WETLAND CONSERVATION IN CENTRAL AMERICA

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Canadian International Development Agency / Agence canadienne de développement international

Unión Mundial para la Naturaleza
Oficina Regional para Centroamérica

Report No. 93-3

North American Wetlands Conservation Council (Canada)

Printed 1993
Ottawa, Canada

Cat. No. CW69-10/1-93-3E
ISBN: 0-662-21358-0

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NAWCC (Canada) Reports are published by the Secretariat of the North American Wetlands Conservation Council (Canada). These reports are devoted to the publication of information concerning wetland management, policy, and science issues. The objective is to make people in Canada and elsewhere more aware of the importance of the wise use and conservation of wetland ecosystems and their natural resource values.

Funding and support services for the production of this report were provided by:
- Canadian International Development Agency
- Latin American Program, Canadian Wildlife Service, Environment Canada
- Wetlands for the Americas
- Wildlife Habitat Canada
- North American Wetlands Conservation Council (Canada)
- Regional Office for Central America, World Conservation Union (IUCN)

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Cover: Traditional fishing in coastal wetlands, Guatemala. Source: Wetlands for the Americas.

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WETLAND CONSERVATION IN CENTRAL AMERICA

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Report No. 93-3

North American Wetlands
Conservation Council (Canada)

Recommended Citation

Davidson, I. and M. Gauthier. 1993. *Wetland Conservation in Central America.* Report No. 93-3. North American Wetlands Conservation Council (Canada). Ottawa, Ontario. 87 p.

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PREFACE

This report, entitled *Wetland Conservation in Central America*, was produced with the support of the Canadian International Development Agency (CIDA) in response to numerous requests from Central American and Canadian government and non-government organizations for CIDA's support of wetland initiatives in Central America. Originally designed to provide CIDA with an overview of the wetland situation in Central America, this report now serves as an information source for groups interested in supporting wetland initiatives in Central America.

The report gives a general overview of the status of Central American wetlands and a detailed analysis of international, national and regional wetland initiatives that affect Central America. This is followed by recommendations designed to focus attention on the pressing wetland issues in Central America and to issues in which Canada has a significant interest. Appendix 1 profiles wetland issues in each Central American country with a focus on the importance of specific wetland areas; Appendix 2 summarizes the international strategy in Canada's 1991 *Federal Policy on Wetland Conservation*; Appendix 3 lists individuals contacted concerning this study in Canada and Central America; and Appendix 4 lists the many acronyms used in this report.

The information in this report will hopefully not only augment the sparse data available on Central American wetlands but, even more importantly, stress the need for rapid affirmative action to ensure the survival of the rich tropical wetlands of Central America. Many people have contributed to this report by providing background information which, until now, has not been published. These people are acknowledged in the appendices, along with their country of origin and professional affiliations. In particular, valuable assistance was provided by Georgina Wigley from CIDA, who had the foresight to recognize the growing importance of wetlands throughout the Western Hemisphere. Her support and generous comments were the impetus for the development of this report. Acknowledgement is also due to Jeanne Pagnan of Environment Canada, Ken Towle of Conservation International—Canada, John Roper of CIDA, Caroline Caza of Wildlife Habitat Canada, and Allan Whitehead, a consulting biologist familiar with Central American wetlands, for reviewing parts of the report and offering valuable advice.

Finally, a special thanks to Clayton Rubec of Environment Canada and Jim Patterson of Ducks Unlimited Canada whose interest in bringing together individuals with a diverse interest in wetland conservation has resulted in a more open dialogue between CIDA and organizations with an interest in pursuing wetland conservation in Latin America. Clayton Rubec also provided significant input to the final review and editing phases of this project. The authors are most grateful for the assistance of the Secretariat to the North American Wetlands Conservation Council (Canada) in coordinating and managing the production and publication of this report as well as for the considerable effort provided by LL Communications in the complex editing of this report.

Monetary figures in this document are quoted in 1990 United States or Canadian dollars unless otherwise indicated. Geographic place names and Central American organizations are presented in Spanish throughout the text.

SUMMARY OF RECOMMENDATIONS

Ten recommendations are presented in this report. These are based upon Canada's internationally-recognized expertise in wetland conservation; the demonstrated interest of both Canadian and Central American organizations; the more stable political climate in Central America; the critical nature of many Central and North American wetlands shared by migratory species; and Canada's commitment to the Ramsar Convention. These recommendations are:

1. **The North American Wetlands Conservation Council (NAWCC) (Canada), with its mandate to promote national and international wetland conservation, should be encouraged to coordinate and develop a strategy for Canadian assistance to Central American and other international wetland initiatives. The NAWCC (Canada) should also be encouraged to develop a program that would be aimed at "educating" CIDA and other potential funding agencies, on the merits of wetland conservation as a development issue.**

2. **Bilateral and multilateral projects, fully or partially funded by Canadian institutions, should be screened for their impact on wetland resources (including an assessment of the current value of these resources to humans and the possible effects of change).**

3. **The vehicle for Canadian involvement should be Canada's commitment to the Ramsar Convention on Wetlands of International Importance. Canadian attention should be focused on fulfilling its international obligations through the provision of financial and/or technical assistance (such as management, inventories, legislation, equipment) to initiatives in:**

   (a) designated Ramsar sites in Costa Rica (Caño Negro, Bajos de Tempisque, and Tamarindo); Guatemala (Laguna del Tigre); Honduras (Barras de Cuero y Salado); and Panama (Bahía de Montijo and San San-Pond Sak);

   (b) proposed Ramsar sites in Nicaragua (Los Guatusos) and Guatemala (Manchón-Guamuchal and Bocas del Polochic); and

   (c) internationally-recognized wetland sites in Central America that could be declared Ramsar sites. These include: Golfo de Fonseca in Nicaragua, El Salvador and Honduras; the Cayos Miskitos in Nicaragua; Bahía de Panamá and Bahía de Parita in Panama; Laguna de Caratasca in Honduras; Laguna de Jocotal in El Salvador; and Monterrico in Guatemala.

   The IUCN is the regional organization in Central America with the capacity to coordinate any joint ventures between Canadian and Central American organizations. The IUCN has been actively promoting the Ramsar Convention since it initiated its wetland program in 1988.

4. **Canadian expertise could be used to augment wetland management skills currently being taught to university graduates at the *Centro Agronómico Tropical de Investigación y Enseñanza* (Tropical Agricultural Centre for Research and Education) (CATIE). The Association of Universities and Colleges of Canada supports international university exchanges and can provide financial support to facilitate international linkages of this nature.**

5. **Support should be given to initiatives in Central America that promote "clean technologies," such as the installation and maintenance of wastewater management facilities to reduce the human waste contamination of rivers, lakes and coasts, including many internationally-important wetland habitats. To date, no effective wastewater management facilities have been constructed to deal with the major human effluent discharge emanating from major cities.**

6. **Activities promoting the general awareness of internationally-important wetland issues that affect Canada, Latin America and the Caribbean should be supported. These activities could include workshops, displays and the publishing of pertinent material.**

7. **Given the importance of international wetland sites for migratory species that breed in Canada, there is a need to foster Canadian expertise in international wetland management; expertise that is sensitive to the growing needs of developing countries whose wetland interests are driven by socio-economical factors rather than by interest in maintaining and preserving biological diversity. This could be achieved through federal support to such institutions as the new Wetlands Research Centre at the University of Waterloo which has been created to develop a centre of expertise in the area of wetland research.**

8. **CIDA should play a catalytic role in helping Canadian organizations develop links with organizations in Central America interested in wetland issues. This support could include acting as an intermediary between groups or providing short- and medium-term financial assistance for workshops, publications and exchanges. The Canadian Environmental Network (CEN) should also provide funds (through the Environment and Development Support Program) to ENGOs interested in establishing links with like-minded groups in developing countries.**

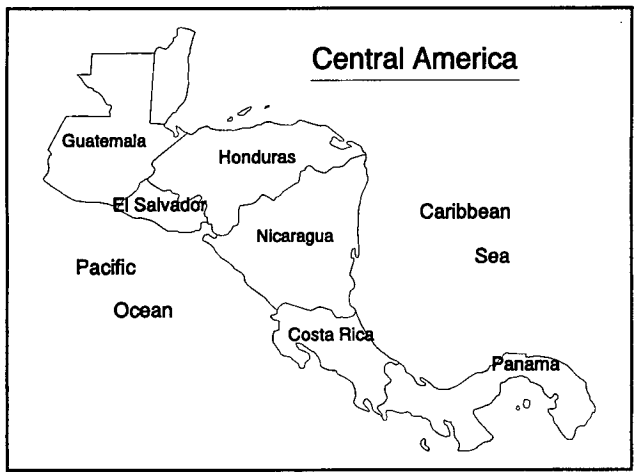
9. **Any joint wetland initiatives between Canada and Central America should ensure close collaboration with the rural communities concerned and ensure the active participation of women in all activities. Only through local support will the conservation of these ecosystems be successful.**

10. **Considering CIDA's ongoing support and interest in the Central American Tropical Forestry Action Plan (TFAP), CIDA should consider providing bilateral assistance to two regional projects given priority by the regional TFAP. Both projects include the sustainable development of internationally-important wetland areas in the Golfo de Fonseca on the Pacific and along the Río San Juan which flows along the border between Costa Rica and Nicaragua.**

These 10 recommendations encourage Canadian support for a Central American wetland initiative which could be coordinated by the NAWCC (Canada) and the IUCN's Central American Regional Office (ORCA). This would hopefully result in an open dialogue between the needs of the two regions and a better understanding of the issues affecting wetlands. By no means are these recommendations exhaustive nor are they particularly detailed. They do, however, focus on specific areas where Canadian assistance is seen as useful and permissible.

1. WETLAND CONSERVATION IN CENTRAL AMERICA

INTRODUCTION



In 1980, the World Commission on Environment and Development (WCED) saw the possibility for a new era of economic growth based on policies that sustain and expand the environmental resource base (WCED 1987). In its report, *Our Common Future*, the sustainable development of earth's resources was seen as a necessary path for nations to follow "to ensure the needs of the present were met without compromising the ability of future generations to meet their own needs." Sustainable development became the "catch phrase" of the 1980s and governments worldwide strived to incorporate this concept into their national policies. The Commission briefly identified wetlands as a habitat of international importance. Now, a decade later, wetland conservation is a major issue of international concern. In 1990, the World Conservation Union's *World Conservation Strategy* (IUCN 1990) recognized the fundamental value of wetlands and warned that they are also the most undervalued and threatened ecosystems.

Globally, wetlands account for an estimated six percent of the land and freshwater area. Although this is significantly less than the percentage of forested areas, it still represents a sizeable portion of this planet. In accordance with this size, wetlands perform important regulatory functions. These include: maintaining water quality; filtering sediments and toxic elements; controlling floods; recharging aquifers (used as sources for drinking water and irrigation); supporting high biological diversity; protecting coastal zones; and the cycling of important basic elements (nitrogen, carbon and oxygen). Wetlands also support commercial and traditional fishing industries, timber and non-timber wood production, tourism, agricultural production, wildlife hunting, salt collection and processing, peat production, and many recreational activities.

People have exploited Central American wetlands for as long as two millennia. The ancient Mayans constructed elaborate canal systems through the lowland wetlands of the Peten to transport food and other resources to their great cities (Schele and Freidel 1990). The Miskito Indians of the Caribbean coast continue to ply the inland waterways and canals of the Miskitia, hunting, harvesting and fishing, as they had done before the first Europeans arrived in the 17th century. The Maleku Indians of northern Costa Rica still maintain ancient ties with the lowland wetlands near Lago de Nicaragua, where they traditionally collect turtle and garfish for meat (Girot 1991).

During the last 100 years, the rapid colonization of Central America has greatly diminished the extent of wetland areas throughout the isthmus. An expanding population, particularly along the Pacific coast, coupled with the expansion of intensive and extensive agricultural practices, are largely responsible for wetland deterioration in the isthmus. Even remote wetlands in the Peten, Miskitia and Darien are not immune to the forces that are reshaping the geopolitical and biophysical settings of Central America. The expansion of the agricultural frontier toward the Caribbean is a result of growing and displaced populations searching for arable land to establish subsistence farming. This "invasion" of the Caribbean side of Central America has occurred in tandem with the expansion of resource extraction companies who opened the way into Central America's heartland. Ranching, forestry, urban and agricultural activities are responsible for the rapid deterioration of the remaining wetland habitats.

The loss of these habitats in Central America has serious negative implications on local forestry, fishery and tourism industries. At risk too is human health—which indirectly benefits from the biophysical functions of wetlands such as improved water quality, water retention and flood control. The effects of wetland loss in Central America also have negative consequences on shared wildlife populations. Each year tens of millions of wetland-dependent waterfowl and shorebirds migrate from their northern breeding grounds in Canada and the United States to wetlands in Central and South America. More than 50 wetland migratory bird species use wetlands that are critical "refuelling" and "wintering" habitats. The deterioration and/or destruction of these important wetland areas in Central America will certainly have a negative impact on population levels as their vital food supplies and refuge areas are degraded.

For many years the Canadian government has invested significant amounts of money and effort promoting the conservation of wetland habitat important to migratory species within Canada's borders. These migratory species (mainly waterfowl) contribute significantly to regional and local economies through various recreational activities (i.e. hunting, birdwatching). However, declines in migratory bird populations emphasize the need for a broader, more global strategy by Canada for wildlife and habitat conservation. The Latin American Program of the Canadian Wildlife Service has been supporting joint research initiatives on migratory bird species and, to a minor degree, has promoted wetland habitat conservation throughout the Western Hemisphere. However, more support is needed.

The Canadian International Development Agency (CIDA) actively supports the sustainable development of natural resources. In 1990, a preliminary investigation by CIDA staff identified a growing interest by Central American organizations to support initiatives promoting the sustainable use of critical wetland habitats. In light of this growing interest, CIDA commissioned this report on the wetland situation in Central America to guide and encourage Canadian support for wetland initiatives in Central America.

OBJECTIVES

The specific objectives of this study are:

- to provide current information on Central American wetlands in Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama;
- to determine the ecological and socio-economic importance of wetlands in Central America;
- to describe current Canadian, international, national and regional wetland initiatives in relation to Central America;
- to assess the wetland conservation and management issues facing Central America; and
- to give recommendations on a course of action while considering the assistance mechanisms available in the region, the technical and socio-economic justification for involvement; and available Canadian and Central American expertise.

STUDY AREA AND METHODOLOGY

The geographic study area includes the Central American countries of Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica and Panama. Belize was not included because it is not covered by CIDA's Central American program. However, future initiatives should include the wetlands of Belize because they are contiguous with those of Mexico, Guatemala and Honduras.

In 1985, the International Waterfowl and Wetlands Research Bureau (IWRB), with partial support from the Canadian Wildlife Service (CWS) and other international agencies, coordinated the first comprehensive survey of Neotropical wetlands of international importance. The resulting *Directory of Neotropical Wetlands* (Scott and Carbonell 1986) lists and describes wetlands in each Latin American and Caribbean country. This *Directory* was used as a baseline for identifying wetlands in Central America with emphasis on areas of particular importance to humans and of high biological diversity.

Further information on wetlands in Central America was gathered from discussions with national and international non-government and government organizations involved in wetland initiatives in the region. Representatives from IUCN's Regional Wetland Program provided key contacts in each Central American country. In Canada, information was obtained from government organizations and NGOs. As part of this consultation, a meeting in Ottawa in April 1992, was hosted by the Secretariat of the North American Wetlands Conservation Council (NAWCC) (Canada) to discuss the preliminary results of this wetland study with interested government and non-government organizations. A workshop of the International Waterfowl and Wetlands Research Bureau (IWRB) in Florida, in November 1992, also provided an opportunity to meet with key groups from the United States, Europe and Mexico. Further discussions with Canadian agencies during the summer of 1992 provided additional comment on the draft report.

CHARACTERISTICS OF CENTRAL AMERICAN WETLANDS

Several wetland definitions have been proposed (Anderson *et al.* 1976; Cowardin *et al.* 1976; Martin *et al.* 1953). For the purposes of this study and because of its universal acceptance, this report has adopted the definition used by the Ramsar Convention (1971), an internationally recognized treaty on wetland conservation, which describes wetlands as:

> *"...areas of marsh, fen, peatlands or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine waters, the depth of which at low tide does not exceed six metres."*

Covering a surface area almost equal to that of Costa Rica (approximately 40 000 km^2), or eight percent of the surface area of Central America, wetlands in Central America are characteristically found in coastal and inland lowland areas. Because of the region's unique location—a narrow landmass dividing the world's two great oceans—and the extreme variations in climate, altitude, latitude, geology and tidal fluctuations, Central America has some of the potentially most productive wetland resources on earth.

Central America can be divided into three geographical regions: the Pacific Lowlands, the Interior Highlands and the Caribbean Lowlands. Within each region, there are several wetland categories with distinct wetland types, including:

1. Marine Wetlands:	coral reef seagrass bed
2. Coastal Wetlands:	freshwater marsh tidal saltwater marsh mangrove swamp estuarine mudflat salt pan

3. Inland Wetlands: freshwater marsh (upland/lowland)
forested swamp (upland/lowland)
riverine

The greatest expanses of wetlands are coastal and found predominantly along the Caribbean coast. Other large coastal wetlands are found dispersed along the Pacific, but they seldom approach in size the seemingly endless stretch of wetlands that extend from the northern coast of Costa Rica to Honduras (Figure 1). In the interior, significant areas of wetlands are relegated to the lowland rainforests of the Peten and along the shores of Nicaragua's great lakes.

The wetlands of the Pacific Lowlands are generally characterized by:

- a short rainy season that delivers 1 000 to 2 000 mm of rain between December and April;
- a definite dry season from June to November, with little, if any, precipitation;
- a tidal oscillation of as much as three metres; and
- narrow coastal lowlands that quickly give way to the rugged and active volcanic highlands of the interior.

On the Caribbean Lowlands, wetlands are generally characterized by:

- heavy precipitation, year-round (receiving from 2 500 to 6 000 mm of rain);
- a tidal oscillation of approximately one metre; and
- broad coastal lowlands along the Caribbean that extend well inland, creating conditions for extensive wetland formations.

These different biophysical conditions result in characteristically different wetland habitats. A combination of high precipitation levels along the Caribbean coast and broad coastal lowlands has created ideal conditions for luxuriant mixtures of deciduous hardwood, palm and mangrove forests that tend to be periodically inundated. The Pacific coastal wetlands are dominated by mangrove estuaries and extensive areas of tidal mudflats. The narrow coastline and extended seasons of drought do not support the luxuriant growth characteristic of the Caribbean Lowlands.

Inland wetlands, except around Lago de Nicaragua and in the Peten region, are scarce. Those that have not been drained or cleared usually consist of grassy marshes or lowland, flooded, deciduous broadleaved forests. The remote wetlands around the southern end of Lago de Nicaragua and in the Peten region receive as much precipitation as the Caribbean and are therefore similar in nature to the freshwater wetlands found in the coastal lowlands.

Human pressure to develop wetlands is far greater along the Pacific coast and in the interior than it is along the Atlantic coast. Today, the vast majority of Central American wetlands along the Caribbean have neither been exploited nor even inventoried. Historically neglected, the Caribbean coast still supports the richest and most productive wetland ecosystems remaining in Central America.

IMPORTANT WETLAND SITES IN CENTRAL AMERICA

Figure 1 identifies Central American wetlands of national and international importance. These include wetlands that are legally protected as national parks, wildlife refuges, confirmed and proposed Ramsar sites, reserves and special management zones (see Section 4 entitled "Overview of Wetland Conservation in Central American Nations" and Appendix 1 for a more detailed description on the state of each country's wetlands).

There is a fairly clear demarcation between the wetland regions of the Pacific coast, the interior highlands and the Atlantic coastal lowlands of the Caribbean. In general, the Pacific coastal wetlands are restricted to a narrow belt along the coast, seldom extending more than five to 10 km inland. Interestingly, the location of these wetlands corresponds with the areas of greatest human population density (Figures 2a and 2b). Important sites along the Pacific include the Bahía de Panamá, Bahía de Parita, Golfo de Chiriquí, Bahía de Montijo, Sierpe-

Terraba, Golfo de Nicoya, Golfo de Fonseca, Bahía de Jiquilisco, Barra de Santiago, Monterrico and Manchón (Figure 1). Most of these sites are mangrove-dominated estuaries and are critical nursery habitats for many aquatic species. The livelihood of many local human communities are dependent upon these mangrove forests which provide important reserves of fuelwood and construction materials.

Pacific coast wetlands on the Osa Peninsula of Costa Rica assume characteristics similar to those wetlands found along the Caribbean coast because of significantly higher precipitation rates and a noticeably reduced dry season (Quesada and Jimenez 1988). Wetlands, such as those found around the Golfo de San Miguel in Panama, are one of the few areas where important reserves of wetland timber species occur along the Pacific coast (Figure 1).

Along the Caribbean coast, an extensive lowland coastal floodplain, stretching inland some 50 to 75 km in Honduras and Nicaragua, supports large expanses of estuarine and inundated forest wetlands. The largest wetlands are found along the Caribbean coasts of Nicaragua and Honduras in an area known as the Miskitia. The Caratasca wetlands in Honduras occupy an area of approximately 3 700 km^2 and are the largest of the Miskitia estuarine wetlands. Other important Caribbean wetlands include Bocas del Toro in Panama, the Río San Juan in Nicaragua, Barra de Colorado in Costa Rica and the Lago de Izabal as well as the Río Dulce wetlands of Guatemala (Figure 1).

Important inland wetlands are found throughout the lowland region of the Peten of Guatemala and along the shores of the three largest lakes in Central America: Lago de Nicaragua and Lago de Managua in Nicaragua, and Lago de Izabal in Guatemala (Figure 1). However, the steep and mountainous terrain of the Central American Highlands generally do not support significant wetland areas. Those that do exist have generally been altered by human activity and are confined to very small areas, such as the shores of volcanic lakes, or are being formed along the newly created shorelines of reservoirs. The wetland swamps and marshes of the Peten are located in the drainage basin of the Río Usumacinta, which empties into the Caribbean to form one of Mexico's most important coastal wetland sites.

The Cayos Miskitos, off the Miskitia coast of Nicaragua, are the second largest marine wetlands in Central America. The extensive coral reefs and seagrass beds are critical habitats for marine turtles and are also prime commercial fishing grounds for lobster and fish. The Islas de la Bahía, off the Caribbean coast of Honduras, also support important marine wetlands and are an extension of the coral reefs stretching from the Yucatán Peninsula toward Guatemala and Honduras. These coral reefs attract tens of thousands of tourists annually to the area.

