support the following rare and endangered species: the Green turtle, the Hawsbill turtle, the Caribbean manatee, and the Tucuxi (freshwater dolphin), and the caiman crocodile.	
Deltas del Estero Real y Llanos de Apacunca (site no. 1136 -- 81,700 ha) -- The Deltas is a natural reserve that is an estuarine system within a large mangrove in the Golfo de Fonseca, a zone shared with El Salvador and Honduras. Shrimp cultivation, fishing and agriculture predominate. There are 35 animal species present. Part of the site was declared a reserve for Genetic Resources in 1996 to preserve wild maize endemic to this area of Nicaragua.	
Lago de Apanás-Asturias (site no. 1137 -- 5,415 ha) -- The Lago is a reservoir on the Río Tuma characterized by seasonally flooded agricultural land, water storage areas and canals. The site is important for the Perro de Agua (water dog, or Plata Otter), and numerous aquatic birds and fish of local economic value. The potential for ecotourism is high because of migratory birds and artisanal fishing practices; opportunities also exist for recreation and educational experiences.	
Los Guatuzos (site no. 915 – 43,750 ha) --Guatuzos is an area of woodlands and alluvial depressions subject to season flooding. The rare environmental conditions support rich populations of indigenous and migratory fauna: 326 birds (77 migratory), 32 mammals, and 10 reptiles. Several species are threatened with extinction.	
Refugio de Vida Silvestre Río San Juan (site no, 1138 -- 43,000 ha) -- The Refugio is a wildlife refuge (part of which is in the Biosphere Reserve Indio Maiz) that follows the course of the Río San Juan to the coast, and includes coastline to the north. The Refugio contains an array of wetlands including an estuary, shallow marine waters, a coastal freshwater lagoon, an intertidal march, permanent lakes, and rivers. Rarae fauna include four species of turtles and the Caribbean manatee.	