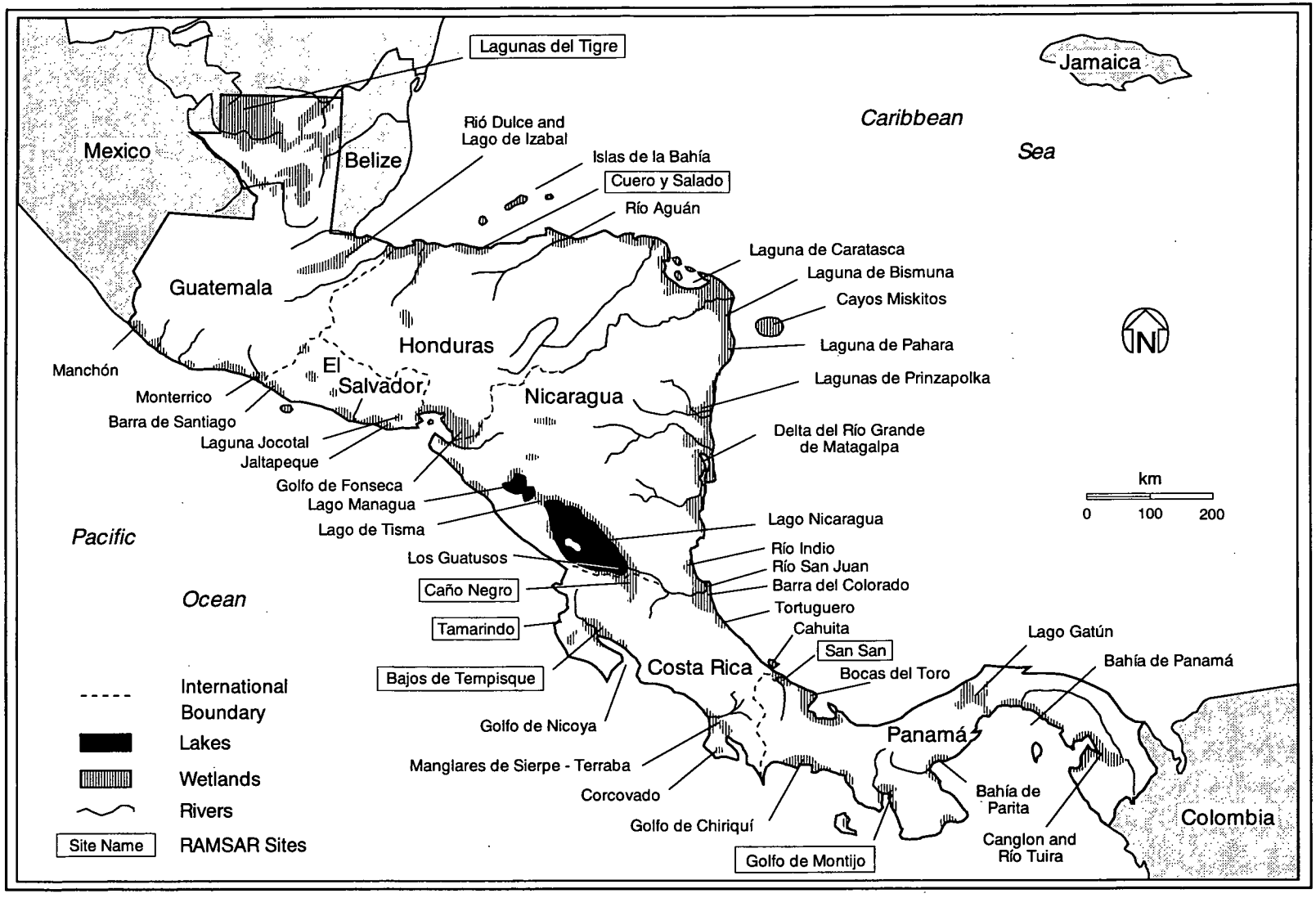


Figure 1. Wetlands of International Importance in Central America

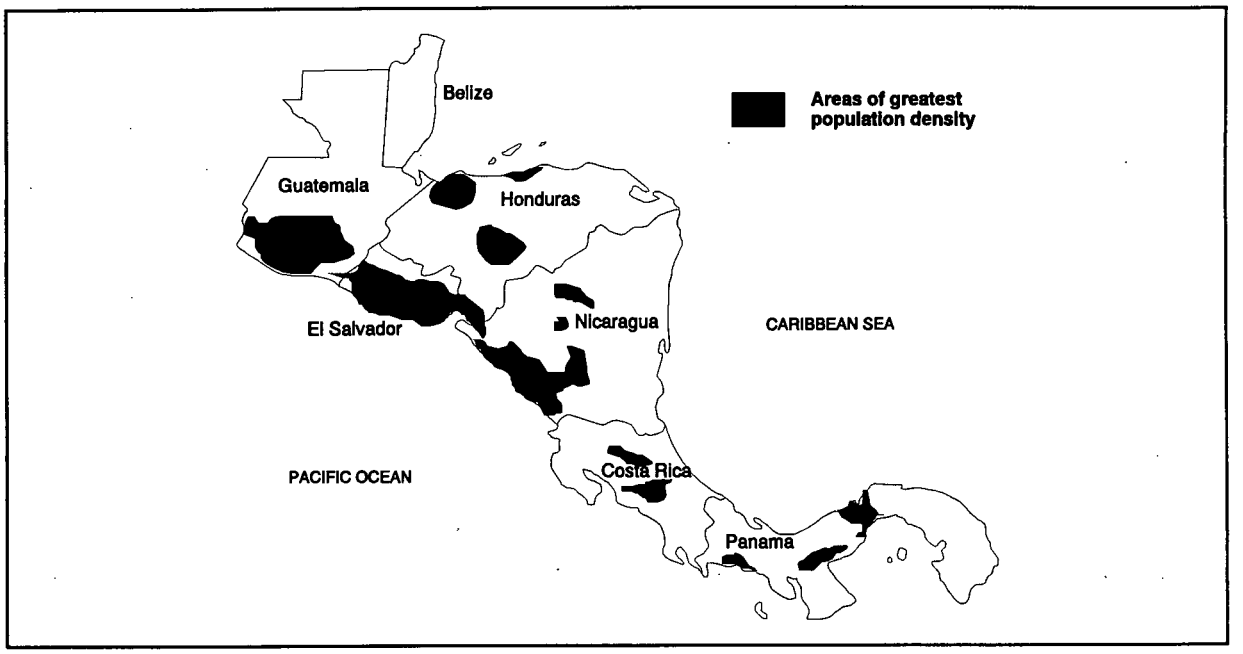


Figure 2a. Areas of greatest population density in Central America.

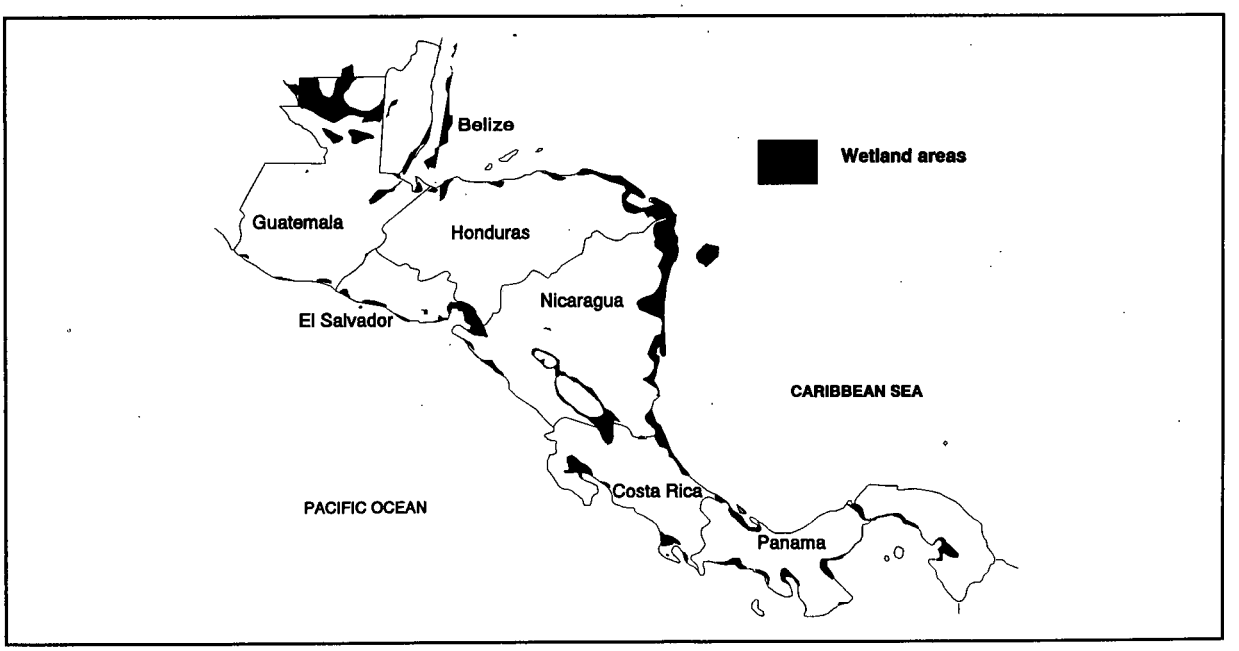


Figure 2b. Major wetland areas in Central America.

THE IMPORTANCE OF WETLAND ECOSYSTEMS

While wetlands provide important resources for local human populations in Central America, they are also critical habitat for wetland-dependent species which reside or take refuge in these areas at various times of the year or during different stages of their lifecycles.

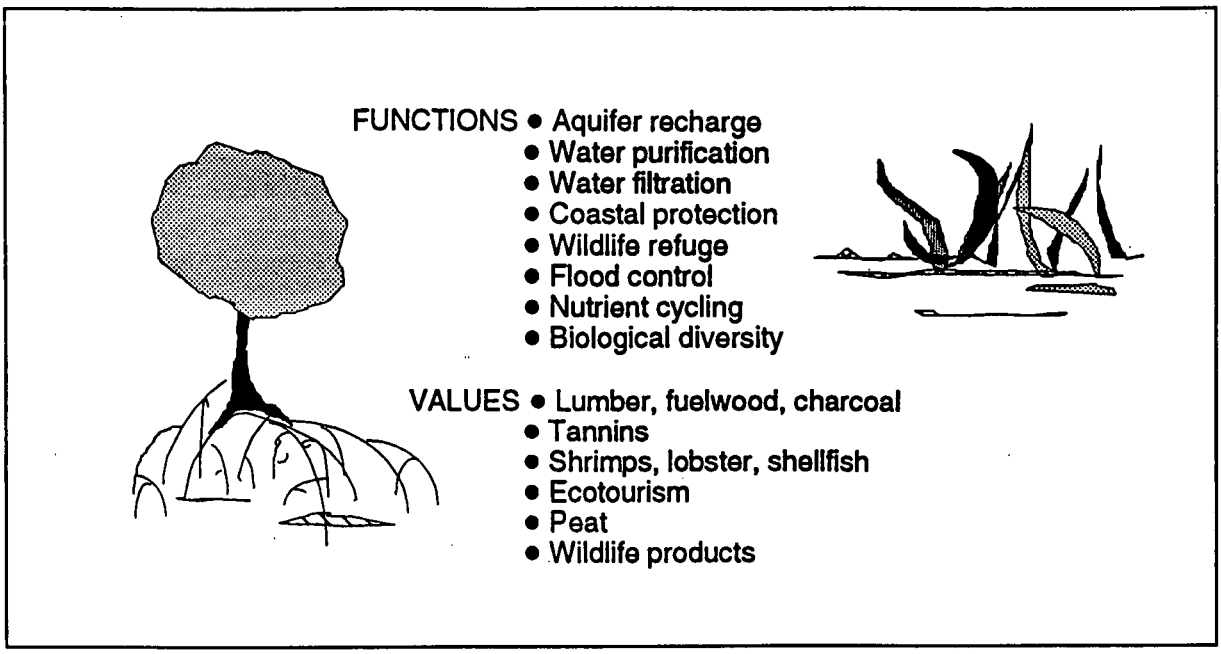


Figure 3. Wetland functions and values in Central America.

Until now, the economic benefits of wetlands in Central America have rarely been considered. In the following section, specific examples of wetland functions and values illustrate the growing importance of these habitats to the region (Figure 3).

Forest Timber and Non-Timber Wood Products

Wetlands contain important reserves of valuable timber species. Inventories of marketable timber species have been undertaken for a few small areas, but in general, the remoteness of these forests has prohibited their estimation. In the lowland inundated forests of the Darien and Bocas del Toro in Panama, large homogeneous stands of valuable cativa (*Prioria capaifera)* and orey (*Camnosperna panamensis*) have been targeted for lumber and plywood production (TFAP 1990). Recent requests from international consortiums for permission to log the Caribbean lowland tropical rainforests are an indication of a strong interest to exploit the flooded forest reserves of the Miskitia. The broadleaved lowland tropical forests of the Peten, including vast tracts of swamp forest, have also been exploited for their valuable timber.

Along the Pacific coast of Central America, wetland forests such as mangroves have traditionally been important sources of fuelwood, charcoal, construction materials and tannin. Remarkably adapted to saline conditions, mangrove forests grow in areas where most other species cannot. Individual trees can attain heights of 15 to 20 metres and are characterized by prop-root systems that anchor them to shoreline substrates. The important genera in Central America include the *Rhizophora* and *Avicennia* sp. (West 1977) (Figure 4).

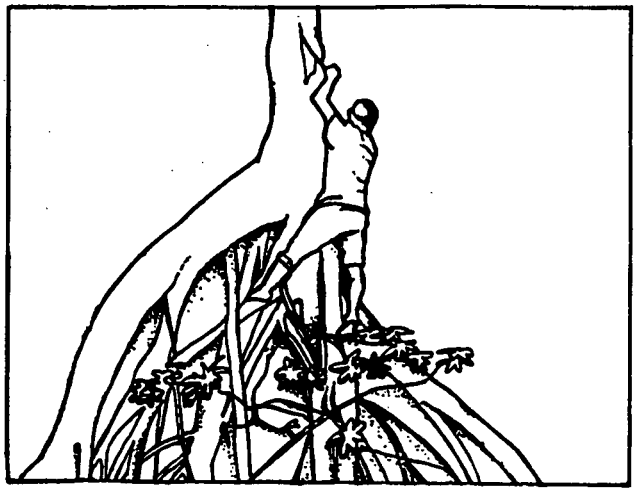


Figure 4. Mangrove prop roots stabilize coastal shorelines. In some areas, mangrove bark is collected and processed to make tannins for curing leather. *(Source: IUCN 1989).*

The densely populated Pacific regions are largely devoid of upland forests. This has put tremendous pressure on mangrove wetlands to meet human demands for various wood products and has severely reduced the mangrove forests along the Pacific coasts of El Salvador, Guatemala and Nicaragua. However, the remaining mangrove forests continue to provide coastal communities with fuelwood, tannin and construction material. Cooperatives in the Sierpe-Terraba region of Costa Rica are developing more sustainable methods of producing charcoal from mangrove wood—an activity that supports numerous families in the area (Quesada and Jimenez 1991). The remaining 412.9 km^2 of Pacific mangrove forest in Costa Rica plays a minor role in forestry activities, although bark extraction was an important source of tannin before cheaper, synthetic materials appeared on the market (Jimenez 1991). Recent studies in the Pacific northeastern corner of Nicaragua indicate that as much as 11% (10 000 - 15 000 people) of the rural population depends on mangrove forests for their livelihood (Gutierrez 1991). The populated regions along this coast regard these forests as important reserves for fuelwood and tannin.

Estimates of the total area of mangrove forest remaining in Central America vary from 8 000 km^2 (Quesada and Jimenez 1988) to 8 980 km^2 (Leonard 1987). Statistics from the IUCN (1983), indicate the general size of the mangrove forests in Central America (Table 1) but it is unclear whether they include estimates for reserves along the Caribbean. In 1990, a study of mangrove wetlands in Central America was coordinated by the *Confederación Universitaria Centroamericana* (Confederation of Central American Universities) (CSUCA). Statistics from these reports show that mangrove forests in some countries, notably Panama and Guatemala (where the majority of mangroves grow along the Pacific Ocean), have decreased significantly since the 1983 inventory conducted by the IUCN (Table 1). These reports also noted that large areas of mangrove forests along the coasts of Nicaragua and Honduras have yet to be fully inventoried.

Obvious discrepancies exist between the figures obtained by the IUCN (1983) for the total area of mangrove forest and the figures provided by CSUCA (1990) for the area of mangroves along the Pacific coast.

Estimates for mangrove forests in Costa Rica are greater on the Pacific coast in 1990 than for all of Costa Rica in 1983. It is unlikely that the mangrove forests have increased that substantially along the Pacific coast. Conversely, estimates for the total area of mangrove forest in Nicaragua seem to be under-estimated in 1983 since estimates in 1990 indicate a similar area for the Pacific coast alone. This lack of reliable information underlies the scarcity of information on Central American mangrove forests and possibly is one of the reasons that they have been poorly managed to date.

Table 1
Areas of Mangrove Forest in Central America 1983 and 1990

Country	Total Area (km^2 1983) Caribbean and Pacific Coasts	(km^2 1990) Pacific Coast
Costa Rica	390.0	412.9
El Salvador	450.0	414.9
Guatemala	500.0	138.9
Honduras	1 450.0	n/a
Nicaragua	600.0	600.0
Panama	4 860.0	1 581.0

n/a - data not available

Sources: 1983—IUCN, Gland; 1990—C. López and M. Saravia, Universidad de San Carlos de Guatemala; J. B. Yanes, Universidad de El Salvador; H. G. Gutierrez, Universidad Nacional Autónoma de Nicaragua; J. A. Jimenez, Universidad Nacional de Costa Rica; and L. D'Croz, Universidad de Panamá.

Statistics on the value of mangrove forests vary considerably. In the late 1970s, the annual commercial yield from mangrove forests close to Panama City was estimated at US$ 95 000/km^2 (United States Agency for International Development—USAID 1980). This is comparable to estimates from Trinidad (US$ 50 000/km^2) and Puerto Rico (US$ 155 000/km^2).

Based on recent statistics on forestry practices in Honduras, Quesada and Jimenez (1988) estimate that more than 54 000 cubic metres of mangrove trees are being cut for fuelwood in the Golfo de Fonseca annually. Given an average production of 1 000 cubic metres of fuelwood per km^2, 54 km^2 of mangrove forest are being cleared annually. If mangrove deforestation continues at this rate, it will destroy the wetlands of the Golfo de Fonseca in less than 30 years.

Fisheries

It is estimated that two-thirds of all fish caught throughout the world are hatched in tidal areas, and roughly 90 % of the commercial species of fish and shellfish taken in the Gulf of Mexico and the Caribbean depend on mangroves, seagrass beds and coral reefs during critical stages in their life-cycle (Lean, Hinrichsen and Markham 1990). According to Leonard (1987), during the mid-1980s the fishing industry contributed between two to five percent of the gross domestic product (GDP) of each country in Central America. Since then, fisheries production has increased significantly, particularly with the growth in the shrimp farming industry. Unfortunately, the rapid development of the shrimp industry has been detrimental to wetlands. Large tracts of mangrove and estuarine wetlands are cleared to build large holding ponds for shrimp cultivation.

Traditional fisheries supply most of the fish for domestic consumption, and tend to rely more on estuaries and bays where mangroves and marshes support larger fish populations. In El Salvador, for example, as many as 18 000 traditional fishermen depend on the fishing industry, whose productivity is related to the state of coastal wetlands (USAID 1991). Commercial fisheries rely to a lesser degree on mangrove systems but, ultimately, their productivity also depends to a significant extent on the state of coastal wetlands. There are strong indications

from many parts of the world (for example, Thailand) that the health of the fishing industry is directly affected by the conditions of the reproductive and protective habitat of commercially caught fish species. As mangroves were cleared along the coast of Thailand to make way for shrimp farms, the production of shrimp larvae and commercial fish species began to decrease. The majority of small shrimp farms, which relied on the collection of shrimp larvae to stock their ponds, were forced to relocate, moving further along the coast to restart the process. This destructive practice has destroyed substantial mangrove forests throughout the Far East.

Biological Diversity

A wetland is the interface between aquatic and terrestrial environments. As such, it supports a wide assortment of flora and fauna, often exceeding the diversity associated with other tropical habitats.

The largest wetlands are probably the last strongholds for several important mammalian and reptilian species targeted elsewhere for their valuable skins. The relative inaccessibility of these areas provides ideal refugia for such species as the jaguar (*Panthera onca*), manatee (*Trichechus manatus*) and American crocodile (*Crocodylus acutus*).

During the dry season from November to May, the rich biological diversity of Central American wetlands is accentuated by hordes of migrating birds. This remarkable influx in numbers and species is a testament to the capacity of these ecosystems to support life.

A majority of the 27 shorebird species breeding in the Canadian Arctic migrate through the Central American isthmus, using wetlands as "refuelling" sites on their longer journey to South America. Sites, such as the Bahía de Panamá and the Golfo de Fonseca in Central America, should be internationally-recognized as critical for these shorebirds in migration through a network of wetlands spanning the length of the American continents. Each wetland is a vital "stepping stone" between their breeding and wintering habitats. The demise of any *one* of these wetlands could seriously affect the long-term survival of these and many other migratory species.

It is the rich and varied biological diversity characteristic of tropical habitats, such as wetlands, that has spurred the growth of ecotourism in Central America. As a resource, biological diversity may soon compete with traditional export crops as an important economic alternative for helping to revitalize impoverished Central American economies. Costa Rica is well on the way to proving this.

Unfortunately, the exotic nature of some of this biological diversity is encouraging an uncontrolled and unmanaged growth in the trade of wildlife and wildlife products. In 1988, 272 897 reptiles, 13 257 crocodile skins and 26 769 birds were legally exported from Honduras (USAID 1989). Trade in exotic animals has also been on the increase in Nicaragua, particularly caiman and crocodile skins, which are legally caught and sold to support a growing domestic clothing manufacturing industry.

Given the tremendous diversity of plant and animal species in tropical ecosystems like wetlands, it is not surprising to find multinational firms involved in the search for new substances derived from tropical plants and animals that may produce important cures for human and animal diseases. Merck, a pharmaceutical corporation, has recently signed an agreement with the Costa Rican government to fund a survey of Costa Rica's rich biodiversity in return for access to this biological wealth for future research purposes.

Hydrological Importance

The hydrological functions of wetland ecosystems are numerous (Mitsch and Gosselink 1986). Wetland ecosystems: (a) protect coastal settlements from coastal erosion; (b) maintain the quality of coastal and freshwater systems; (c) filter human and industrial waste, agro-chemicals, animal excrement, etc.; (d) control flooding; (e) recharge aquifers; (f) reduce sedimentation; (g) contribute to the global cycling of carbon, nitrogen and oxygen; and (h) create conditions for high biodiversity.

Because of the alarming deforestation rate of major watersheds in Central America, large quantities of soil are being washed into river systems. Wetlands adjacent to many of these rivers act as giant filters, trapping sediments, causing them to settle out. These trapped sediments contribute to the wetland productivity and provide excellent areas in drier seasons for cultivation.

Wetlands have various biological, chemical and physical processes which immobilize, transform and fix contaminants preventing high proportions of them from flowing out or entering groundwater or the foodchain (Maltby 1986). According to Maltby, the efficiency of heavy metal removal in wetlands, for example, varies from 20 to 100%. This capacity to filter enhances the quality of water which often serves as a source for human use. However, massive dumping of some agro-chemicals can kill wetland vegetation outright and wetlands close to human settlements are often destroyed by toxic industrial waste (Lago de Managua in Nicaragua is an example). Wetlands throughout the region have been sinks for an inordinate array of toxic agro-chemicals used to combat plagues affecting crops (cotton, coffee, bananas and basic grains).

The absorptive capacity of wetlands helps to moderate water flow, thus reducing the destructive nature of flooding. The very characteristics of wetland vegetation contribute to stabilizing soils along streams, rivers and lakes, and protects them against the powerful forces of nature. For example, mangrove trees with their prop-root system, can deeply penetrate shorelines that stabilize soils during storms which consistently batter the Caribbean. Many coastal communities reap the benefits of this natural buffer against the elements.

In some upland areas, wetlands may help to retain water long enough for the replenishment of aquifers. Wetlands act like sponges, absorbing large quantities of water during the rainy season, releasing it slowly in the dry season. This not only helps to replenish aquifers but also controls flooding, traps soil particles and regulates water runoff. However, heavy deforestation along the Pacific has reduced the capacity of the land to retain its moisture. Rain water quickly runs off into streams, reducing the amount of water absorbed into the ground.

Cultural Values

Large wetland areas in Central America have supported indigenous cultures for centuries. The Miskito Indians of the Caribbean Lowlands of Honduras and Nicaragua have traditionally lived off the rich resources of the lowland forests and coastal estuaries. Along the north coast of Honduras, an estimated 30 000 Miskito Indians continue to sustainably use the coastal and marine resources of the region (*Secretaría de Coordinación, Planificación y Presupuesto*—Secretariat for Coordination, Planning and Budget Management 1989). In the Cayos Miskitos of northeastern Nicaragua, they harvest a variety of marine species, including green sea turtles (*Chelonia mydas*) that migrate annually to the cays to feed in the extensive seagrass beds.

The Maleku Indians are a small ethnic group (about 500 people) who live close to the wetlands of Caño Negro in Costa Rica. Traditionally they have harvested turtles and garfish that migrate to these wetlands from Lago de Nicaragua. Despite the declaration of Caño Negro as a national wildlife refuge, the Maleku Indians continue to use these wetlands for sustenance (Girot 1991).

Tourism

It is hard to quantify the benefits of wetlands to the tourism industry in Central America. Military conflicts throughout Central America have discouraged the development of tourism, except in Costa Rica where tourism promises to become the largest contributor to the GDP, surpassing coffee and bananas. With a recent cessation of hostile activities in Central America, ecotourism is being hailed as an alternative for attracting precious foreign exchange currency to the area. Interestingly, many of the most popular areas preferred by ecotourists are wetland sites. Wetlands offer an opportunity for close interaction with wildlife, particularly birds. Increasing numbers of ecotourists are lured by the opportunity to view wildlife in popular wetland areas such as Palo Verde, Caño Negro and Tortuguero in Costa Rica; Bahía de Parita in Panama; the Peten and Río Dulce in Guatemala; Islas de la Bahía in Honduras; and Laguna de Jocotal in El Salvador.

Energy

As Central American countries continue to deplete their forest resources, alternative sources of energy will need to be developed. One option lies in the vast reserves of tropical peat. Where low temperature, high acidity, low nutrient supply, waterlogging and oxygen deficiency retard decomposition, the plant matter does not oxidize, but instead accumulates and is transformed into peat (Maltby 1986). Large quantities of peat are found in Panama, Nicaragua and Honduras (Table 2).

According to Maltby (1986), this "attractive" non-traditional fuel source is seen as a viable alternative for fuel and its exploitation is supported by several foreign aid and bilateral and multilateral agencies. However, it should be noted that peat extraction for energy has serious environmental consequences including long-term damage to the wetland ecosystems, alteration of watertables and water quality, and irreplaceable loss of biological diversity.

Table 2
Area of Peatlands in Central America

Country	Peatland Area (ha)
Costa Rica	37 000
El Salvador	9 000
Guatemala	-----
Honduras	453 000
Nicaragua	371 000
Panama	787 000
Total (ha)	1 657 000

Source: Maltby (1986).

DIRECT AND INDIRECT CAUSES OF WETLAND LOSS IN CENTRAL AMERICA

Wetlands in Central America suffer from direct and indirect resource exploitation (Quesada and Jimenez 1988). Figure 5 illustrates the relationship between direct and indirect causes of wetland loss in Central America.

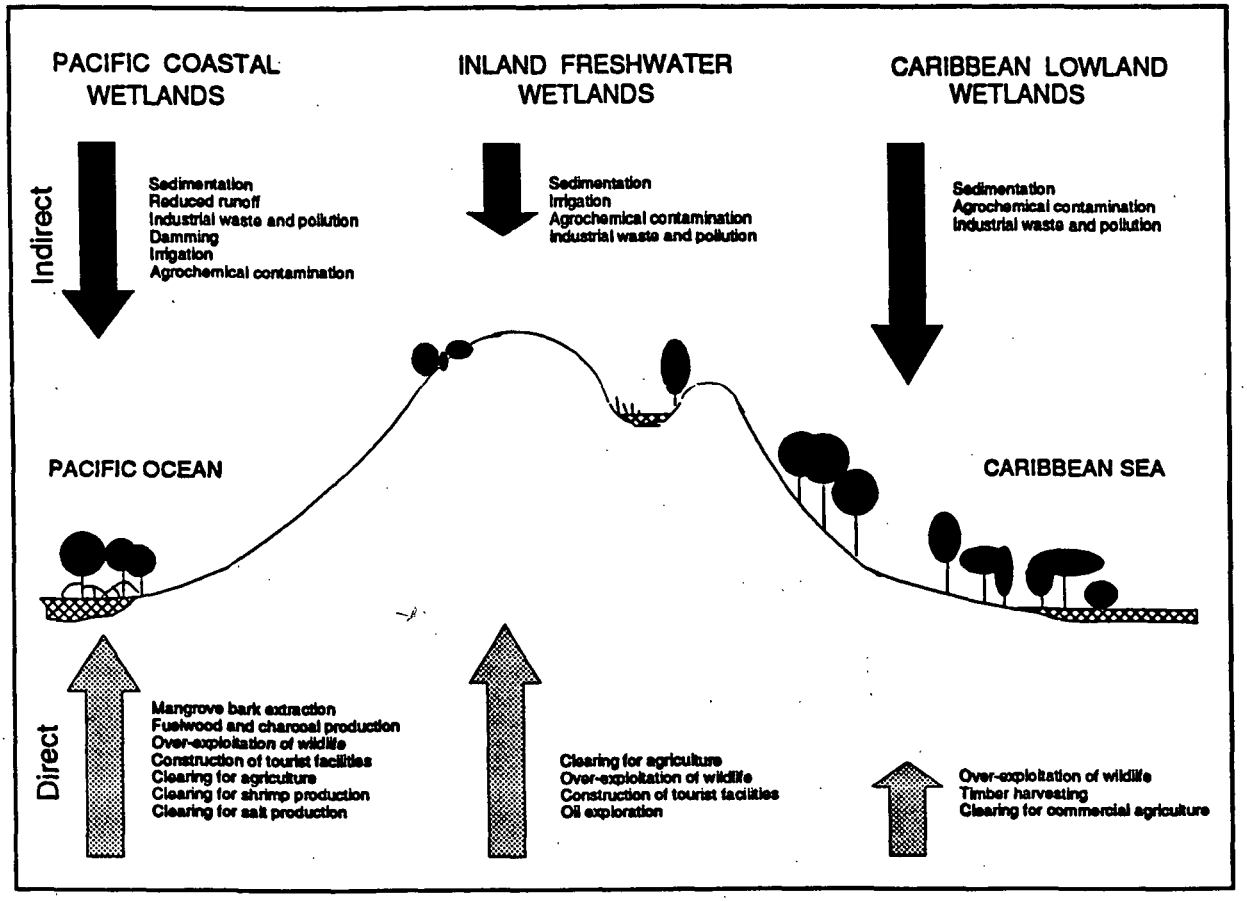


Figure 5. Direct and indirect causes of wetland loss in Central America (arrows represent proportion of direct and indirect causes of wetland loss).

Wetlands along the Pacific and in the interior suffer more deterioration and loss as a direct result of pressures caused by human demands for resources. The reverse is true along the sparsely populated Caribbean coast. Wetland deterioration and loss is indirectly attributed to activities occurring in areas outside of the wetlands. These activities are the deforestation of upper watersheds and the diversion of rivers to provide water for irrigation and hydroelectricity.

Direct Causes of Wetland Loss in Central America

The following are a few examples in Central America of how specific activities are directly impacting wetland ecosystems.

DIRECT CAUSES	EXAMPLES
■ Deforestation of wooded wetland areas (e.g. mangroves, flooded broad-leaved forests) for timber, fuelwood and charcoal.	A recent outbreak of cholera has compounded the rate of mangrove deforestation throughout Central America. A reduced demand for fish products (thought to be a major carrier of the cholera bacteria) has forced many fishermen to look for alternative sources of income such as the production of charcoal from mangrove wood.
■ Removal of bark from mangrove trees to produce tannin for curing leather.	In northwestern Nicaragua, tannin production is still an important activity. The lack of coordination between collectors of bark and fuelwood results in twice as much wood being cut than is necessary to satisfy market demands.
■ Clearing for commercial shrimp and salt production.	It is estimated that more than 28 000 ha of shrimp farms alone have been built along the Honduran sector of the Golfo de Fonseca in the last 10 years and an additional 10 000 ha are being planned. With an estimated capacity for about 20 000 ha of shrimp farms, the Gulf wetlands may be in jeopardy. A large traditional fishing industry depends on these wetlands to provide critical habitat for shrimp larvae and commercial fish species.
■ Agricultural clearing of marginal wetland areas along the Pacific slope.	Central America's population growth rate is 2.8% per year. At this rate, the population will have doubled in 25 years (Leonard 1987). Landless farmers in El Salvador are being forced to convert marginal lands, such as wetlands, to raise crops and livestock. This has several important negative implications. Marginal lands are less productive and therefore more area is required to equal the production obtained on a smaller piece of more arable land. By draining wetlands, farmers risk exposing soils which oxidize rapidly and become toxic to plants.

■ Uncontrolled forest fires, set primarily by farmers and poachers to clear land for pasture and to flush out wildlife, is devastating several important wetlands in Central America.	Each year, hundreds of hectares of wetland forests are destroyed by forest fires set by ranchers and poachers along the southern coast of Lago de Nicaragua. These fires are used to create pastureland for cattle and to flush wildlife species that are then shot, skinned and sold on the growing illegal market in the region.
■ Uncontrolled tourism development.	Development along the shores of Lago Atitlán in Guatemala has decimated indigenous species of wetland fauna such as the Poc (*Podilymbus gigas*)—an endemic species of waterfowl that once survived in the reedy marshes along the lake. Tourism threatens to ruin the pristine nature of remaining wetlands.
■ Poaching and over-harvesting of wildlife species is increasing as the demand for these commodities soars.	Wetlands, especially in Honduras, Nicaragua and Panama, are suffering from heavy poaching and over-harvesting. A deterioration in the Central American economic condition has encouraged an illicit trade in wildlife products—caiman, turtles, waterfowl, fish, iguanas, etc. The trade in Scarlet Macaws (*Ara macao*), which are readily found in wetlands such as the delta of the Río San Juan, illustrates the lucrative nature of this industry. Live Macaws fetch up to $US 600 in local markets. These same birds, smuggled to North America, may fetch between $US 10 000 to $US 20 000.

Indirect Causes of Wetland Loss in Central America

The following are examples of how certain activities are indirectly responsible for wetland deterioration and loss in Central America.

INDIRECT CAUSES	EXAMPLES
■ The acute deforestation of major watersheds along the Pacific slopes is resulting in the heavy sedimentation of many major river systems. The vegetative material that once protected the upland soils has been removed and heavy rains wash these arable topsoils away.	Wetlands are intrinsically linked to their surrounding habitats. Because most wetlands in Central America are formed at the mouths of rivers, they are vulnerable to disturbances in the upper watersheds. The heavy deforestation along the entire Pacific slope affects wetlands by increasing the quantity of sediments entering rivers which when reaching these wetlands can literally choke the ecosystem.
■ The deterioration of wetland ecosystems is being exacerbated by agro-chemical contamination.	The intensive use of agro-chemicals in the vicinity of the Golfo de Fonseca is severely contaminating this internationally important wetland. Massive die-offs of fish and shrimp have been attributed to agro-chemical contamination in the Gulf and there is little doubt that other marine species which breed on the coast, such as sea turtles, are being affected. This site is also an important feeding and resting site for migrating shorebirds. It is not known how the heavy contamination of these wetlands is affecting human and wildlife populations.
■ Raw sewage and industrial waste products are being dumped directly into nearby rivers, lakes and wetlands.	Managua, Nicaragua's sprawling capital city, was built along the shores of Lago de Managua—the second largest lake in Central America (1 042 km^2). Wetlands along the shore of this lake are probably the most contaminated of any in Central America. This lake has been a repository site for billions of litres of raw sewage and industrial waste from Managua. Because the lake has no direct outflow, the concentration of toxic materials continues to worsen.
■ Construction of dams and irrigation channels alter both river flow and water quality. Many wetlands, particularly mangroves, are destroyed by altered river levels and changes in water composition.	The construction of a major dam across the Río Lempa has significantly reduced the river flow downstream. According to some El Salvadoran biologists, this reduction in flow is destroying the mangrove wetlands along the coast which rely on influxes of freshwater and nutrients.

■ Rapid and unplanned development in wetlands results from a lack of knowledge and foresight at the policy and decision-making levels.	Interior wetlands, such as those found along the shores of Lago de Nicaragua, are being drained and cleared for agricultural production without consideration for their overall importance to local economies. Important fisheries are being decimated along with the future possibility for promoting tourism and other less impactive activities. A lack of proper land-use policies for wetlands can generally be attributed to a lack of knowledge and a perception that wetlands are unproductive and the source-areas for diseases.

LONG-TERM CONSEQUENCES OF WETLAND LOSS

The long-term consequences of wetland deterioration are predictable:

- The continued pollution of mangrove and associated estuarine wetlands along the coast will destroy optimum habitats used by aquatic species such as shrimp and many important commercial fish. Already there are strong indications that fishery catches of shrimp, lobster and conch are decreasing in Central America (Leonard 1987). Multi-million dollar investments in shrimp farms have been lost as natural shrimp larval production decreases and offshore waters become polluted. It is estimated, in the United States for example, that the destruction of estuarine ecosystems between 1954 and 1978 cost over US$ 200 million annually in lost revenues from commercial and sport fisheries alone (World Resources Institute—WRI 1992). Similar statistics are lacking for Central America but it is probable that as these countries move towards expanding their economic bases, the losses incurred from wetland destruction will result in significant economic losses to the fishing industry.

- Alternative fuel sources will be required along the Pacific if mangrove forests continue to be cleared at the present rate. As a result, many coastal communities may be forced to search for alternative economic activities to support their families. This will put pressure on other ecosystems such as the Atlantic tropical rainforests which are rapidly succumbing to the demands of displaced families searching for agricultural lands.

- Increased flooding and coastal shoreline erosion could result from the deterioration of coral reefs, estuaries and inland wetlands, negatively affecting adjacent settlements and associated infrastructure (e.g. ports, roads), agricultural production, and even aquatic transportation.

- Wetland loss may result in a decrease in aquifer recharge near some urban areas, thereby reducing subterranean water reserves used for domestic, industrial and agricultural purposes.

- Migratory and resident wildlife populations, such as wildfowl used for local consumption, will likely diminish as suitable habitats for their reproduction and feeding become scarce. Important staging areas for resident and migratory shorebirds and waterfowl have already been drastically altered.

- A loss of wetland sites will similarly reduce the opportunities available for promoting ecotourism; an industry that has recently shown a significant growth in the region. Wetlands attract numerous tourists interested in viewing the rich biological diversity found in these habitats. It is already estimated that half of the ecotourists who visit Costa Rica visit at least one wetland site. With tourism slated to become Costa Rica's most important industry, it can ill afford any more substantial loss of wetland habitat.

- The value of wetland genetic diversity is being lost without regard to its future potential. Genetic material collected from other tropical habitats has been used to combat diseases, increase crop resistance to pests and even reduce human fertility. Compounds extracted from plants, microbes and animals were involved in developing all of the 20 best-selling drugs in the United States, drugs whose combined sales approached US$ six billion annually (Miller and Brewer 1991).

2. *INTERNATIONAL WETLAND CONSERVATION IN CENTRAL AMERICA*

THE RAMSAR CONVENTION

As of October 1993, 80 countries have signed the Convention which emphasizes the wise or sustainable use of wetlands. Under this Convention, signatory countries must designate one or more internationally significant wetlands as Ramsar sites and promote activities that will not alter or destroy the ecological character of the wetland(s). Signatory governments provide annual operating contributions to the Convention which administers these funds to support projects worldwide. Wealthier nations are encouraged to provide technical and financial assistance to those countries that need support.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) serves as the depository for the Convention. The Secretariat to the Convention, known as the Ramsar Bureau, is an independent body co-located with the World Conservation Union (IUCN) at its headquarters in Gland, Switzerland.

In Central America, four countries have joined the Convention: Costa Rica, Guatemala, Honduras and Panama. Nicaragua and El Salvador are in the process of nominating Ramsar sites and, hence, joining the Convention.

INTERNATIONAL ORGANIZATIONS WITH WETLAND EXPERTISE IN CENTRAL AMERICA

International Waterfowl and Wetlands Research Bureau

The International Waterfowl and Wetlands Research Bureau (IWRB) is an NGO established in 1954 to stimulate international cooperation for the conservation of migratory waterfowl and their wetland habitats. Through a small secretariat based at Slimbridge in the United Kingdom, IWRB facilitates international partnerships between scientists, organizations and institutions. Many activities are coordinated through research groups, comprising experts from around the world. The major activities of the IWRB fall into three categories: research, surveying and monitoring, and the transfer of information.

The IWRB was instrumental in the creation of the Ramsar Convention. It has also played a lead role in compiling wetland inventories for various regions of the world, including South and Central America. The IWRB actively promotes the sustainable development of wetlands through training courses and workshops on wetland management planning. The IWRB also organizes numerous international symposia to stimulate international cooperation for wetland conservation. Funding is obtained through membership. Government organizations, NGOs and individuals make annual contributions to the Bureau.

With funds from the Canadian Wildlife Service (CWS), the United States Fish and Wildlife Service (USFWS), Ducks Unlimited, Wildfowl Foundation Inc. and the World Wildlife Fund (WWF), the IWRB in 1986 completed a *Directory of Neotropical Wetlands*. Coordinators were selected to characterize the important biological features, threats, uses and benefits derived from wetland habitats in their respective countries. The results of this inventory revealed a serious lack of information on wetlands in Central America, particularly in Honduras and El Salvador. The inventory also revealed that only a quarter of the 96 wetlands of international importance in Central America receive some form of protection (Scott and Carbonell 1986).

The Nature Conservancy

The Nature Conservancy (TNC) is an American-based international NGO dedicated to protecting ecologically-significant natural areas and the diversity of life they shelter. TNC builds conservation capacity abroad, helping other nations safeguard their own natural heritage. Founded in 1951, TNC has recently focused its attention on Latin America and the Caribbean where it is involved in programs designed to support the conservation of natural areas such as wetlands. These include a program to establish **Conservation Data Centres (CDCs)**, the **Parks in Peril Program** and the **Central American Environmental Education Program.**

The program to establish CDCs throughout Latin America was created to continually update inventories of the most significant biological and ecological features of the country or region in which each centre is located. This information can then be used by government agencies, development banks, and national and international conservation organizations to assist with conservation and development planning.

The second program is being financed by the United States government, and is an emergency effort to safeguard the most important and imperiled natural areas in the Western Hemisphere. Working with 30 conservation organizations in Latin America, the program will bring on-site conservation to 20 critical parks each year for the next 10 years. Longer-term funding to sustain these initiatives will be secured through mechanisms such as debt-for-nature swaps.

TNC has joined with CARE and Conservation International (CI) to implement the multi-million dollar **Central American Environmental Program (PACA)**, which is funded by the United States Agency for International Development (USAID). Still in its infancy, this initiative proposes to cooperate with local organizations, both public and private, on conservation issues of mutual concern (TNC 1990). PACA reflects the conviction of the three organizations that integrated strategies are required to effectively address the complex environmental and natural resource management challenges facing Central America. PACA provides an opportunity to conserve biological diversity through coordinated action in wildlands management, environment education, conservation information and strategic planning (PACA 1991). In Costa Rica, PACA is focusing its attention on the conservation of an internationally-important wetland complex in the Bajos de Tempisque.

TNC is based in Arlington, Virginia; as of 1991 TNC had partnerships in 13 Latin American and Caribbean nations. The Nature Conservancy receives its funding from private foundations, acquisition of lands and through memberships.

World Wildlife Fund

The World Wildlife Fund (WWF) is an international NGO concerned with the conservation of wildlife species and their habitats. Although it does not have a specific wetlands program, it has been instrumental in supporting worldwide wetland conservation initiatives. WWF's 23 national organizations are involved in wetland conservation activities, and through its international program, WWF is undertaking wetland projects in Africa, Asia, the Americas and Europe. The WWF is a strong supporter of the Ramsar Convention and often works in concert with other international NGOs, such as the IUCN and IWRB, to promote the Convention.

The WWF is currently involved in wetland-related projects in Guatemala (Monterrico), El Salvador (Laguna de Jocotal) and Costa Rica (Tortuguero National Park), where it provides financial, technical and educational support.

The WWF headquarters is located in Gland, Switzerland and regional offices are found throughout the world including a field office in Turrialba, Costa Rica, where it coordinates its Central American activities. The WWF works in close association with the IUCN Wetland Program giving technical and financial support to many

projects throughout Central America. In particular, the WWF has been instrumental in its support to *Centro Agronómico Tropical de Investigación y Enseñanza* (Tropical Agricultural Centre for Research and Education) (CATIE) which provides academic training to future wetland managers. The WWF often works in association with the IUCN in Central America on issues concerning wetland conservation.