Sistema de Humedales de la Bahía de Bluefields (site no. 1139 -- 86,501 ha) -- The Sistema de Bluefields contains diverse ecosystems ranging from saline to freshwater that encompass the coastal lagoon on the Río Escondido. The intertidal forests, including mangroves, provide habitat for larger endangered species such as the jaguar, tapir (or Danta), howler monkeys, and ocelot. Artisanal fishing forms the economic and cultural base for local groups.	
Sistema de Humedales de San Miguelito (site 1140 -- 43,475 ha) -- The Sistema de San Miguel, located along the southeast coast of Lake Nicaragua, supports numerous species of mammals, birds, reptiles, and fish.	
Sistema Lagunar de Tisma (site no.? -- 10,295 ha?) -- The Sistema de Tisma is comprised of a number of small lakes, marsh, and river shoreline ecosystems associated with the northwest shores of Lake Nicaragua. The system supplies water for agricultural activities, and helps to recharge groundwater and to control floods, and supports numerous migratory birds. Local inhabitants derive meat, fish, and fiber for handicrafts from the area.	

Source: Ramsar Convention on wetlands.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Hurricane

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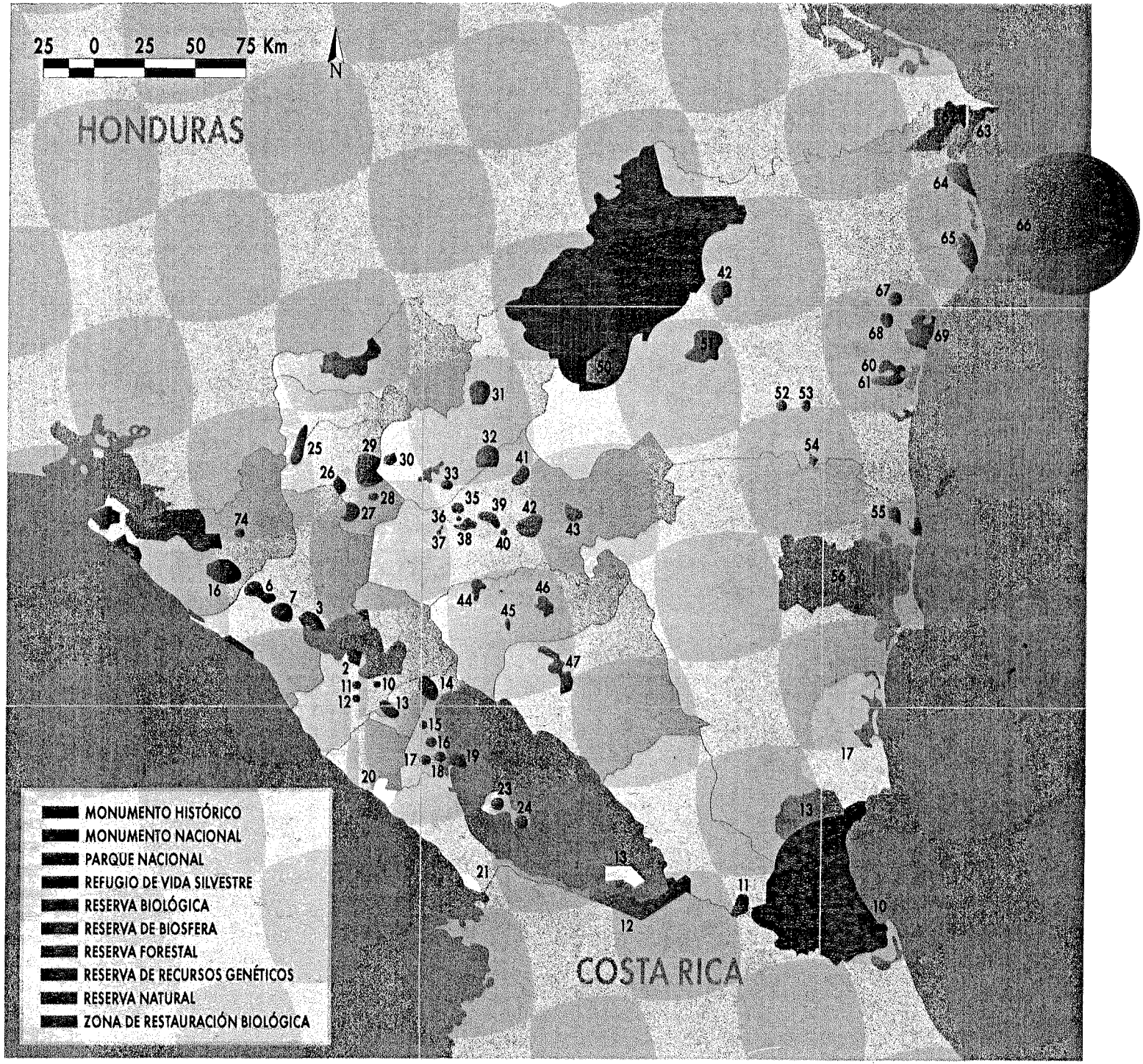
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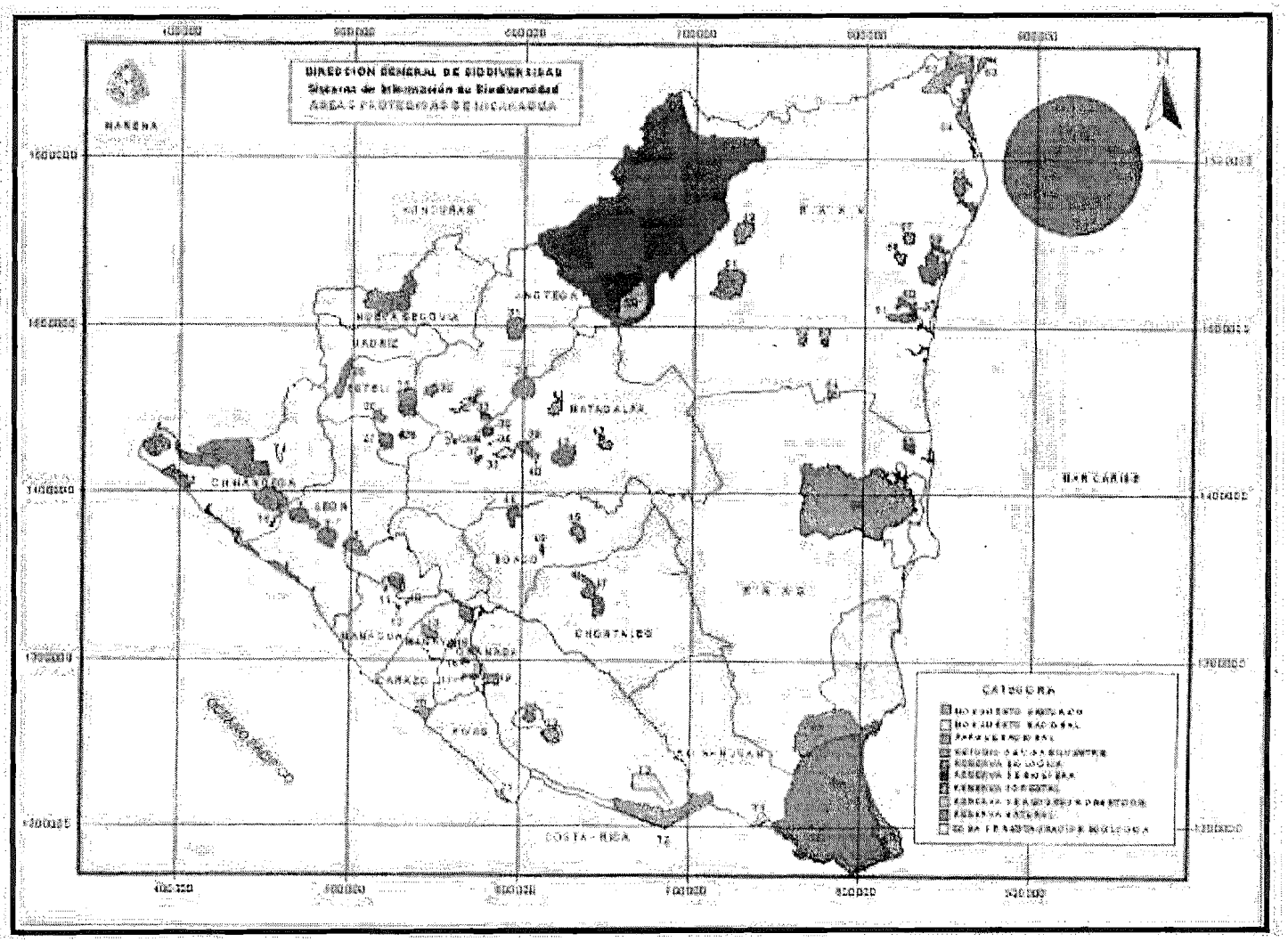
RESERVA FORESTAL
RESERVA DE RECURSOS GENÉTICOS
RESERVA NATURAL
ZONA DE RESTAURACIÓN BIOLÓGICA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