Ducks Unlimited

Ducks Unlimited (DU) is a private, non-profit, internationally supported conservation organization whose goals are to preserve, restore, develop and maintain waterfowl breeding habitats. Established in the United States as Ducks Unlimited Inc. (DUI) in 1937, this organization is now well represented in Canada, Mexico and New Zealand.

Over the past decades, DU has been actively involved in wetland promotion through research, conservation and fund-raising activities. Working in conjunction with government organizations and NGOs in Canada, the United States and Mexico, DU plays a key role in the *North American Waterfowl Management Plan* (NAWMP), described earlier in this report. DU joined with the IWRB and WHSRN to support waterfowl census in Latin America.

The World Conservation Union (IUCN)

The World Conservation Union (IUCN) is an independent, international organization that is a union of governments, NGOs and other non-government agencies. Its goal is to initiate and promote scientifically-based actions to preserve the earth's natural environment through its monitoring, strategic planning, promotion and advisory capacities.

The **IUCN Wetland Program** coordinates the activities of the Union concerned with managing wetland ecosystems. Established in 1988, the program focuses on conserving ecologic and hydrologic processes in particular, by promoting the sustainable use of wetlands. Although the major international focus of this program has been the conservation of wildlife species dependent on wetland habitats, the IUCN has begun to put more emphasis on social issues related to wetland conservation. This new approach includes a series of field projects which will be used to develop sustainable management practices which are practical in developing countries where wetlands are used extensively by local communities.

Governments and NGOs are encouraged to become members of this international organization. The IUCN receives funds from many international and national government agencies. The Union acts as an executing agency, developing proposals for funding and then administering these funds as they are received.

The IUCN headquarters in Gland, Switzerland is also the location of the Ramsar Secretariat. In 1988, the IUCN expanded its Wetland Program to include Central America. The Program promotes coordinated action for the sustainable use of Central America's wetlands. In collaboration with CATIE, this program has developed several pilot projects in critical wetlands throughout the region.

The IUCN's Central American Regional Office (IUCN-ORCA) has identified wetland areas in Central America where it now works or has plans to provide assistance to field demonstration projects (Table 3) (IUCN 1990). The IUCN-ORCA Wetland Program provides courses on wetland management to graduates from the CATIE's Master's program in Costa Rica. Several CATIE graduates are actively promoting the wise use and conservation of wetlands in El Salvador, Nicaragua, Costa Rica and Panama.

Table 3
IUCN-ORCA Wetland Projects in Central America
Proposed or in Progress (as of 1991)

Country	Wetlands	Project
Costa Rica	Sierpe-Terraba Forest Reserve	(**)
	Caño Negro	(*)
	Bajos de Tempisque	(+)
El Salvador	Barra de Santiago	(*)
Guatemala	Monterrico	(+)
	El Golfete and Río Dulce	(+)
	Río La Pasion, Peten	(**)
Honduras	Cuero y Salado	(*)
Nicaragua	Los Guatusos	(*)
	Estero Real	(**)
	Isla del Venado	(**)
Panama	Bocas del Toro	(*)

Projects: (+) proposed; (*) in progress; (**) in progress, managed by CATIE with technical assistance from IUCN-ORCA.
Source: Updated from IUCN (1990).

The IUCN-ORCA Wetland Program is also promoting the Ramsar Convention in the region and has been successful in convincing Guatemala and Panama to become signatory members. In 1990, Guatemala became the first Central American country to sign this Convention, designating the 483.72 km^2 **Laguna del Tigre** wetland as a protected Ramsar site. That same year, Panama declared the 807.65 km^2 **Bahía de Montijo** a protected Ramsar site, becoming the second nation to officially recognize the importance of wetlands. During the development of this report, Costa Rica and Honduras became the third and fourth Central American countries to join the Ramsar Convention. Costa Rica nominated the **Caño Negro** and the **Bajos de Tempisque** respectively (UNESCO-MAB 1991). In June 1993, Honduras joined the Convention with the nomination of the 132.25 km^2 **Barras de Cuero y Salado National Wildlife Refuge** as its first Ramsar site. Nicaragua is in the process of completing internal procedures for accession to the Convention and is proposing to nominate **Los Guatusos** as a Ramsar site. In June 1993, Costa Rica also nominated the 4.2 km^2 **Tamarindo National Wildlife Refuge** wetlands and Panama nominated the 164.1 km^2 **San San-Pond Sak** as new Ramsar sites.

An ambitious Marine and Coastal Program is being proposed by the IUCN-ORCA. Its coverage will include some of the most important wetland areas (mangroves, coral reefs, seagrass beds and estuaries) in Central America. The International Centre for Ocean Development (ICOD), based in Canada, has reviewed a proposal to assist this regional program and to fund a regional workshop to identify program priorities. Unfortunately, the Canadian government was forced to cut its support to ICOD in 1992 because of budget constraints and prospects for future projects involving ICOD look doubtful.

The IUCN-ORCA's Wetland Program has developed an extensive library of wetland information from around the world in an attempt to promote the transfer of information that might otherwise be unavailable to interested organizations and institutions in Central America. A small fund (up to US$ 2 000 per project) has also been created to support a limited number of graduate theses pertaining to wetland conservation in Central America.

The majority of funding for IUCN wetland initiatives in Central America are funnelled from various Scandinavian aid agencies to the IUCN-ORCA's Wetland Program. The Scandinavians have a history of involvement in the natural resources sector in Central America.

Wetlands for the Americas Western Hemisphere Shorebird Reserve Network

The Western Hemisphere Shorebird Reserve Network (WHSRN) is a program of the newly-created **Wetlands for the Americas** whose mission is to promote the conservation of wetland ecosystems in the Americas. The WHSRN is a voluntary consortium of private organizations and governments committed to the protection of shorebirds and the wetlands they depend on. This is accomplished by promoting the cooperative management and protection of sites throughout the Western Hemisphere (WHSRN 1989). Launched in 1985, the WHSRN program now relies on the collaboration of national agencies in Canada, the United States, Suriname, Peru, Mexico, Brazil, and Argentina and 32 state or provincial agencies in Canada and the United States.

The WHRSN has developed an innovative approach to wetlands by concentrating on the conservation of wetland areas of international concern along the migratory routes of shorebirds. Designation of a reserve as a WHSRN site can be undertaken by wildlife agencies, resource managers and private landowners. WHSRN and its affiliates then give management recommendations and foster protection of these sites. They also sponsor training and education programs and promote international research. The enhanced prestige, assistance, and international recognition gained from reserve status result in effective long-term management and conservation of critical wetlands throughout the Americas. Activities in Central America have been restricted to Panama where several wetlands support exceptionally large concentrations of migratory shorebirds. Expansion of the WHSRN into other parts of Central America has been proposed, but only enough to augment IUCN Wetland Program initiatives.

Wetlands for the Americas has program managers in Argentina, Canada, Mexico and Peru as well as the United States to develop its activities throughout the Hemisphere. Working with bilateral and multilateral donors, Wetlands for the Americas is embarking on an assessment of South American wetlands in order to develop an agenda for regional wetland conservation.

3. REGIONAL WETLAND CONSERVATION IN CENTRAL AMERICA

REGIONAL WETLAND STRATEGIES

The *Comisión Centroamericana de Ambiente y Desarrollo* (Central American Commission on the Environment and Development) (CCAD) was established in 1989 by the presidents of the six Central American nations. Concerned with creating a regional mechanism for cooperation, one of the mandates of the CCAD is to promote the protection of the region's natural heritage. The CCAD has developed a regional agenda on the environment and development and presented it to the United Nations Conference on the Environment and Development (UNCED) in Brazil in 1992. This agenda does not directly identify wetlands but does stress the need for a regional approach to the conservation of rapidly disappearing Central American wildlands (e.g. mangrove swamps and tropical moist rainforests).

REGIONAL INITIATIVES IN CENTRAL AMERICA

Tropical Forestry Action Plan

The Tropical Forestry Action Plan (TFAP) was established in 1985 in response to growing international concern for the destruction of tropical forests. Global responsibility for the Program was entrusted to the TFAP Coordinating Unit of the Food and Agriculture Organization (TFAP 1991).

One of the regional priorities of the TFAP is the ... *conservation of tropical forest ecosystems* ... including wetland habitats (e.g. mangrove forests and seasonally inundated swamp forests). The Central American TFAP has identified two important wetland areas of regional importance: the **Golfo de Fonseca** (see Figure 1) and the area encompassed by the **Sistema de Areas Protegidas por la Paz** (Protected Areas System for Peace) (known as the SI-A-PAZ Project) along the border between Nicaragua and Costa Rica.

Under the category of **Conservation of Ecosystems**, the TFAP identified the populated coastal wetland ecosystem of the Golfo de Fonseca as a priority area for developing and implementing a sustainable management plan. Aimed at conserving the wetland ecosystems shared by El Salvador, Honduras and Nicaragua, the project's first phase involves several diagnostic studies that will develop a base for an integrated management plan for the Gulf. Scandinavian aid agencies (including the Danish International Development Agency—DANIDA, the Finnish International Development Agency—FINNIDA, and the Norwegian International Development Agency—NORAD) have shown interest in the first phase of this project which will cost about US$ 1 680 000. Although the TFAP recognizes the importance of wetland areas, the success of any of its proposed plans still depends on securing funding from international donors.

Through the TFAP process, individual Central American countries have completed or are in the process of completing national forestry action plans. Several countries have identified the need to conserve important wetland ecosystems, particularly wetland sites that are important to local and national economies (see Appendix 1 for individual country profiles).

REGIONAL WETLAND EXPERTISE IN CENTRAL AMERICA

Tropical Agricultural Centre for Research and Education

The *Centro Agronómico Tropical de Investigación y Enseñanza* (Tropical Agricultural Centre for Research and Education) (CATIE) and the IUCN work together on research aspects related to the IUCN-ORCA Wetland

Program. CATIE gives graduate courses in natural resources management which includes courses on wetland management. CATIE is involved in wetland research with the IUCN in Guatemala, Honduras, Nicaragua and Costa Rica. The Centre is located in Turrialba, Costa Rica and has national offices throughout Central America.

Confederation of Central American Universities

The Confederation of Central American Universities (CSUCA) has been active regionally and has supported wetland studies in the SI-A-PAZ region on both sides of the frontier between Nicaragua and Costa Rica. These studies have focused on the socio-economic dynamics of populations living close to wetland areas. CSUCA also supported a regional review on the status of mangrove forests in Central America that was completed in 1991. CSUCA is based in San José, Costa Rica but has recently suffered serious cutbacks that will undoubtedly affect its future operations in Central America.

4. OVERVIEW OF WETLAND CONSERVATION IN CENTRAL AMERICAN NATIONS

HISTORICAL PERSPECTIVE

The importance of wetland ecosystems is only now becoming an issue in Central America. The accession to the Ramsar Convention by Guatemala (1989), Panama (1989), Costa Rica (1991) and Honduras (1993) is a clear indication that federal governments are beginning to realize the need for developing plans to safeguard these areas of national, regional and international importance. A summary of information on Ramsar sites in Central America is listed in Table 4; the map in Figure 6 identifies their location.

This new interest in wetlands has largely been brought about by the IUCN-ORCA's Wetland Program which, since its inception in 1988, has galvanized support for wetland conservation, particularly in Costa Rica, Panama and Nicaragua. Many international and national NGOs are coordinating efforts to promote the wise use of these ecosystems.

This study has revealed that it is not only government and international agencies promoting the need for wetland conservation, but also local groups, whose support has been galvanized by the deterioration of wetland habitats on which they depend.

Table 4
The Ramsar Convention in Central America as of 1993

Country	Ramsar Site (and date of accession)	Responsible Management Authority	Organizations Involved
Costa Rica	• Caño Negro (1991)	MIRENEM	IUCN, CSUCA, Universidad Nacional de Costa Rica
	• Bajos de Tempisque (1991)	MIRENEM	PACA, Universidad Nacional de Costa Rica
	• Tamarindo (1993)	MIRENEM	n/a*
Guatemala	• Laguna del Tigre (1990)	CONAP	TNC, IUCN
Honduras	• Barras de Cuero y Salado (1993)	MRNH	Fundación Cuero y Salado
Nicaragua	• Los Guatusos (pending)	IRENA	ABEN, MAN, IUCN, Fundación del Río
Panama	• Bahía de Montijo (1990)	INRENARE	n/a
	• San San-Pond Sak (1993)	INRENARE	IUCN

* *n/a - information not available.*

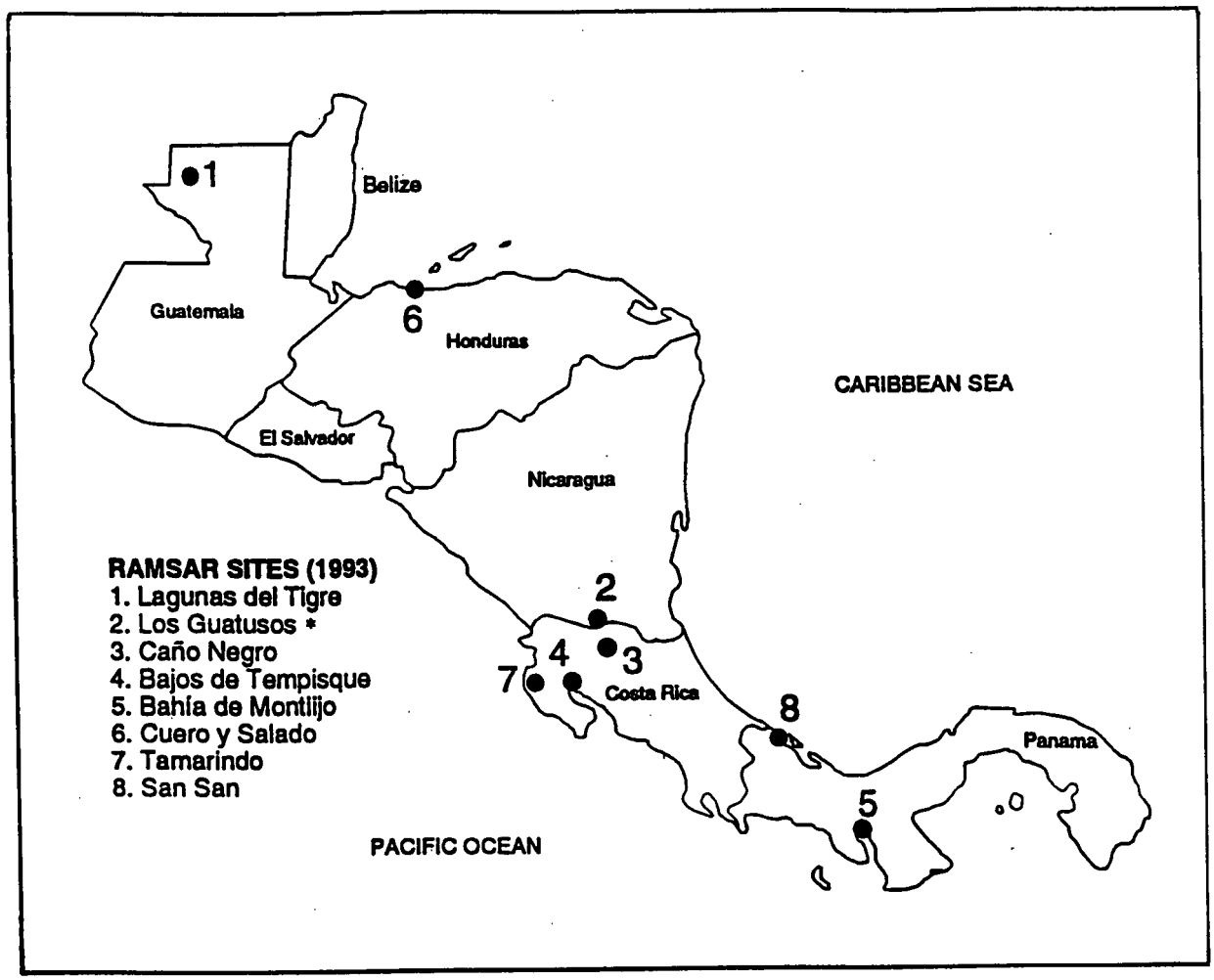


Figure 6. Internationally-recognized Ramsar sites in Central America.

* *Official declaration of Los Guatusos is pending approval by Government of Nicaragua.*

COUNTRY PROFILES

A brief summary of the major wetland initiatives underway in each of the six Central American countries, as of 1991, is presented below. A more detailed analysis of the wetland situation in each country is provided in Appendix 1.

Costa Rica

Costa Rica's system of national parks and wildlife refuges offers the greatest protection for wetlands in Central America. The Costa Rican Ministry of Natural Resources, Energy and Mines (MIRENEM) manages three wetland areas as national parks and six as wildlife refuges. MIRENEM will also be responsible for administering the accords of the Ramsar Convention.

The National University is currently mapping the wetlands of Costa Rica and hopes to complete this task shortly. The *Confederación Universitaria Centroamericana* (Confederation of Central American Universities) (CSUCA) has also been mapping the wetlands of Caño Negro in an attempt to understand the social dynamics of the local population with respect to their environment.

The IUCN and CATIE are working with local inhabitants in Sierpe-Terraba, a large area of mangrove forest near the Osa Peninsula, to develop more efficient methods for producing charcoal from mangrove wood. The IUCN-ORCA Wetland Program is also supporting conservation projects in two protected wetlands: Caño Negro and Tortuguero.

El Salvador

In El Salvador, a group called **Prohumedales** (Pro-wetlands) has recently formed to promote national wetland issues. Membership includes individuals from the National University, the *Centro Nacional de Recursos Naturales de El Salvador* (El Salvadoran National Centre for Natural Resources) (CENREN) and the general public. One of the group's founders is a graduate from CATIE's Natural Resources Program who recently completed his thesis on wetlands.

Sadly, a decade of civil war in El Salvador has created potentially the worst environmental crisis in Central America. Wetlands may represent the last refuge for many wildlife species in El Salvador.

Guatemala

Guatemalan wetland initiatives are concentrated in the Peten region along the border of Guatemala and Mexico. Researchers from the IUCN and CATIE are undertaking an assessment of the economic value of wetlands on the floodplain of the Río La Passion. This is similar to the study being conducted by CATIE on the Pacific coast of Nicaragua. No information was obtained on the Laguna del Tigre Ramsar site but, given its remote location, it is assumed that few activities other than resource inventories have been completed.

The National Council for Protected Areas (CONAP) has the mandate to manage protected areas throughout Guatemala, including the Laguna del Tigre site.

Honduras

In Honduras, local *campesinos*, aided by technical advisors, have formed a committee called **Comité para la Defensa y Desarrollo de la Flora y Fauna del Golfo de Fonseca** (Committee for the Protection and Management of the Flora and Fauna of the Gulf of Fonseca) (CODDEFFAGOLF) to defend the Golfo de Fonseca from expanding shrimp farms that are destroying the mangroves and the livelihood of 5 000 families who rely on traditional fishing.

In La Ceiba, another group is actively working toward the conservation of the internationally-important Cuero y Salado wetlands at the foot of the Pico Bonito National Park. With support from the USAID, CATIE has been assisting Cuero y Salado complete a socio-environmental study of the Cuero y Salado Wildlife Refuge.

The United States Peace Corp volunteers are working to conserve Honduras' national parks through placements with local NGOs, such as **Prolansate**. Prolansate is a local NGO working with inhabitants near Punta Sal to help ensure the sustainable development of a protected national area containing important coastal wetland habitats.

Nicaragua

The *Instituto Nacional de Recursos Naturales de Nicaragua* (Nicaraguan Ministry of Natural Resources) (IRENA) took a positive step in 1991 towards demonstrating its commitment to wetlands by creating the Department of Protected Areas which is concentrating on completing a thorough inventory of Nicaraguan wetlands. IRENA is also responsible for developing management plans for newly-declared protected wetland areas such as the Cayos Miskitos and the Golfo de Fonseca.

The IUCN-ORCA Wetland Program helped the former *Asociación de Biólogos y Ecólogos de Nicaragua* (Nicaraguan Association of Biologists and Ecologists) (ABEN) undertake an inventory of the Los Guatusos wetlands in southern Nicaragua. These important wetlands sustain tremendous wildlife populations (including many nationally and regionally endangered species) and are important reproductive and nursery sites for many commercial fish species. This area is currently being considered as Nicaragua's first Ramsar site.

The *Universidad Nacional Autónoma de Nicaragua* (Autonomous University of Nicaragua) (UNAN) is actively promoting the sustainable development of mangrove sites. In collaboration with the IUCN and CATIE, the UNAN is working with local populations to develop more effective measures for the use of mangrove resources in the large mangrove forests along the Pacific coast north of León.

Panama

Under the auspices of the University in Santiago, and with assistance from the Canadian Wildlife Service of Environment Canada, a group of dedicated scientists are conducting research on the wetlands around the Bahía de Parita and are fighting for the inclusion of the Bahía de Panamá as a Ramsar site. The Bahía de Montijo has been designated a Ramsar site and is being managed by the *Dirección General de Bosques y Vide Silvestre* (Panamanian Directorate of Forests and Wildlife) (DIGEBOS).

The IUCN has been providing technical support for more than three years to assist in developing a strategy for the sustainable development of the Bocas del Toro region—an internationally recognized wetland area along the Caribbean coast of Panama.

Panama is one of the few countries to include project profiles for key wetland sites in the implementation of the Tropical Forest Action Plan. These include projects to develop a sustainable approach to forestry activities in the Canglon and Bocas del Toro areas.

SUMMARY

These initiatives indicate a growing awareness of wetland importance throughout Central America. Continued support by the IUCN and CATIE for a wetland program in Central America, which includes a graduate program in natural resource management, is creating a nucleus of technical expertise in the region. The development of technically-adept natural resource managers is fundamental to promoting new and innovative ways in which sustainable natural resource plans can be implemented.

Unfortunately, the majority of these initiatives rely on outside funding sources. The chronic lack of funds for undertaking wetland research and conservation greatly undermines the brave attempts of individuals. It is interesting to note that Ramsar sites in Central America have not received any international support. With Guatemala and Panama having acceded to the Ramsar Convention, followed by Costa Rica in 1991 and Honduras in 1993, and Nicaragua set to follow suit, it is an opportune time to demonstrate international support by offering technical and financial assistance to develop conservation plans for Ramsar sites in these nations.

5. *CANADIAN WETLAND CONSERVATION*

Wetland conservation initiatives in Canada are emphasized in this section to demonstrate Canada's interest and leadership in wetland conservation and promote Canada's involvement in international wetland issues. A brief review of the current state of wetland conservation in Canada is presented by examining government and non-government actions, policy and programs. This information is important in identifying areas of wetland expertise both in and outside of government agencies.

HISTORICAL PERSPECTIVE

- There are approximately 1.24 million km^2 of wetlands in Canada (National Wetlands Working Group 1988).
- Canadian wetlands contain 15% of the world's fresh water (Gillespie, Boyd and Logan 1991).
- Canadian wetlands comprise an estimated 24% of the world's wetlands (North American Wetlands Conservation Council Canada—NAWCC 1990).
- The Canadian government manages an estimated 29% of Canadian wetlands (NAWCC 1990).
- Wetlands annually contribute more than CA$ 10 billion to the Canadian economy (NAWCC 1990).
- In the 1988 to 1993 period, the public and private sectors have spent over CA$ 165 million on wetland conservation within Canada (Environment Canada, SEDESOL and United States Department of the Interior 1993).

Canada has a long history of involvement in wetland development and conservation. The first wetlands were protected under the *Migratory Birds Convention Act*, signed in 1916. Since then, over 100 Migratory Bird Sanctuaries have been created by the Government of Canada in addition to 45 National Wildlife Areas collectively covering approximately 11.3 million ha—much of which is wetland habitat (Gillespie, Boyd and Logan 1991). The *Canadian Wildlife Act* was enacted in 1973 to protect habitats such as wetlands, through purchases, donations and leasing. The *Act* encourages cooperation between federal, provincial and territorial governments to promote and protect wetlands. It is estimated that at least 18% of the 38.7 million ha protected by the Government of Canada as National Parks, National Wildlife Areas and Migratory Bird Sanctuaries is wetland (Environment Canada 1993). Thousands of other provincial, territorial and regional park and wildlife areas protect many additional wetlands in Canada.

There has also been strong non-government support for wetland conservation in Canada, especially in the last 10 to 15 years. Groups such as Ducks Unlimited Canada, Wildlife Habitat Canada, the World Wildlife Fund and the Nature Conservancy of Canada have assisted private landowners in managing wetland areas, in securing several million ha of wetland habitats, as well as working side-by-side with provincial and federal governments.

During the 1980s, concern for rapidly disappearing wildlife habitats resulted in several important wetland initiatives. The *North American Waterfowl Management Plan* (NAWMP) was designed to meet growing concerns for decreasing waterfowl populations in North America and Mexico. In 1990, the North American Wetlands Conservation Council (NAWCC) (Canada) was established by the federal Minister of the Environment with a broad mandate to promote and facilitate wetland conservation (NAWCC 1991).

Realizing that trans-boundary wildlife species, such as migratory birds, could not be effectively managed in Canada alone, Environment Canada established the Latin American Program (LAP) in 1980 to assist in the research and implementation of conservation strategies for internationally-shared populations of migratory birds. This program includes in its mandate the promotion of wetland conservation in the Neotropics and currently has related projects in several Central and South American countries.

WETLAND CONSERVATION IN CANADA

The Federal Policy on Wetland Conservation

In 1990, the *Green Plan* (Canada's environmental action plan) identified the need for Canada to adopt a policy on wetlands. A four-year consultative process culminated in the announcement of *The Federal Policy on Wetland Conservation* by the Government of Canada in March 1992. This process took into account interests from many private and government parties. This policy outlines strategies concerning Canada's commitment to wetland conservation both nationally and internationally, elevating wetlands to the national environmental agenda. The seventh strategy (see Appendix 2) specifies how the federal government will carry out its international commitments.

The Ramsar Convention in Canada

The **Ramsar Convention on Wetlands of International Importance** is an intergovernmental treaty that provides a framework for the conservation of wetland habitats through international cooperation. On May 5, 1981, Canada became the 28th signing member of this Convention and has since designated 32 wetlands with a combined area of over 13 million ha.

The Government of Canada promotes the maintenance and protection of the designated Ramsar sites across Canada. The Canadian Wildlife Service (CWS) has been designated the lead national body responsible for monitoring and coordinating activities related to Ramsar. The Secretariat to the NAWCC (Canada) assists the CWS in distribution of Ramsar information to the **Canadian Ramsar Network**, an informal national mechanism for communication and seeking advice.

National Wetland Programs

The conservation of wetlands in Canada is a shared federal, provincial and territorial responsibility. The federal government does not have a specifically designated wetlands program, but is committed to assisting national efforts in wetland conservation by providing models, tools and expertise, and improving the knowledge on the wetland resources of Canada (Environment Canada 1991). The Government of Canada, however, is one of the major financial partners in the *North American Waterfowl Management Plan* and manages more wetland area than any other jurisdiction in Canada. It has also implemented major wetland research, inventory and monitoring initiatives in all regions of the nation.

There are several initiatives with major wetland conservation components. Both Ducks Unlimited Canada and Wildlife Habitat Canada are involved in the conservation of wetland habitats important to wildlife across Canada in cooperation with the Government of Canada and the 12 provincial and territorial governments as well as numerous other non-government and corporate partners. These programs involve working jointly with private landowners, industry and government bodies to ensure the sustainable use of wetland resources (more detailed information is provided below).

Wetland Expertise in Canada

Federal Expertise

Under the *Migratory Bird Convention Act* of 1916, the federal government is responsible for implementing programs that will conserve habitats critical to maintaining wildlife populations. It is the role of the CWS to help

ensure the conditions of this treaty are fulfilled. However, CWS jurisdiction does not govern all land and water management on areas outside of federal bird sanctuaries and national wildlife areas. This is the responsibility of other government departments.

The federal Minister of the Environment, under the *Canada Wildlife Act*, has established the **North American Wetlands Conservation Council (NAWCC) (Canada)**. The NAWCC (Canada) Secretariat, based in Ottawa, supports the activities approved by the Council. The role of this Council is to:

- provide national leadership on all matters related to the funding and management of the implementation and evaluation of NAWMP habitat joint ventures in Canada;
- serve as a national coordinating committee for the development and implementation of wetland conservation policies and programs in Canada; and
- facilitate Canadian involvement in international wetland conservation.

Provincial Expertise

At the provincial level, departments of natural resources and/or environment are responsible for wetland management on lands under provincial jurisdiction. The Ontario Ministry of Natural Resources, for example, has developed the *Wetland Classification System for Southern Ontario*, which has been used to identify and evaluate priority areas for conservation in that region. This classification system is currently being adapted by the University of Heredia in Costa Rica for use as a model for developing a classification system for tropical wetlands.

Non-Governmental Organization (NGO), University and Private Sector Expertise

Wildlife Habitat Canada

Founded in 1984, Wildlife Habitat Canada (WHC) is a non-government organization that addresses immediate conservation needs and promotes progressive policies of wildlife habitat resource management through cooperation with landowners, governments, conservationists, associations and concerned citizens (Wildlife Habitat Canada 1986).

Wildlife Habitat Canada provides funding for projects involving private land stewardship of natural areas, habitat rehabilitation and improvement, integrated land-use management studies, investigation of land tax rebates, and income tax relief systems. Many of these projects involve wetlands.

Ducks Unlimited Canada

Ducks Unlimited Canada (DUC) is a private, non-profit, internationally supported conservation organization whose goals are to preserve, restore, develop and maintain waterfowl breeding habitat in Canada. DUC has been active since 1937, and now has nine provincial and territorial offices. DUC's main goal is to secure wetland and upland habitat for waterfowl nesting and brood rearing. It is involved in wetland research, land stewardship, wetland restoration, public education and fund-raising.

DUC is one of the main implementation agencies for the *North American Waterfowl Management Plan* in Canada and supports the **Institute for Wetlands and Waterfowl Research**. Its annual budget exceeds CA$ 45 million. This makes them one of Canada's leading conservation-oriented groups and by far the most active in waterfowl and wetland conservation and research. Ducks Unlimited is also active in the United States, Mexico, New Zealand and Australia. Other international expenditures are unfortunately minimal.

World Wildlife Fund Canada

World Wildlife Fund Canada (WWF-Canada), an affiliate of WWF-International, is concerned with the conservation of wildlife species and their habitats (more details on their international wetland activities are given in Section 2 entitled "International Wetland Conservation in Central America"). Wetland conservation is a major component of WWF-Canada's conservation agenda. In Canada, WWF has committed at least US$ 100 000 to wetland projects involving the conservation of wildlife species such as plovers, swans and pelicans, and US$ 600 000 to prairie conservation through its Wild West Program.

University of Waterloo

The Faculty of Environmental Studies is involved in wetland research in southern Ontario and in boreal wetlands across Canada. In association with various departments, the university established the **Wetlands Research Centre** in January 1992.

University of Guelph

The Geography and Rural Planning Department has been involved in wetland research. Recent research includes biocontrol strategies for invasive plant species (such as purple loosestrife *Lythrum salicaria*) in wetlands.

University of Manitoba

The Department of Natural Resources Planning has a strong research program involving activities on the Prairies. The university has a major field research station for studying wetlands on the southern shore of Lake Winnipeg.

Simon Fraser University

The Natural Resources Management Program considers broad applications to wetland areas and has been involved in wetland-related research throughout the province of British Columbia, particularly in the Fraser River Delta.

Private Sector Expertise

There are many firms in Canada that have begun to expand their expertise in the area of wetland conservation. Most of these firms have been involved in ecological restoration of wetland sites altered by human activity in Canada. These firms include **Gartner Lee and Associates, Ecological Services for Planning Ltd., Dryade Ltée,** and **Ecoplans Ltd.** There is also a growing number of private consultants who have developed extensive experience in wetland ecosystems.

CANADA AND INTERNATIONAL WETLAND CONSERVATION

Federal Policy Initiatives

Government of Canada Policy

The recent *Federal Policy on Wetland Conservation* includes seven strategies, one of which promotes international wetland actions (see Appendix 2). It states:

> *"... the federal government will promote conservation and sustainable use of wetlands internationally, and encourage the involvement of other nations and international organizations in wetland conservation efforts"* (Environment Canada 1991).

This includes strengthening the Canadian commitment to the Ramsar Convention and ensuring that Canadian international assistance, administered by the Canadian International Development Agency (CIDA) and the International Development and Research Centre (IDRC), is based on sustainable development principles and promotes the maintenance and enhancement of wetland functions (Environment Canada 1991).

Canadian International Development Agency Policies

Although CIDA does not specifically refer to wetlands in its policies on natural resources, it is committed to the promotion of sustainable development and a number of its policies apply to activities involving wetland conservation.

The *CIDA Policy for Environmental Sustainability* (CIDA 1992) explains how CIDA will integrate environmental considerations into its decision-making processes and work with its partners in developing countries to improve their capacity to promote environmentally sustainable development. CIDA's objectives for environmental sustainability are to:

- *increase the institutional, human resource and technological capacities of developing country governments, organizations and communities to plan and implement development policies, programs and activities that are environmentally sustainable*; and

- *strengthen the capability of developing countries to contribute to the resolution of global and regional environmental problems, while meeting their development objectives* (CIDA 1992).

CIDA's Forestry Sector has developed several operational objectives to support CIDA's official development assistance objectives, which are directly related to the sustainable development of wetland ecosystems (CIDA 1988a). These objectives include:

- *maximizing the productive environmental effects of trees to enhance agricultural productivity and protect soil and water resources*;

- *conserving the wild natural resource heritage of the poorest regions*; and

- *assisting in the human resource development necessary to ensure that sustainable forest use will be feasible for each assisted country through its own people.*

Canadian Support to the Ramsar Convention

The *Convention on Wetlands of International Importance* (the Ramsar Convention) encourages signatory nations to promote the conservation of wetlands in their own country and in developing countries. Through the federal Department of the Environment, each year Canada has contributed about CA$ 35 000 to support the Ramsar Bureau's core program activities (in the 1994 to 1996 triennium this will be increased to about $76 000 per year) and has given up to CA$ 25 000 each year to the Ramsar **Wetland Conservation Fund.** Through CIDA and the NAWCC (Canada), Canada has also provided support for developing nation delegates' travel to the Fourth and Fifth Conferences of the Parties to the Ramsar Convention. Aside from this, Canada has not taken any direct initiatives to promote Ramsar sites in developing countries other than to encourage governments to designate as Ramsar sites those wetlands of importance to wildlife shared with Canada.

Canadian International Wetland Conservation Programs

The Latin American Program

The Canadian Wildlife Service of Environment Canada initiated the Latin American Program (LAP) in 1980 to promote the conservation of birds that migrate between Canada and Latin America. Although research-oriented, this program has also served as a mechanism for sharing information and expertise as well as developing conservation programs and agreements. LAP is a strong supporter of the Western Hemisphere Shorebird Reserve Network (WHSRN)—a program of Wetlands for the Americas.

The North American Waterfowl Management Plan

The *North American Waterfowl Management Plan* (NAWMP) is a cooperative agreement signed between Canada and the United States in 1986. Mexico is expected to become a signator to the *Plan* in the near future. The main objective of NAWMP is to restore waterfowl populations to the levels of the 1970s through the conservation of wetland and upland habitats and waterfowl populations. Over a 15-year period, CA$1.5 billion is proposed to be spent throughout North America to fulfil the objectives of the NAWMP (Environment Canada 1986). NAWMP is jointly coordinated by representatives appointed by the Canadian Wildlife Service (CWS), the United States Fish and Wildlife Service (USFWS), and the Secretariat of Social Development (SEDESOL) in Mexico.

The North American Wetlands Conservation Council (NAWCC), which has both a Canadian and American counterpart, was initiated as a result of the NAWMP. The NAWCC-Canada and the NAWCC-United States are the points of contact for approval and funding of joint proposals under the NAWMP. The NAWCC is supported by government organizations and NGOs such as Ducks Unlimited, The Nature Conservancy, Wildlife Habitat Canada, the International Association of Fish and Wildlife Agencies, and the National Wildlife Federation (Environment Canada 1986).

Canadian Wetland Expertise Involved in Central America and Mexico

Most of the expertise in international wetland conservation in Canada has been developed at the federal government level through the CWS's Latin American and International Programs. Canada's participation in the recent *Tripartite Agreement on the Conservation of Migratory Birds and Their Habitats* with Mexico and the United States has increased Canadian experience in Mexico. Collaborative projects are being undertaken by the three national wildlife agencies. These projects include monitoring populations as well as determining how to maintain and increase critical marshland and other wetland habitat.

Several CWS scientists have been involved in wetland related activities (e.g. monitoring shorebird populations and conducting workshops) in Central and South America during the past decade, and have been particularly active in promoting wetland conservation in Argentina, Brazil, Panama and Suriname.

CIDA has funded several Canadian Wildlife Service wetland-related initiatives in Latin America. The **Biggi Pan Project** in Suriname was a joint effort between Canadian and Suriname experts to develop a management plan for this internationally important coastal wetland. One area of CIDA's Forestry Sector expertise is in relating wetland conservation to development issues. This is one example where the potential for CIDA's involvement in wetland initiatives is expected to significantly increase in the near future.

The following Canadian NGOs and universities have also been involved or are interested in wetland conservation in Central America (in addition to those non-government agencies with wetland expertise that were listed previously):

- **Conservation International—Canada (CI—C):** The CI—C is an NGO currently looking at different options for supporting the development of a management plan for important wetlands along the Caribbean coast of Nicaragua.

- **Canadian Organization for Teaching and Research in Costa Rica (COTERC):** The COTERC is a Toronto-based group that has established a biological station in the wetland areas of Tortuguero, Costa Rica, and is promoting the development of sustainable practices in these lowland areas.

- **Long Point Bird Observatory (LPBO):** The LPBO is working with the CWS and the Instituto de Ecología y Sistematica in Cuba to determine the importance of specific Cuban wetlands to migratory birds.

- **Faculty of Environmental Studies, York University:** York University has conducted a brief survey on wetland conservation in Latin America and continues to demonstrate interest in this area. A cooperative project between Mexico and York University has been developed to assist research initiatives in the internationally-important wetlands of the Tabasco region.

- **Faculty of Environmental Studies, University of Waterloo:** The University of Waterloo has been engaged in international wetland projects in Thailand and Indonesia and has recently been approached by Bolivia to establish an environment program with a wetland focus.

The degree of Canadian involvement in wetland conservation from these sources in Latin America is quite low. Most of these groups operate with small budgets (CA$ 5 000 to 10 000 annually) and limited personnel.

6. *CANADIAN INVOLVEMENT IN CENTRAL AMERICAN WETLAND INITIATIVES*

OBSERVATIONS ON CANADIAN INVOLVEMENT

The recommendations presented in this section are based on a number of important observations made during the course of this study. These observations focus on key areas where Canada could offer the most effective support to international wetland initiatives such as those encountered in Central America. In support of the recommendations that follow, a brief summary of these observations follows.

■ *A growing environmental awareness in Central America offers an important opportunity for supporting wetland conservation initiatives such as Ramsar.* Ratification of the Ramsar Convention by Guatemala, Panama and more recently, Costa Rica and Honduras, is a good indication of the new importance placed on wetlands by these governments. In this age of environmental concern, politicians are being forced to deal with a growing environmental crisis that threatens the livelihoods of thousands of Central Americans.

■ *There has been more political stability within Central America in the 1990-1992 period than at any time during the last decade.* In Nicaragua, elections in 1990 brought an end to the civil war and a lifting of an American embargo that crippled the Nicaraguan economy. In 1991, a truce was negotiated in the decade-long civil war that gripped El Salvador. The peace that now prevails permits governments to shift their attention from war to the more pressing needs such as the environment.

■ *Wetlands in Central America are directly linked to wetlands in North and South America by large populations of migratory shorebirds and waterfowl.* Together these wetlands constitute a global support system for these species. Destruction of one of these important links in the global system will have significant repercussions on all migratory bird populations in the Western Hemisphere.

■ *In Canada, the North American Wetlands Conservation Council (NAWCC) has expressed its interest to function as a coordinating body to promote wetland initiatives between Central American and Canadian groups.* In Central America, the IUCN has also shown interest in acting as a coordinating body for Canadian support to Central American wetland initiatives. Both organizations have the capacity to represent their regions.

■ *Although a number of funding sources were identified during this study, the availability of these funds for wetland conservation is extremely limited.* In many cases, funds are restricted for specific projects—projects, which in most cases do not further the conservation of wetlands in the country of their origin. In other cases, the funds are too small to effect any major changes. In 1992, Canada contributed CA$ 25 000 to the Ramsar Wetland Conservation Fund, funds which are used to help finance wetland projects around the world. During the course of this study, a number of wetland proposals were received requesting support for conservation activities in specific Central American wetlands. Most proposals contained annual budgets surpassing CA$ 25 000—the total amount donated by Canada to the Ramsar Fund in 1992.

■ *There is a disproportionate concentration of wetland expertise in Central America.* The nucleus of this expertise is centred in Costa Rica at CATIE where courses in wetland management at the undergraduate and master's level are taught. This growing expertise is limited to a few individuals selected from applicants across Latin America. The IUCN-ORCA's Wetland Program is also based in Costa Rica and gives additional support for national wetland initiatives.

■ *If Canada's Federal Policy on Wetland Conservation is a serious declaration of its intent to promote national and international wetland conservation, then Canada should be far more active than it has been in the international arena.* As a signatory member of the Ramsar Convention, Canada has an obligation to support requests for wetland conservation assistance from developing nations.

RECOMMENDATIONS

Given Canada's internationally-recognized expertise in wetland conservation, the demonstrated interest of both Canadian and Central American organizations, a more stable political climate in Central America, the critical nature of many Central and North American wetlands, and Canada's commitment to the Ramsar Convention, the following 10 recommendations are presented:

1. **The North American Wetlands Conservation Council (NAWCC) (Canada), with its mandate to promote national and international wetland conservation, should be encouraged to coordinate and develop a strategy for Canadian assistance to Central American and other international wetland initiatives. The NAWCC (Canada) should also be encouraged to develop a program that would be aimed at "educating" CIDA and other potential funding agencies, on the merits of wetland conservation as a development issue.**

2. **Bilateral and multilateral projects, fully or partially funded by Canadian institutions, should be screened for their impact on wetland resources (including an assessment of the current value of these resources to humans and the possible effects of change).**

3. **The vehicle for Canadian involvement should be Canada's commitment to the Ramsar Convention on Wetlands of International Importance. Canadian attention should be focused on fulfilling Canada's international obligations through the provision of financial and/or technical assistance (such as management, inventories, legislation, equipment) to initiatives in:**

   (a) designated Ramsar sites in Costa Rica (Caño Negro, Bajos de Tempisque, and Tamarindo); Guatemala (Laguna del Tigre); Honduras (Barras de Cuero y Salado); and Panama (Bahía de Montijo and San San-Pond Sak);

   (b) proposed Ramsar sites in Nicaragua (Los Guatusos) and Guatemala (Manchón-Guamuchal and Bocas del Polochic); and

   (c) internationally-recognized wetland sites in Central America that could be declared Ramsar sites. These include: Golfo de Fonseca in Nicaragua, El Salvador and Honduras; the Cayos Miskitos in Nicaragua; Bahía de Panamá and Bahía de Parita in Panama; Laguna de Caratasca in Honduras; Laguna de Jocotal in El Salvador; and Monterrico in Guatemala.

   The IUCN is the regional organization in Central America with the capacity to coordinate any joint ventures between Canadian and Central American organizations. The IUCN has been actively promoting the Ramsar Convention since it initiated its wetland program in 1988.

4. **Canadian expertise could be used to augment wetland management skills currently being taught to university graduates at the Centro Agronómico Tropical de Investigación y Enseñanza (Tropical Agricultural Centre for Research and Education) (CATIE). The Association of Universities and Colleges of Canada supports international university exchanges and can provide financial support to facilitate international linkages of this nature.**

5. **Support should be given to initiatives in Central America that promote "clean technologies," such as the installation and maintenance of wastewater management facilities to reduce the human waste contamination of rivers, lakes and coasts, including many internationally-important wetland habitats. To date, no effective wastewater management facilities have been constructed to deal with the major human effluent discharge emanating from major cities.**

6. **Activities promoting the general awareness of internationally-important wetland issues that affect Canada, Latin America and the Caribbean should be supported. These activities could include workshops, displays and the publishing of pertinent material.**

7. **Given the importance of international wetland sites for migratory species that breed in Canada, there is a need to foster Canadian expertise in international wetland management; expertise that is sensitive to the growing needs of developing countries whose wetland interests are driven by socio-economical factors rather than by interest in maintaining and preserving biological diversity. This could be achieved through federal support to such institutions as the new Wetlands Research Centre at the University of Waterloo which has been created to develop a centre of expertise in the area of wetland research.**

8. **CIDA should play a catalytic role in helping Canadian organizations develop links with organizations in Central America interested in wetland issues. This support could include acting as an intermediary between groups or providing short- and medium-term financial assistance for workshops, publications and exchanges. The Canadian Environmental Network (CEN) should also provide funds (through the Environment and Development Support Program) to ENGOs interested in establishing links with like-minded groups in developing countries.**

9. **Any joint wetland initiatives between Canada and Central America should ensure close collaboration with the rural communities concerned and ensure the active participation of women in all activities. Only through local support will the conservation of these ecosystems be successful.**

10. **Considering CIDA's ongoing support and interest in the Central American Tropical Forestry Action Plan (TFAP), CIDA should consider providing bilateral assistance to two regional projects given priority by the regional TFAP. Both projects include the sustainable development of internationally-important wetland areas in the Golfo de Fonseca on the Pacific and along the Río San Juan which flows along the border between Costa Rica and Nicaragua.**

These 10 recommendations encourage Canadian support for a Central American wetland initiative which could be jointly coordinated through the NAWCC (Canada) and the IUCN-ORCA. This would hopefully result in an open dialogue between the needs of the two regions and a better understanding of the issues affecting wetlands. By no means are these recommendations exhaustive nor are they particularly detailed. They do, however, focus on specific areas where Canadian assistance is seen as useful and permissible.

7. CONCLUSIONS

THE IMPORTANCE OF WETLANDS

Wetlands play an important biophysical and socio-economical role in Central America. They provide critical habitat for aquatic, avian, reptilian and mammalian species of considerable economic value to local populations. They are reserves for valuable timber and fuelwood species. The rich biological diversity of wetland areas lures thousands of ecotourists giving job opportunities for tour operators, wardens, souvenir vendors and many other local service industries. Certain wetlands support important crops such as rice while others serve to feed cattle during the dry seasons. Specific values aside, wetland functions maintain water quality, reduce erosion, control flooding, filter sediment and act as sinks for a host of noxious and potentially lethal agro-chemicals. Wetland structure also provides protection for coastal communities and coastal transportation routes.

Globally, Central American wetlands are a link in a chain of international wetlands stretching from the Canadian High Arctic to Patagonia in Argentina. Each year a moving mass of biological diversity, consisting of wetland-dependent shorebirds and waterfowl, moves up and down these wetlands without heed for political boundaries or cultural differences. These birds rely on healthy wetland habitats for their survival. Central American wetlands, such as those in the Golfo de Fonseca and Bahía de Panamá, are not only important to the resident human populations but are also critical to the survival of many of these migratory species.

However, like many other ecosystems in Central America and around the globe, wetlands are quickly succumbing to human pressures. The demand for natural resources is rapidly outpacing the ability of nature to replenish these resources. Wetlands in Central America are deteriorating at a rapid pace. Many are being cleared for agriculture. Some are so severely contaminated that they cannot even support plant life. Others are being stripped of their wealthy natural resources. If this onslaught continues, the great promise of wetlands as a source of biological diversity will be lost.

WETLAND DETERIORATION IN CENTRAL AMERICA: CAUSES AND EFFECTS

With a likelihood of doubling its population in the next 50 years (based on a two to three percent annual growth rate), Central America will have to confront added pressures on its already depleted natural resources. This growing population combined with an increase in the number of displaced families seeking arable land are the greatest threats to wetlands in Central America today.

This situation has been exacerbated by costly civil wars waged in Nicaragua and El Salvador, and political unrest in Guatemala and Panama. The war in Nicaragua has placed it among the world's most heavily indebted nations; it owes over 25 times its gross national product (Lean, Hinrichsen and Markham 1990). This situation puts pressure on governments to encourage the production of non-traditional agro-exports that can be used to help support debt payments. Many of these agricultural products (such as cotton, rice and coffee), require large areas of fertile land and heavy applications of pesticides. This intensification of agriculture forces small farmers off scarce productive lands onto more marginal areas such as wetlands. It also requires heavier applications of agro-chemicals adding to the already high concentrations entering wetland ecosystems.

Unlike tropical forests, the values of wetlands in Central America have not been adequately quantified. In addition to a lack of knowledge, there is also a lack of information on wetlands in general—where are they located, how big are they, and what is their importance to local communities and protected areas for example. With this information it would be far easier to influence political decision makers on the merits of wetland conservation and to develop sound conservation strategies for their sustainable development.

Government institutions, with a mandate to manage natural resources in Central America, are grossly underfunded and understaffed. Governments have not placed a priority on developing sustainable management plans for their resources. They are justifiably concerned with health, education, debt reduction and loan repayments. There is not enough political will to allocate badly needed funds into the natural resources sector—particularly into sectors that don't provide the government with immediate dividends. Therefore, it is not only government institutions that need support but also non-governmental organizations whose initiatives often promise new and innovative approaches to wetland conservation for the future.

Wetland conservation in Central America faces another major obstacle. Wetlands transcend various government departmental jurisdictions. Each one has its own set of interests and priorities. The lack of sectoral coordination between these departments often results in the promotion of conflicting activities—one department encouraging conservation while another is authorizing its destruction. Intra-governmental coordination needs to improve so that a unified approach to the sustainable development of wetlands can be attained.

CANADIAN VERSUS CENTRAL AMERICAN INTERESTS AND PRIORITIES

The interests of developed countries in wetland conservation in developing countries has often centred around the "esoteric details of animal behaviour or evolutionary affinity" instead of facing the more difficult tasks of promoting and ensuring the sustainable development of wetlands (Dugan 1988). Canadian interests in Central American wetlands have traditionally focused on their importance to migratory shorebirds and wildfowl.

Central American interests in the conservation of important wetlands consider the survival of waterfowl and shorebirds secondary to their primary function of providing economically important resources. Only recently have certain wetlands been protected in Central America solely for their importance to migratory wildfowl (Laguna de Jocotal, El Salvador and Caño Negro, Costa Rica). Interestingly, the creation of these reserves has become an economic success by attracting thousands of ecotourists willing to pay for an opportunity to view wildfowl in "exotic" habitats.

This dichotomy in interests has created some tension in the past when North American natural resource managers attempted to introduce traditional Western models for creating protected areas that ignored the needs of the local inhabitants. It is now recognized that human needs must play an integral part in the conservation of wetland areas in Central America. For without their support, the notion of sustainable development will remain unattainable—this has been demonstrated time and time again.

There are a number of regional priorities for wetland conservation in Central America. The Regional Tropical Forestry Action Plan (supported by all six Central American governments) identified two priority areas containing internationally-important wetlands: the Golfo de Fonseca and the Río San Juan. Both areas have significant wetlands that support local human populations and maintain a rich biological diversity. The Golfo de Fonseca may be one of the most important habitats for migratory shorebirds and waterfowl along the Central American coastline.

The IUCN-ORCA's Wetland Program has additional priorities. It is currently supporting pilot projects throughout Central America; their activities range from developing sustainable management plans for wetlands to producing models for predicting wetland values. The IUCN is also promoting the Ramsar Convention and conservation of declared Ramsar sites including Bahía de Montijo, Caño Negro, Bajos de Tempisque and Laguna del Tigre.

Canadian priorities, insofar as their involvement in Central American wetland conservation issues, have not been determined. Recent assistance to wetland initiatives has been limited to brief exchanges between the Canadian Wildlife Service and the Departments of Natural Resources in Panama and Costa Rica. Given Canada's interest in wetlands of importance to migratory birds, support to Ramsar activities in the region seems only

logical. CIDA has no policy towards wetlands but it does support the Regional Tropical Forestry Action Plan which has identified wetlands in its regional proposals.

OPPORTUNITIES AND CHALLENGES FOR CANADA

Central America is enjoying a tremendous growth in the environmental management sector. Undoubtedly, this growth is a result of international concern for the state of the global environment that has translated in unprecedented support for environmentally-related projects throughout Central America.

This growth in the environmental management sector has also given rise to new concerns for the threatened habitats such as wetlands. This is reflected by an increase of new wetland initiatives that have appeared in the last several years. Some of this momentum is a result of the IUCN-ORCA's Wetland Program—particularly their promotion of the Ramsar Convention.

Another interesting development in Central America is the renewed "spirit of regional cooperation." This has been emphasized by the recent accords signed by all the regions' governments including agreements to participate in binational and trinational environmental projects. This spirit of cooperation bodes well for wetland initiatives—many of which span two or three borders.

A new focus in wetland conservation has opened up a number of interesting possibilities in Central America that could be seen as opportunities for Canadian support. Based on the 10 recommendations presented in this paper, the following are the primary areas seen as potential for Canadian involvement:

1. Support to the new signatory members of Ramsar in Central America

By focusing support for Ramsar initiatives in Central America, Canada would not only be fulfilling its mandate under the Ramsar Convention to assist developing countries but would also elevate the status of Ramsar in the region. The lack of support to date for Ramsar sites in Central America gives Canada an opportunity to promote the value of the Convention. With the expertise and experience in managing Ramsar sites in Canada and internationally, Canada could offer both technical and financial assistance to regional and national wetland initiatives.

2. Support to the IUCN Central American Wetland Program

The demands on the IUCN's Central American Wetland Program continue to grow while the budget and personnel remain the same. Financial support to hire new personnel and undertake more workshops would help promote wetlands at the national and regional level.

3. Support to the Regional Tropical Forestry Action Plan

Canada has been actively supporting the TFAP process in Central America. Two particular projects involve wetland areas of both international and regional importance: these include the large wetlands critical to human and wildlife populations in the Golfo de Fonseca and the Río San Juan. Project proposals have been developed and are currently being circulated for review by potential donors.

4. Support to National Initiatives

Exciting opportunities exist for Canadian support to wetland initiatives on a national scale. For example, the Nicaraguan Ministry of Natural Resources has requested Canadian technical assistance to develop Nicaraguan expertise in natural resources management. Having recently created a department responsible for wetlands within the Ministry, it would be an excellent opportunity for Canadian support.

Central America has suffered a decade of civil conflict and continues to reel from the political and social uncertainties which abound. This makes it difficult to establish bilateral and multilateral links between parties with common interests such as wetland conservation. However, many NGO and international institutions have been involved in natural resources protection in Central America for over a decade. These include the WWF, USAID, CIDA, TFAP and UNEP. As environmental degradation continues unabated throughout the region, the risks of not supporting environmentally-sustainable initiatives could be far more detrimental.

THE FUTURE OF CENTRAL AMERICAN WETLANDS AND CANADIAN INVOLVEMENT

The future of wetland conservation in Central America will depend largely upon the political motivation of Central American governments to give priority to the conservation of their nationally and internationally important wetland sites. Without government support for wetland conservation, the demands of rapidly growing human populations for land and resources will continue to reduce the future economic potential and biological integrity of wetlands.

It is estimated that already 50% of the world's population lives within 60 km of the coastal shoreline and by the year 2020, this figure could rise to 75%. With this growth near coastal areas, the importance of promoting the sustainable development of wetlands will become paramount if wetland resources are to meet the growing demands of human populations—particularly because Central America has one of the greatest ratios of coastline per unit area in the world (Quesada and Jimenez 1988).

Even in the face of war, climatic and geological catastrophes, and rapid population growth, there have been significant gains in wetland conservation in Central America. Less than a decade ago, wetland conservation was barely an issue. Today, several regional, national and international organizations are actively promoting the importance of wetlands and are working towards their sustainable development. Large strides were made when the governments of Costa Rica, Guatemala, Honduras and Panama endorsed the Ramsar Convention on Wetlands of International Importance. This opened the way for international support, especially from countries like Canada that have a mutual, albeit different, interest in the state of Central American wetlands.

It is unlikely that wetland conservation will attain the status of a major issue like tropical rainforest conservation, but given international support, wetlands may become an important, recognized feature of the economic landscape of Central America. Ironically, the fate of Central American wetlands will be tied to the degree to which the remaining rainforests can be conserved. The majority of coastal wetlands in Central America depend on the tropical rainforests in upland watersheds that are critical to the functioning of the total watershed system.

Canada's role in promoting wetland conservation in Central America should be linked to its support for the Ramsar Convention. This gives credibility to the intentions of the Convention and also fulfils Canada's commitment to the accords and provides a focus for Canadian support. In Central America there are now four Ramsar partners who have demonstrated their interest and concern for wetlands. Here lies a unique opportunity for Canadian organizations to forge a strong link with Central American partners in the conservation of important international wetlands.

8. REFERENCES

Anderson, J. R., E. E. Hardy, J. T. Roach, and R. E. Witmer. 1976. *A Land Use and Land Cover System for Use with Remote Sensor Data.* United States Geological Survey Professional Paper No. 964. Washington, D.C.

Boza, M. A. 1989. *Parques Nacionales de Costa Rica.* INCAFO, S.A. San José, Costa Rica.

CIDA. 1988a. *Sustaining the Forest: Forestry Development Issues.* Policy Guidelines. Canadian International Development Agency. Hull, Quebec.

CIDA. 1988b. *Canada Funds for Local Initiatives.* Information document. Canadian International Development Agency. Hull, Quebec.

CIDA. 1989. *Guide for Project Submissions: Management for Change Program.* Canadian International Development Agency. Hull, Quebec.

CIDA. 1992. *CIDA Policy for Environmental Sustainability.* Advance edition. Canadian International Development Agency. Hull, Quebec.

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1976. *A Classification of Wetlands and Aquatic Habitats of the United States.* United States Fish and Wildlife Service. Washington, D.C.

Cruz, G. A. 1986. *Guida de los Parques Nacionales, Refugios de Vida Silvestre, Reservas Biólogicas y Monumentos Naturales de Honduras.* Asociación Hondureña de Ecología. Tegucigalpa, Honduras.

D'Croz, L. 1990. Los manglares de la república de Panamá: Situación actual y perspectivas. Unpublished report. Universidad de Panamá. Panama City, Panama.

Dugan, P. J. 1988. El programa para las zonas pantanosas de la UICN; el papel de los biólogos. In Proceedings, First Everglades National Park Symposium. Ed. G. H. Dalrymple, W. F. Loftus and F. S. Bernardino, Jr. Florida International University. Miami, Florida.

Environment Canada. 1993. Forest and Wetland Attributes for Highly Protected Conservation Areas in Canada. Project report to State of Environment Reporting Service. R. Bryson and Associates. Ottawa, Ontario. Unpublished.

Environment Canada and United States Department of the Interior. 1986. *North American Waterfowl Management Plan: A Strategy for Cooperation.* Ottawa, Ontario and Washington, D.C.

Environment Canada, SEDESOL, and United States Department of the Interior. 1993. *Expanding the Commitment—North American Waterfowl Management Plan 1993 Update.* Draft Report. Ottawa, Ontario, Mexico City, Mexico and Washington, D.C.

Farnsworth, N. R., and D. D. Soejarto. 1985. Potential consequences of plant extinctions in the U.S. and the current and future availability of prescription drugs. *Economic Botany* 39: 231-40.

Gillespie, D. I., H. Boyd, and P. Logan. 1991. *Wetlands for the World: Canada's Ramsar sites.* Canadian Wildlife Service, Environment Canada. Ottawa, Ontario.

Girot, P. 1991. The historical and cultural relations of the Maleku Indians with the wetlands of Caño Negro. Unpublished report. Universidad de Costa Rica. San José, Costa Rica.

Glooschenko, W. A. 1989. Wetland conservation in Latin America. Water Quality Bulletin 14(2): 81-87, 104. World Health Organization Collaborating Centre on Surface and Groundwater Quality, Environment Canada. Burlington, Ontario.

Godoy, J. C. *et al.* 1986. Guatemala. In *Inventario de Humedales de la Región Neotropical.* Eds., Scott, D. A., and M. Carbonell. International Waterfowl and Wetlands Research Bureau, Slimbridge, and IUCN, Cambridge, United Kingdom.

Government of Canada. 1991. *The Federal Policy on Wetland Conservation.* Environment Canada. Ottawa, Ontario.

Gutierrez, H. G. 1991. Diagnostico de manglares en Nicaragua. Unpublished report. Universidad Nacional Autónoma de Nicaragua. Managua, Nicaragua.

IICA. 1989. *Centroamérica en Gráficas.* San José, Costa Rica.

IUCN. 1983. *Global status of mangrove ecosystems.* Commission on Ecology, Paper No. 3. Eds. P. Saenger, E. J. Hegerl and J. D. S. Davie. International Union for Conservation of Nature. Gland, Switzerland.

IUCN. 1984. *World Conservation Strategy.* International Union for Conservation of Nature. Gland, Switzerland.

IUCN. 1990. *Wetlands Programme for Central America.* International Union for Conservation of Nature. San José, Costa Rica.

IUCN. 1991a. *Future Wetland Challenges.* In: Wetlands Programme Newsletter No. 3. International Union for Conservation of Nature. Gland, Switzerland.

IUCN. 1991b. *USA's Wetlands Conservation Act.* In: Wetlands Programme Newsletter No. 3. International Union for Conservation of Nature. Gland, Switzerland.

IUCN. 1991c. *Diseño y Preparación de un Programmea Marino y Costero en el Caribe de Centroamericana—Perfil.* International Union for Conservation of Nature. San José, Costa Rica.

Jimenez, J. A. 1991. Diagnostico sobre la situación actual de los manglares de Costa Rica. Unpublished report. Universidad Nacional de Costa Rica. San José, Costa Rica.

Lean, G., D. Hinrichsen, and A. Markham. 1990. *Atlas of the Environment.* Prentice-Hall Press. New York, New York.

Leonard, H. J. 1987. *Natural Resources and Development in Central America: A Regional Environment Profile.* Transaction Books for the International Institute for Environment and Development. New Brunswick, New Jersey.

López, C., and M. Saravia. 1990. Diagnostico sobre la situación de los manglares en Guatemala. Unpublished report. University of San Carlos. Guatemala City, Guatemala.

Maltby, E. 1986. *Waterlogged Wealth.* Earthscan. International Institute for Environment and Development. Washington, D.C.

Martin, A. C., N. Hotchkiss, F. M. Uhler, and W. S. Bourn. 1953. *Classification of Wetlands of the United States.* Special Report No. 20. United States Fish and Wildlife Service, Washington, D.C.

Miller, J. S. and S. J. Brewer. 1991. The discovery of medicines and forest conservation. Unpublished manuscript. Missouri Botanical Gardens and Monsanto Company. St. Louis, Missouri.

Mitsch, W. J., and J. G. Gosselink. 1986. *Wetlands.* Van Nostrand Reinhold Company. New York, New York.

NAWCC (Canada). 1990. *Sustaining Wetlands: International Challenge for the 90s.* North American Wetlands Conservation Council (Canada). Ottawa, Ontario.

NAWCC (Canada). 1991. *Canadian Wetlands Conservation Task Force: Formation, Mandate, Composition and Duties.* North American Wetlands Conservation Council (Canada). Ottawa, Ontario.

NWWG—National Wetlands Working Group. 1988. *Wetlands of Canada.* Ecological Land Classification Series, No. 24. Environment Canada and Polyscience Publications Inc. Ottawa, Ontario and Montreal, Quebec. 452 p.

PACA. 1991. *Proyecto Ambiental para Centro América.* PACA. San José, Costa Rica.

Quesada, A., and J. A. Jimenez. 1988. Watershed Management and a Wetlands Conservation Strategy: The Need for a Cross-sectoral Approach. In The Ecology and Management of Wetlands. Volume 2. Eds., Hook, D. D. *et al.* Timber Press. Portland, Oregon.

Ramsar. 1991. *Contracting Parties to the Ramsar Convention.* Ramsar Bureau. Gland, Switzerland.

Schele, L., and D. Friedel. 1990. *A Forest of Kings: The Untold Story of the Maya.* William and Morrow and Company Inc. New York, New York.

Scott, D. A., and M. Carbonell. 1986. *Directory of Neotropical Wetlands.* International Waterfowl and Wetlands Research Bureau, Slimbridge, and IUCN, Cambridge, United Kingdom.

Secretaría de Coordinación, Planificación y Presupuesto (SECPLAN) 1989. *Perfil Ambiental en Honduras.* Teguciagalpa, Honduras.

TFAP. 1990. *Plan de Acción Forestal de Panamá: Perfils de Proyectos.* INRENARE. Panama City, Panama.

TFAP. 1991. *Plan de Acción Forestal Tropical para Centroamérica.* CCAD. Guatemala.

The Nature Conservancy. 1990. *Parks in Peril: A Conservation Partnership for the Americas.* Washington, D.C.

UNESCO—MAB. 1991. *Implementation of the Ramsar Convention in the Neotropical Region.* UNESCO. Gland, Switzerland.

USAID. 1980. *Panama: State of the Environment and Natural Resources. Panama II.* United States Agency for International Aid. Washington, D.C.

USAID. 1989. *Environment Profile of Honduras.* United States Agency for International Aid. Washington, D.C.

USAID. 1991. *El Salvador Coastal Resources Profile.* United States Agency for International Aid. Washington, D.C.

USFWS. 1991. *USA's Wetland Conservation Act* In: Wetlands Programme Newsletter No. 3. International Union for Conservation of Nature. Gland, Switzerland.

WCED. 1987. *Our Common Future.* Oxford University Press. Oxford, England.

West, R. C. 1977. Tidal salt marsh and mangal formations of Middle America. In *Wet Coastal Ecosystems.* Ed., Chapman, V. J., Elsevier Scientific Publishing Co., Amsterdam, The Netherlands.

WRI—World Resources Institute. 1992. *World Resources 1991-92.* Oxford University Press. Washington, D.C.

WHSRN. 1989. *Western Hemisphere Shorebird Reserve Network.* Environment Canada. Ottawa, Ontario.

Wildlife Habitat Canada. 1986. *The Status of Wildlife Habitat in Canada: Problems, Issues and Opportunities.* Ottawa, Ontario.

Yanes, J. B. 1990. Diagnostico de la Situación de los Manglares en El Salvador. Unpublished report. University of El Salvador. San Salvador, El Salvador.

APPENDIX 1: DETAILED COUNTRY PROFILES

A compilation of detailed information on the state of wetland conservation in each Central American country, as of 1991, is provided in this section. Updated information on Central American Ramsar sites, as of October 1993, is included. Hopefully, this overview will add support for wetland conservation in Central America. Most of this information was gathered through discussions with individuals throughout Central America who have been directly and indirectly involved in wetland-related activities (see Appendix 3).

For each nation the following sections are presented:

- National statistics;
- Wetland areas of national and international importance
  - *General description*;
  - *Protected wetland areas*;
  - *Other critical wetlands*;
- Major conservation problems and threats to wetland habitat;
- Specific values and functions of the nation's wetlands;
- Canadian assistance to nation's wetland initiatives; and
- Organizations and institutions involved in wetland initiatives.

WETLANDS IN COSTA RICA

NATIONAL STATISTICS

Surface Area:	50 899 km^2
Population:	3 020 000 (WRI 1992)
Population Growth:	2.6%/year (IICA 1989)
Area Forested:	14 900 km^2 (TFAP 1991)
Deforestation Rate:	400 km^2/year (TFAP 1991)
Total Wetland Area:	Unknown

WETLAND AREAS OF NATIONAL AND INTERNATIONAL IMPORTANCE

General Description

The importance of wetlands to Costa Rica is reflected in the progressive programs established by the government to protect nationally-important wetland sites. Although wetlands cover a relatively small proportion of Costa Rica (Figure A-1), they do occupy a large percentage of designated conservation areas.

Wetlands in Costa Rica have not suffered the large-scale deforestation that has decimated its interior tropical deciduous rainforests. A general misconception that wetlands are "wastelands" has probably protected many of them from over-exploitation and degradation.

In the *Directory of Neotropical Wetlands* (Scott and Carbonell 1986), Julio Sanchez, a researcher from the Museum of Costa Rica, describes 12 important Costa Rican wetlands. The majority of these wetlands are found on the Pacific coast, along the Golfo de Nicoya. Here, a mixture of estuaries, mangroves, brackish lagoons, freshwater ponds and seasonally inundated rivers has created conditions favourable for agriculture and commercial

fishing interests. These wetlands also support major concentrations of wildlife species, including hundreds of thousands of wintering North American wildfowl.

The Caribbean wetlands are a study in contrast. Heavy year-round precipitation, extensive lowlands and minimal tidal fluctuations have promoted the formation of wetlands dominated by treed swamps. These often inundated, broad-leaved forests, interspersed with raphia palm swamps, and fresh and saltwater lagoons, form a complex association of distinct animal and plant communities unique to the Central American region. The Caribbean coast is much less populated than the Pacific coast; therefore, it does not suffer, to the same degree, the pressures from human populations.

The Caño Negro wetland complex was not mentioned by Sanchez (Scott and Carbonell 1986) in his description of important wetlands. However, it is now recognized as one of Costa Rica's most important interior, freshwater wetlands. The management of this wetland area is an integral part of the SI-A-PAZ Project which proposes to conserve a broad band of wetlands and tropical rainforests stretching from the interior of Costa Rica to the Caribbean coast of Nicaragua. In addition, Caño Negro was declared Costa Rica's first Ramsar wetland of international importance.

Approximately 412 km^2 of mangrove swamp remain along both the Pacific and Atlantic coasts (Jimenez 1990). Mangroves prefer the sheltered estuaries along the Pacific coast where significant tidal fluctuations expose their prop roots to the air. Key mangrove sites can still be found in the Osa Peninsula and along shores of the Golfo de Nicoya.

Wetlands are becoming increasingly important to Costa Rica's growing ecotourism industry. Most ecotourists seek out wetland areas for their pristine appearance and abundance of wildlife. As tourism is set to dominate the Costa Rican economy, so too will the conservation of these remarkable habitats.

Protected Wetland Areas

Costa Rica officially protects three wetlands as national parks and six areas as wildlife refuges. The national parks system protects representative wetlands throughout Costa Rica. Protected areas that include a mixture of fresh and saltwater wetlands and that are declared as Ramsar wetlands of international importance include:

Caño Negro: a wetland complex of seasonally inundated marshes and swamps which disgorges its contents into Lago Nicaragua—Central America's largest lake. This wildlife refuge protects important populations of migrating wildfowl and many regionally endangered species.

Bajos de Tempisque: supports seasonally inundated wetlands along the Pacific coast. These wetlands harbour large populations of migrating waterfowl which arrive during the dry season—coinciding with the arrival of many tourists eager to see familiar species in unfamiliar habitat.

Tamarindo National Wildlife Refuge: these wetlands were nominated as Costa Rica's third Ramsar site in June 1993.

The other protected wetlands, worthy of mention, are coastal. They are located in Tortuguero National Park and the Barra del Colorado Wildlife Refuge. These protected areas include immense areas of lowland swamp along Costa Rica's northeastern coast. Narrow, forested canals, which connect brackish and freshwater lagoons, are buffered from the sea by palm-lined beaches and sandbars. In the southeastern corner of Costa Rica, the Gandoca-Manzanillo National Wildlife Refuge supports one of the few areas of red mangrove (*Rhizophora mangle*) along the Caribbean coast; its lagoons reportedly provide refuge to a small population of endangered manatee (a species of aquatic mammal dependent on wetlands for its survival).

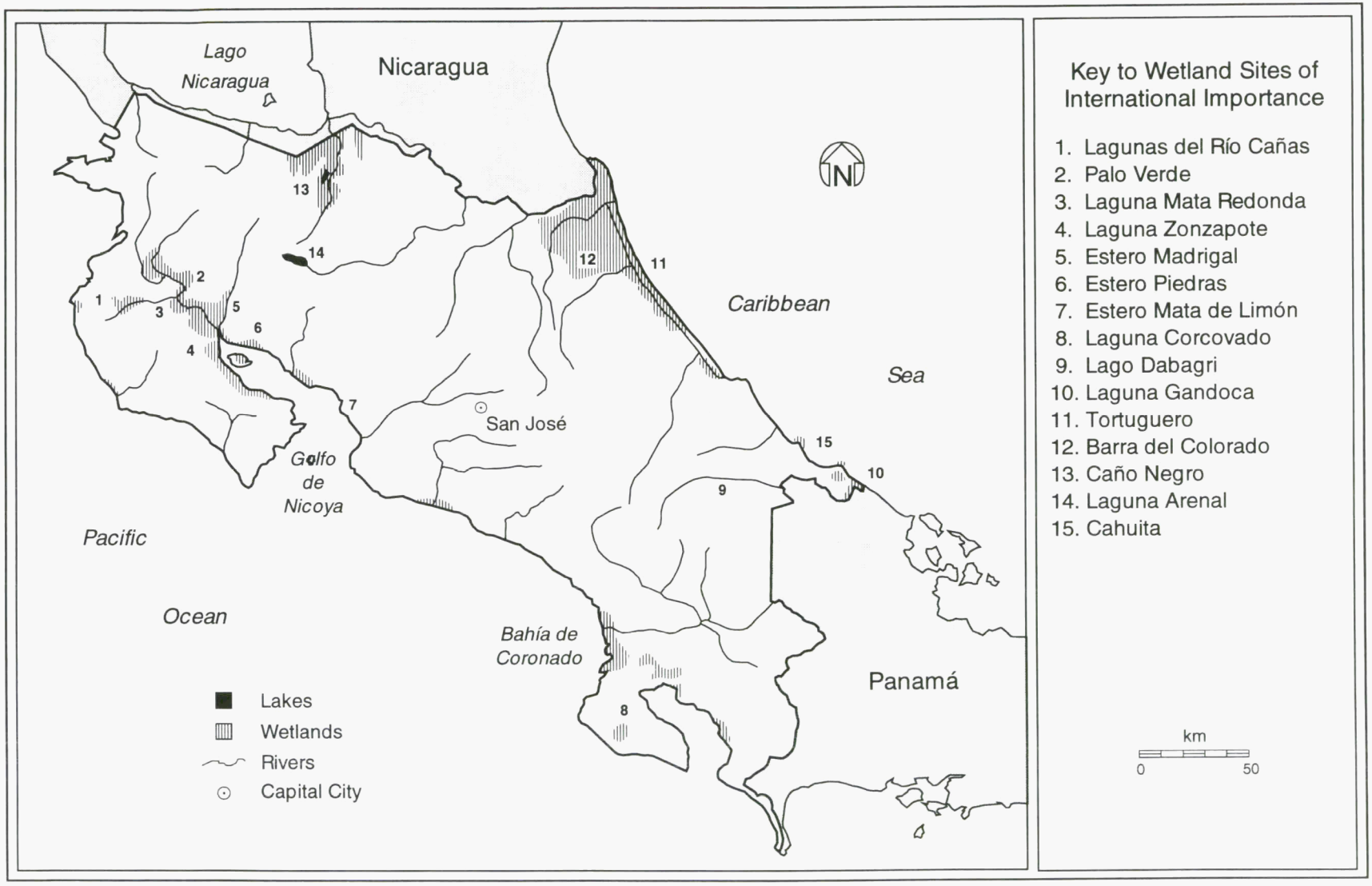


Figure A-1. Wetlands of International Importance in Costa Rica

Other Critical Wetlands

The mangrove forests of Sierpe-Terraba are the largest in Costa Rica but are not included in its system of protected areas. These wetlands support local charcoal industries and are thought to be critical to fish and crustacean production in the nearby Bahía de Coronado.

MAJOR CONSERVATION PROBLEMS AND THREATS TO WETLAND HABITAT

The tourism industry has done more for the protection of wetlands in Costa Rica than government and non-government organizations combined. The growing ranks of ecotourists invariably include pristine wetland sites in their itineraries. Yet, wetlands are being choked by water-laden sediments brought down from the highlands by rains which fall on the deforested soils. In addition, Costa Rica has not developed waste management technologies to deal with its urban waste which is dumped raw into the rivers, eventually finding its way into wetlands.

The more serious conservation problems and threats to wetlands are listed below.

- Although Costa Rica has had the foresight to protect many of its important wetland sites, some areas have not escaped the indirect contamination from human and industrial pollution that continues to be dumped, untreated, into the streams and river systems from urban areas.

- The cutting of mangrove forests to make carbon and fuelwood is seriously threatening the mangroves of Sierpe-Terraba and other small sites along the Pacific coast.

- In the Caribbean lowlands, agro-chemicals used to protect banana plantations, are seriously contaminating rivers and lakes which support wetland ecosystems.

- The cholera epidemic has devastated the fishing industry along the Pacific coast, leaving many fishermen unemployed. This has had negative repercussions on mangrove forests. Unemployed fishermen have had to turn to alternative economic activities such as the production of charcoal from mangrove trees.

- Uncontrolled development of the tourist industry continues to threaten wetlands in certain areas, including Barra del Colorado, where over-fishing has decimated fish populations.

- In some areas, there is a lack of inter-sectoral coordination between responsible institutions. For example, in the lowlands surrounding the nationally protected Bajos de Tempisque wetlands, agro-chemical run-off from adjacent commercial rice fields is being blamed for the contamination of the wetland ecosystem. Sufficient regulations do not exist. In this case, there are conflicting activities being promoted by different ministries: the Department of Agriculture and the National Parks Service.

- The relatively uncontrolled commercial production of shrimp along the Pacific coast, near Puntarenas, has resulted in the clearing of significant areas of unprotected mangrove forest. In some cases, millions of dollars were invested in ventures that have not been financially viable, resulting in the deforestation of large tracts of mangrove forest.

SPECIFIC VALUES AND FUNCTIONS OF COSTA RICAN WETLANDS

Aside from their general functions and values, Costa Rican wetlands are of national importance. Listed below are specific examples of their value and function in Costa Rica.

- The tremendous biodiversity found in Costa Rican wetlands attracts tens of thousands of tourists annually to areas such as Tortuguero, Barra del Colorado, Cahuita and Corcovado. This in turn creates many economic opportunities for local and non-local residents.

- In Costa Rica, mangrove swamps once provided important economic returns. Fuelwood, charcoal, construction material and tannin are all derivatives of mangrove forests. The commercialization of these products helped support many coastal communities. With the advent of electricity and synthetic materials, the use of mangroves for tannin and cooking material decreased; they are being cleared and replaced by shrimp ponds to meet an increasing world demand for shrimp products.

- Tens of thousands of migratory waterfowl winter in the wetlands of Tempisque and Caño Negro before leaving for North America to breed. In some areas, hunting wildfowl still supplements local diets.

- Large quantities of bivalves are harvested throughout the year in the Golfo de Nicoya. This activity supports as many as 150 local harvesters.

- The mangrove forests along the Pacific provide critical habitat for important commercial aquatic species.

CANADIAN ASSISTANCE TO COSTA RICAN WETLAND INITIATIVES

The Canadian International Development Agency has indirectly funded activities in wetland areas and in 1991, it approved funding to support a small wetland conservation program in San Vito, near the Osa Peninsula.

As part of the Latin American Program, the Canadian Wildlife Service (CWS) recently established contacts with Costa Rican biologists to coordinate a study on migratory Peregrine Falcon. CWS and Costa Rican biologists collected data along the coastal wetlands of the Pacific to determine if Peregrines were consuming contaminated prey species feeding on coastal wetlands.

ORGANIZATIONS AND INSTITUTIONS INVOLVED IN WETLAND INITIATIVES

Of the 200 or more environmental organizations in Costa Rica, very few have concentrated work in wetland habitats. Those that have are mentioned below.

Ministerio de Recursos Naturales, Energía y Minas—MIRENEM

The **National Parks Service** is responsible for the regulation and control of nationally protected areas, including Ramsar sites. Caño Negro and Palo Verde are priority areas that are being developed with assistance from non-governmental agencies.

The **Tropical Forestry Action Plan** (TFAP) proposes to strengthen the institutional capacity of MIRENEM for managing its national parks and reserves. Individual wetlands in both protected and unprotected areas have been targeted for future activities promoting investigation, conservation and sustainable development. These include Caño Negro and Barra del Colorado Wildlife Refuges, and Tortuguero National Park. These three key wetland areas will be included in proposals to be submitted for financing to the international community in what has become known as the SI-A-PAZ project. TFAP also recognizes the importance of investigation in the Sierpe-Terraba mangrove swamps and aims to develop a sustainable management plan for the area.

World Conservation Union—IUCN

The Central American IUCN office (IUCN-ORCA) is responsible for coordinating IUCN's Wetland Program. Based at CATIE in Turrialba, the IUCN-ORCA currently provides technical assistance to Caño Negro and Tortuguero as well as support to the SI-A-PAZ initiative along Costa Rica's border with Nicaragua. Through its regional program, the IUCN-ORCA promotes wetland research and leads training programs through workshops and graduate programs. In coordination with CATIE, the IUCN is undertaking research on the Sierpe-Terraba mangrove complex.

National Autonomous University of Costa Rica—UNA

The UNA coordinates a Wildlife Management Program for Latin American students. Included in the program's curriculum are courses on wetland management. An inventory and classification of all Costa Rican wetlands is currently being undertaken by faculty members. Students and professors are working on projects in the Sierpe-Terraba mangrove forests, and in the Bajos de Tempisque.

University of Central America—UCA

The UCA is undertaking research on mangrove forests throughout the country. Details were not available at the time this paper was prepared.

Confederation of Central American Universities—CSUCA

In Costa Rica, CSUCA has been supporting the UCA in its efforts to map the wetlands of Caño Negro in attempts to understand the relationship between the local human populations and the adjacent wetlands that extend across the border into Nicaragua.

Central American Environmental Program—PACA

With support from the United States Agency for International Development (USAID), a new regional initiative is searching for a niche in the expanding environment field. In support of measures to conserve the wetlands in the Bajos de Tempisque, PACA will fund environmental education, reforestation projects and investigations aimed at wetland conservation during the next four to five years. PACA's goal is to select a pilot project for conservation purposes in each of the Central American countries, but not necessarily in wetland areas.

National Museum of Costa Rica

A chapter on Costa Rican wetlands was compiled by the museum and was included in the *Directory of Neotropical Wetlands* (Scott and Carbonell 1986). Although, museum personnel are not actively working on specific wetland issues, they continue to be an excellent source of information on Costa Rican wetlands.

Organization of Tropical Studies—OTS

The OTS conducts research in the Osa Peninsula, particularly in Corcovado National Park. Their research centre serves as a base for studying the tropical ecosystems, including the wetlands of Lago Corcovado.

Asociación de Conservacionistas de la Costa—ANAI

ANAI is a small NGO group conducting research and environmental education along the Caribbean coast. A current project in the Gondoca-Manzanillo National Wildlife Refuge includes activities to protect this important wetland area.

WETLANDS IN EL SALVADOR

NATIONAL STATISTICS

Surface Area:	21 200 km^2
Population:	5 250 000 (WRI 1992)
Population Growth:	2.4%/year (IICA 1989)
Area Forested:	660 km^2 (TFAP 1991)
Deforestation Rate:	20 km^2/year (TFAP 1991)
Total Wetland Area:	Unknown

WETLAND AREAS OF NATIONAL AND INTERNATIONAL IMPORTANCE

General Description

El Salvador is a coastal country bordering the Pacific ocean. The watersheds of this largely deforested country, drain rivers that pass through a rugged central plateau before making their way to the narrow coastal Pacific plains.

In the *Directory of Neotropical Wetlands* (Scott and Carbonell 1986), Manuel F. Benitez describes eight wetland areas of national and international importance in El Salvador. Figure A-2 indicates the location of these wetlands. El Salvador's most important wetlands are found along its estuaries. These naturally protected lagoons often support extensive forests of mangrove—vital habitats for aquatic species harvested by commercial and traditional fishermen.

The coastal estuarine wetlands are a complex system of tidal mudflats, open beaches and mangrove dominated swamp forests which alone, cover 414.9 km^2 (Yanes 1990). This is approximately 60% of the entire forested area (660 km^2) in El Salvador and constitutes an important forestry resource.

In El Salvador, clearing, agro-chemical contamination, heavy sedimentation, over-exploitation of wetland resources and water-diversion projects (e.g. dams, irrigation) are major factors causing wetland degradation. Wetlands have also been a casualty of the country's decade-old civil war. Conservation initiatives, including those planned for nationally important wetlands along the southeast coast, have been postponed indefinitely until the military conflicts are resolved.

Freshwater wetlands are scarce in El Salvador. The Laguna de Jocotal has long been recognized as the most important wildlife refuge and is one of the few inland, freshwater sites to have been studied and protected.

Protected Wetland Areas

The Government of El Salvador lists five protected wetlands: Barra de Santiago, Recifes Cabaños, Santa Clara, Laguna de Jocotal, and a small area in the Golfo de Fonseca. Very few are managed and those that are, usually rely on support from non-governmental organizations.

Currently, the *Centro de Recursos Naturales* (Centre for Natural Resources) (CENREN) and the *Amigos del Arbol* (Friends of the Tree) (AMAR) are being supported by the *Centro Agronómico Tropical de Investigación y Enseñanza* (Tropical Agricultural Centre for Research and Education) (CATIE) and the International Union for Conservation and Nature (IUCN) to complete a study of Barra de Santiago's mangrove forests. Santa Clara, a small coastal freshwater wetland just south of San Salvador, is also being monitored by CENREN.

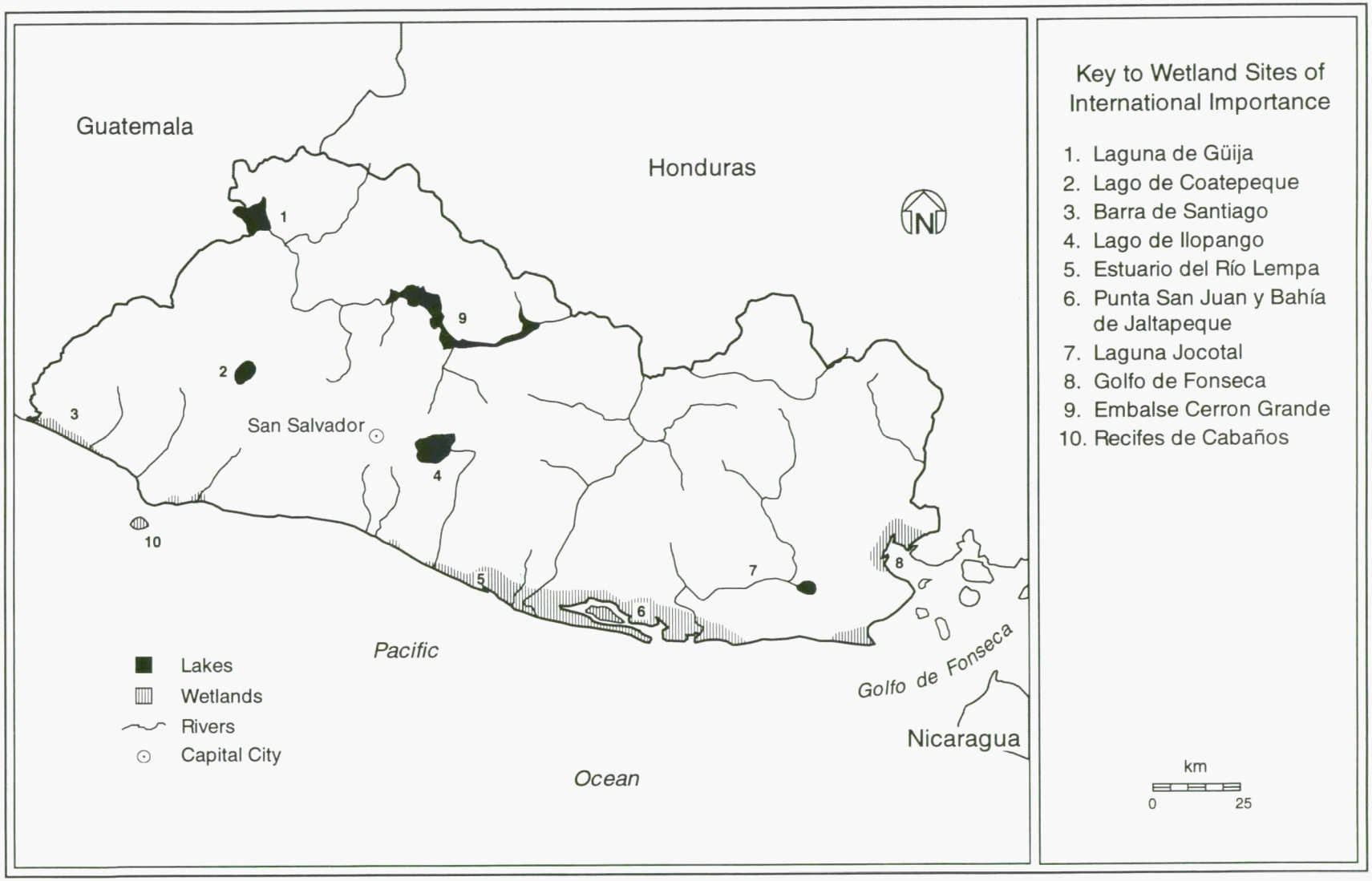


Figure A-2. Wetlands of International Importance in El Salvador

The Laguna de Jocotal is a protected, freshwater wetland in the southeast corner of El Salvador. The marsh and swamp forests attract large concentrations of resident and migratory wildfowl. Local communities are engaged in the construction of nesting boxes to encourage the breeding of tree ducks. In turn, the local residents harvest tree duck eggs for private and commercial use.

Law prohibits the cutting of mangrove trees without prior authorization from CENREN. Unfortunately, this law has been impossible to enforce because government departments are desperately understaffed and the development of an alternative fuel source to mangrove wood along the coast is virtually non-existent.

Other Critical Areas

The following mangrove areas are recognized as having either important ecologic or economic significance: the Laguna de Jaltepeque, the Laguna de Jiquilisco, and the Golfo de Fonseca (including the islands in the Gulf). Little information exists on these areas.

MAJOR CONSERVATION PROBLEMS AND THREATS TO WETLAND HABITAT

A decade of civil war in El Salvador has put a tremendous strain on the country's capacity to manage its depleted natural resources. Faced with a growing debt, a burgeoning population and severe cutbacks to the ministries responsible for managing natural resources, wetlands in El Salvador have been largely ignored.

The following list describes some of the threats and conservation problems facing wetlands in El Salvador:

- Heavy deforestation throughout the country has placed added pressure on mangrove forests to provide fuelwood.
- Mangroves have been cut to expand agriculture activities and increasingly, to make way for shrimp farms.
- An inability to monitor the exploitation of mangrove forests may result in the severe reduction of mangrove forests outside of protected areas.
- A tremendous quantity of agro-chemical residues, from a cocktail of mixtures used to combat pests affecting cotton crops during the last 30 years, remains in these wetland systems and probably continues to affect humans and wildlife species that use wetland areas. The Laguna de Jocotal wetland suffers tremendously from agro-chemical contamination from adjacent farmlands.
- Sediments carried down from the deforested highlands are choking the estuaries and threatening the spawning beds of important commercial fish species and the fragile coral reefs of Cabanos.
- Changing water levels and composition are detrimental to wetlands, particularly, mangroves and coral reefs. Damming, deforestation and irrigation are several common activities that create unfavourable conditions for wetlands in El Salvador and throughout Central America.
- In 1980, a study by the El Salvador National Parks and Wildlife Service estimated that more than 70% of the beaches have been divided into lots for recreational purposes. Development of these areas will be detrimental to adjacent wetlands that are perceived as wastelands and often cleared.

SPECIFIC VALUES AND FUNCTIONS OF EL SALVADORAN WETLANDS

The few remaining wetlands in El Salvador do not compare in size and variety to the vast wetlands of the Miskitia of Honduras and Nicaragua. However, they do provide an important function as refuges for commercially-important aquatic species. This and several other important functions and values of El Salvadoran wetlands are listed below.

- The coastal wetlands, coral reefs, lagoons and riverine estuaries of El Salvador are critical habitats and nursery grounds for many commercial species of fish, crustaceans and molluscs.
- Mangrove forests provide timber and fuelwood for rural communities along the coast. Once important as a source of tannin, they are now largely used to meet an increasing demand for fuelwood.
- With a growth in ecotourism, wetland areas could become important ecotourism sites. Before the recent civil war, the Laguna de Jocotal was a popular tourist attraction to foreign visitors interested in El Salvador's wildlife.
- The newly-created Lago de Cerron Grande has flooded extensive areas in the highlands of El Salvador. New wetlands have started to form, and in time, may become important habitat for fish and wildlife species.

CANADIAN ASSISTANCE TO EL SALVADORAN WETLAND INITIATIVES

There is no apparent Canadian involvement in wetland-related activities in El Salvador.

ORGANIZATIONS AND INSTITUTIONS INVOLVED IN WETLAND INITIATIVES

Centro Nacional de Recursos Naturales de El Salvador—CENREN

The **Department of National Parks and Protected Areas** of the *Centro Nacional de Recursos Naturales de El Salvador* (the El Salvadoran National Centre for Natural Resources) (CENREN) is responsible for the administration and regulation of protected areas in El Salvador. The ministry is currently working in three wetland areas: Barra de Santiago, Santa Clara and Jocotal. The central office coordinates activities in the regional offices and gives technical assistance. Unfortunately, as with most natural resource ministries, the protection of parks and protected areas is a low priority. The ministry relies on the assistance of non-governmental and international groups, particularly in Barra de Santiago where the work is coordinated with CATIE, USFWS, WWF and the IUCN.

The **Tropical Forestry Action Plan** (TFAP) is still in the initial development stages. The government (CENREN) has drawn up a strategy and a draft copy of a *Diagnostic Study of the Socio-economic Situation in El Salvador*, a *Forestry Strategy Paper,* and a list of *Forestry Project Profiles*. Recommendations for improving these draft documents is being discussed by various sectors of governmental and non-governmental groups. It is interesting to note the following project profiles for wetland areas:

a. Delimitation, Restoration and Administration of Mangroves.
b. Development of Santa Clara Regional Park.
c. Integration of Women into the Conservation and Sustainable Use of the Natural Resources of the Barra de Santiago.
d. Environmental Education and Community Services for the Sustainable Development of the Forest Resources of Laguna de Jocotal.

The regional TFAP identifies the Golfo de Fonseca as a priority area. This may explain why it has not been considered in the El Salvadoran TFAP even though its wetlands are of importance to El Salvador.

Amigos del Arbol—AMAR

This small organization is typical of underfunded environmental NGOs in El Salvador. In coordination with CATIE and IUCN, they are promoting the protection and reforestation of mangroves, particularly in the Barra de Santiago area. They are committed to the ecological recuperation of the natural resources in El Salvador.

University of El Salvador

The Department of Natural Sciences is involved in wetland research, especially in the large mangrove system in the Bahía de Jiquilisco. A diagnostic study of the mangrove resources of El Salvador (part of a regional diagnostic study of mangroves in Central America, funded by CSUCA) was completed in 1991 by the Department of Biological Sciences.

World Conservation Union—IUCN

The IUCN is supporting Amigos del Arbol (AMAR) in the Barra de Santiago as part of their regional wetland initiative. This project has an education component for developing techniques to help local populations understand the importance of mangroves and how they can be managed to support human needs without destroying the mangrove ecosystem's integrity.

World Wildlife Fund—WWF

The WWF receives funding from the United States Fish and Wildlife Service (USFWS) to support the conservation of marine sea turtles and their habitats in the Barra de Santiago. This work includes research, conservation activities and environmental education. Incentives are being used to encourage poachers of local turtle eggs to leave a small percentage of eggs to ensure the return of this important species to the local beaches. The collection of sea turtle eggs is a lucrative industry for local residents.

Audubon Society

The Audubon Society has a small following that supports the conservation of birds and their habitat (which includes wetlands).

Asociación Salvadoreña Pro-Salud Rural—ASAPROSAR

This women's organization works with rural communities on environmental issues including health. They also assist locals in the conservation and management of wild tree ducks in the Laguna de Jocotal. ASAPROSAR hopes to assist communities around the Laguna de Güija undertake a wetland inventory to determine the recent decrease in fish populations.

Prohumedales

This newly-formed group of professionals and non-professionals is dedicated to the conservation of wetlands in El Salvador. They have requested training by the IUCN and CATIE, and hope to undertake projects throughout El Salvador. Led by several wetland experts from the University of El Salvador and CENREN, it will be interesting to monitor the progress of this group.

WETLANDS IN GUATEMALA

NATIONAL STATISTICS

Surface Area:	108 889 km^2
Population:	9 200 000 (WRI 1992)
Population growth:	3.1%/year (IICA 1989)
Area Forested:	4 376 km^2 (TFAP 1991)
Deforestation Rate:	900 km^2/year (TFAP 1991)
Total Wetland Area:	Unknown

WETLAND AREAS OF NATIONAL AND INTERNATIONAL IMPORTANCE

General Description

There is a rich diversity of wetland habitats throughout this mountainous country. Large expanses of marshes and inundated tropical rainforests in the Peten lowlands, freshwater marshes along the Río Polochic floodplain, reed marshes in the volcanic Lago Atitlán, and mangrove swamps in the estuaries of Monterrico are just a few examples of this diversity.

In the *Directory of Neotropical Wetlands* (Scott and Carbonell 1986), Juan C. Godoy describes 24 wetland sites of national and international importance in Guatemala. Figure A-3 clearly indicates the extensive wetlands occupying northern Guatemala. This is the region referred to as the Peten. Other wetlands are scattered throughout the country.

Mangrove swamps are found along both coasts. On the Pacific coast, mangrove swamps once dominated the estuarine wetlands. Only 138 km^2 of mangrove forests remain intact. On the Caribbean coast, mangrove wetlands occur along the Punta de Manabique and at the mouth of the Río Dulce. A rich variety of wetlands line the Río Dulce which flows between Lago de Izabal and the Caribbean. The rich biodiversity and the sheer beauty of this region draws thousands of tourists annually.

The wetlands of the Peten are characterized by marsh and swamp forest—many of which are found along shallow lakes which flood during the peak of the rainy season. Several wetlands are found within the Maya Biosphere Reserve—a large conservation area in the Peten which is said to be one of the greatest, biologically diverse regions on this planet.

The wetlands of the Interior Highlands are few. Those that have not been drained or cleared are now important tourist locations. Lago Güija, on the border between El Salvador, contains some marsh wetland areas and the well studied reed marshes of Lago Atitlán are the home of a grebe species, known locally as the "Poc", *Podilymbus gigas*—a water bird believed to be on the verge of extinction.

Protected Wetland Areas

In 1989, the Laguna del Tigre, in the northwestern corner of the Peten, was designated Guatemala's first Ramsar site. This area is notable for its vast tracts of marshes and swamp forests which are part of a larger conservation unit—the Maya Biosphere Reserve.

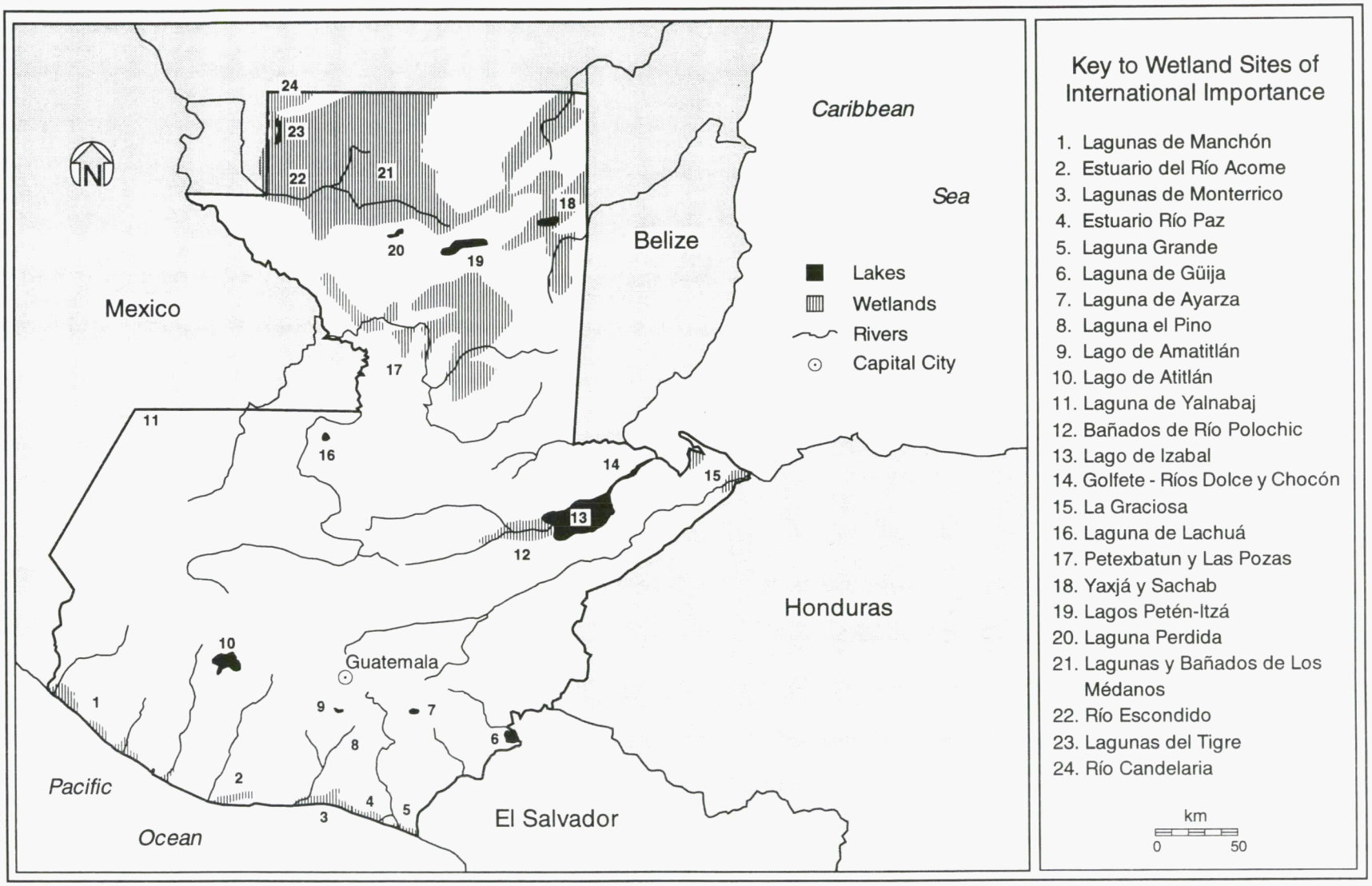


Figure A-3. Wetlands of International Importance in Guatemala

Lago de Lachua is a small lake surrounded by marshes in the lowlands close to the border with Mexico. The 100 km^2 of surrounding habitat is protected but it will soon be isolated by forest clearings as new settlers clear the surrounding forests.

A small marsh in Lago Atitlán has attracted attention because of a nearly extinct species of Grebe that inhabits the disappearing reed beds. The *Dirección General de Bosques y Vida Silvestre* (Forests and Wildlife Directorate) (DIGEBOS) has declared a small wetland site protected to preserve the last remnants of this species' breeding habitat. They have also established an interpretive centre to attract tourists wishing to see this elusive bird.

Along the Pacific coast, two significant mangrove forests have been designated protected areas: Manchón and Monterrico. On the Caribbean coast, protected mangrove swamps have been declared along the Punta de Manabique and at the mouth of the Río Dulce. The Río Dulce and its shoreline are officially claimed to be protected, but uncontrolled development along its banks continues.

Other Critical Wetlands

The Río Dulce flows between Lago de Izabal (589.6 km^2) and the Caribbean. A rich variety of wetlands along the river include mixed treed swamps of mangrove and other broadleaved species as well as marshes on the Río Chocon Delta. According to Godoy *et al.* (1986), 60% of the shoreline around Lago de Izabal are fringing marshes.

The marshes along the floodplain of the Río Polochic, which enters Lago de Izabal from the west, are extensive (185 km^2) and probably support important populations of waterfowl. Unfortunately, little if any documentation exists on the area's ecological importance. Growth of agriculture and the widespread use of agro-chemicals are an increasing threat to the wetlands of this area.

Other important, unprotected wetlands areas that have been studied are the flooded forests and marshlands around Sayaxche, and the wetlands surrounding the Lago Peten-Itza (which are only partially protected in the Biotopo Cerro Cahui).

MAJOR CONSERVATION PROBLEMS AND THREATS TO WETLAND HABITAT

The major conservation problems and threats to Guatemalan wetlands are summarized below.

- An increasing population along the Pacific coast continues to put pressure on the remaining resources of estuaries and mangrove swamps.
- The heavy agro-chemical run-off from agricultural lands along the Pacific slopes has severely contaminated a few coastal wetlands. Agro-chemicals also threaten the remaining wetland areas in the volcanic highlands of the interior, and the Lago de Izabal and Río Dulce region on the Caribbean coast. Massive agricultural development in the Río Polochic floodplain will exacerbate the growing pesticide contamination of Lago de Izabal.
- There are inadequate resources for implementing environmentally sustainable management plans in the protected wetland areas.
- Unchecked development along the Río Dulce threatens the ecological integrity of the area and the characteristics that have made it an important tourist attraction.

- The vast, isolated wetlands of the Peten are now beginning to suffer from the same human pressures that have affected other wetlands in the country. Oil and mineral rights have been granted to multinational firms and threaten to open up the Peten to migrant farmers who follow in wake of clearings created by new access roads. Unless a solution to land tenure is found, migrating farmers will continue to push the agricultural frontier towards the Peten. The **Maya Biosphere Reserve Project** is trying to address this problem in the Peten.

- Based on the scant information available on Guatemalan wetlands, it is clear that very little attention has been focused on identifying important sites. This information is crucial for developing any sort of conservation strategy.

SPECIFIC VALUES AND FUNCTIONS OF GUATEMALAN WETLANDS

The size and biological diversity of Guatemalan wetlands rival those of the Miskitia in Honduras and Nicaragua. Both have immense areas of intact wetland ecosystems. The rich biodiversity found in Guatemalan wetlands is unique to Central America. They are also one of the few areas in Central America under pressure from oil and mining exploration. Specific values and functions of the Guatemalan wetlands are listed below.

- The Pacific coastal wetlands are important sources of fuelwood for coastal communities. They are also ideal sites for establishing shrimp farms and salt pans. Several wetland sites along the Pacific are important habitats for migratory bird species which pass through the region. Manchón and Monterrico are two sites that are identified by Godoy *et al.* (1986) as sites of particular importance to migratory birds.

- Several volcanic lakes in the Central Highlands support wetlands that are important tourist attractions. The Poc is a small waterbird whose population is on the verge of extinction. The Poc live in the reed beds along the shores of the volcanic Lago Atitlán. Thousands of tourists travel to this lake in search of this elusive creature.

- The wetlands around Lago de Izabal are important sites for migratory waterfowl. They include the marshes along the Río Polochic, Lago de Izabal, the Río Dulce, and the Río Chocon delta. These sites are also a major tourist attraction for both foreigners and nationals alike. These wetlands act as important filters of agro-chemicals used in adjacent farmlands.

- The wetlands of the Peten are probably the most extensive and the least visited of the wetland areas in Central America. There are vast areas of flooded forest and open marshes. Their importance as a refuge for immense biodiversity cannot be overlooked. Local indigenous populations depend on this area for their livelihood.

CANADIAN ASSISTANCE TO GUATEMALAN WETLAND INITIATIVES

There is no known Canadian involvement in wetland initiatives in Guatemala.

ORGANIZATIONS AND INSTITUTIONS INVOLVED IN WETLAND INITIATIVES

Consejo Nacional de Areas Protegidas—CONAP

CONAP (National Council on Protected Areas) was created in 1989 to oversee the development of a program for the protection and sustainable use of the natural and cultural heritage of Guatemala. CONAP is an amalgamation

of various governmental departments and non-governmental groups. CONAP has been identified in the Tropical Forestry Action Plan (TFAP) as the institution needing technical and financial support for organizing and developing the Guatemalan System of Protected Areas. CONAP is responsible for maintaining the Ramsar site, La Laguna del Tigre, and other wetland sites in the Peten.

Dirección General de Bosques y Vida Silvestre—DIGEBOS

DIGEBOS (Forests and Wildlife Directorate) was formally responsible for the National Park Service in Guatemala. It now is responsible for projects related to forestry or wildlife within these protected areas. DIGEBOS is working in several wetland areas along the Pacific coast (Monterrico, Manchón), in the interior highlands (Lago Atitlán), along the Caribbean coast (Punta de Manabique) and in the Peten (Laguna de Lachua). Most projects focus on human interests such as promoting sustainable turtle egg harvesting—an important local industry along the coasts.

Centro de Estudios Conservacionistas—CECON

Operated by the University of San Carlos, CECON (Centre for Conservation Studies) is involved in the conservation of natural areas, concentrating on investigation and higher education. CECON is focusing its activities on the "Biotype Reserves", of which three of the nine are wetlands (Laguna del Tigre, Monterrico, Río Dulce). CECON is coordinating the activities of The Nature Conservancy in a five-year project to catalogue the biodiversity of Guatemala's natural regions. Many of the studies have been undertaken in wetland areas throughout the country, particularly in the Péten.

World Conservation Union—IUCN

With direction from the former head of the IUCN in Central America, a new IUCN office in Guatemala has been opened. Several staff members have extensive wetland-related experience in the country. The IUCN is initiating projects in two areas of wetland importance: Monterrico and Río Dulce. The IUCN plans to work with CECON to develop and implement a management plan for the Monterrico wetlands. It is also starting a project in the Yaxja-Naranjo-Nakum area, south of the Laguna del Tigre.

The Nature Conservancy—TNC

The Nature Conservancy is helping CECON establish a Conservation Data Centre as part of its project to establish a bank of information on the biodiversity of each country in Latin America. Other data centres are being financed in Panama and Costa Rica. Significant data have been collected in wetland areas of the Peten and Río Dulce. This data will help design strategies for the sustainable development of Guatemala's natural resources.

Tropical Forestry Action Plan—TFAP

The Tropical Forestry Action Plan is being overseen by a number of representatives from different government agencies. An independent body is coordinating the activities of the TFAP. The preliminary project profiles do not specifically identify wetlands.

Amigos de Lago Atitlán

This NGO (Friends of Lake Atitlán) focused on Lake Atitlán in the late 1980s. It published newsletters and semi-technical reports dealing with water pollution, the Poc, and the causes of lake-level fluctuations. The organization does not appear to be active currently.

WETLANDS IN HONDURAS

NATIONAL STATISTICS

Surface Area:	112 088 km^2
Population:	5 140 000 (WRI 1992)
Population Growth:	3.2%/year (IICA 1989)
Area Forested:	44 320 km^2 (TFAP 1991)
Deforestation Rate:	1 080 km^2/year (TFAP 1991)
Total Wetland Area:	Unknown

WETLAND AREAS OF NATIONAL AND INTERNATIONAL IMPORTANCE

General Description

The coastal lowlands of Honduras, bordering the rugged interior, are fed by a multitude of rivers which have carved out steep valleys and left extensive alluvial deposits along the Caribbean and Pacific coasts. It is here, along the alluvial floodplain, that one finds the majority of Honduran wetlands. Honduras can be divided into three geographical regions, each one with characteristic wetlands:

The **Pacific Lowlands** are characterized by mangroves, tidal mudflats, riverine swamps and marshes, which border the length of Honduras' Pacific coastline.

The **Interior Highlands** occupy 85% of the superficial area of the country. Steep slopes, geological conditions, long dry seasons and human pressures have not favoured wetland formation. The few wetlands that have formed are found along the shores of small lakes and meandering rivers.

The **Caribbean Lowlands** are characterized by narrow alluvial plains extending inland along the major river systems. Large areas of swamp forests, filled with palm and occasionally mixed with mangrove near the coast, are common to this area.

The scant information provided by Wilberto Aguilar and Mercedes S. Reyes in the *Directory of Neotropical Wetlands* (Scott and Carbonell 1986), lists only six internationally-important wetlands. Of these, the most important are located at the mouths of the major river systems draining into the Caribbean, and along the Golfo de Fonseca coastline (Figure A-4). There is very little known about the remaining Caribbean wetlands. Their inaccessibility and remoteness has protected them from exploitation and investigation.

The majority of wetlands in the Golfo de Fonseca lie within Honduran territory and, economically, represent the most important wetland habitat in Honduras. Burgeoning human population growth in the gulf is contributing to the rapid degradation of these fragile wetland ecosystems. The economic benefits derived from the gulf wetlands are threatened by agricultural pollutants, human waste, industry, and the over-exploitation of natural resources.

Protected Wetland Areas

Important protected wetlands along the Caribbean have been briefly described by Cruz (1986). These include:

- the Reserva Biólogica Barra del Río Motagua, which supports 30 000 ha of savannahs, *pantanos* (swamps), freshwater canals, estuaries and mangroves;

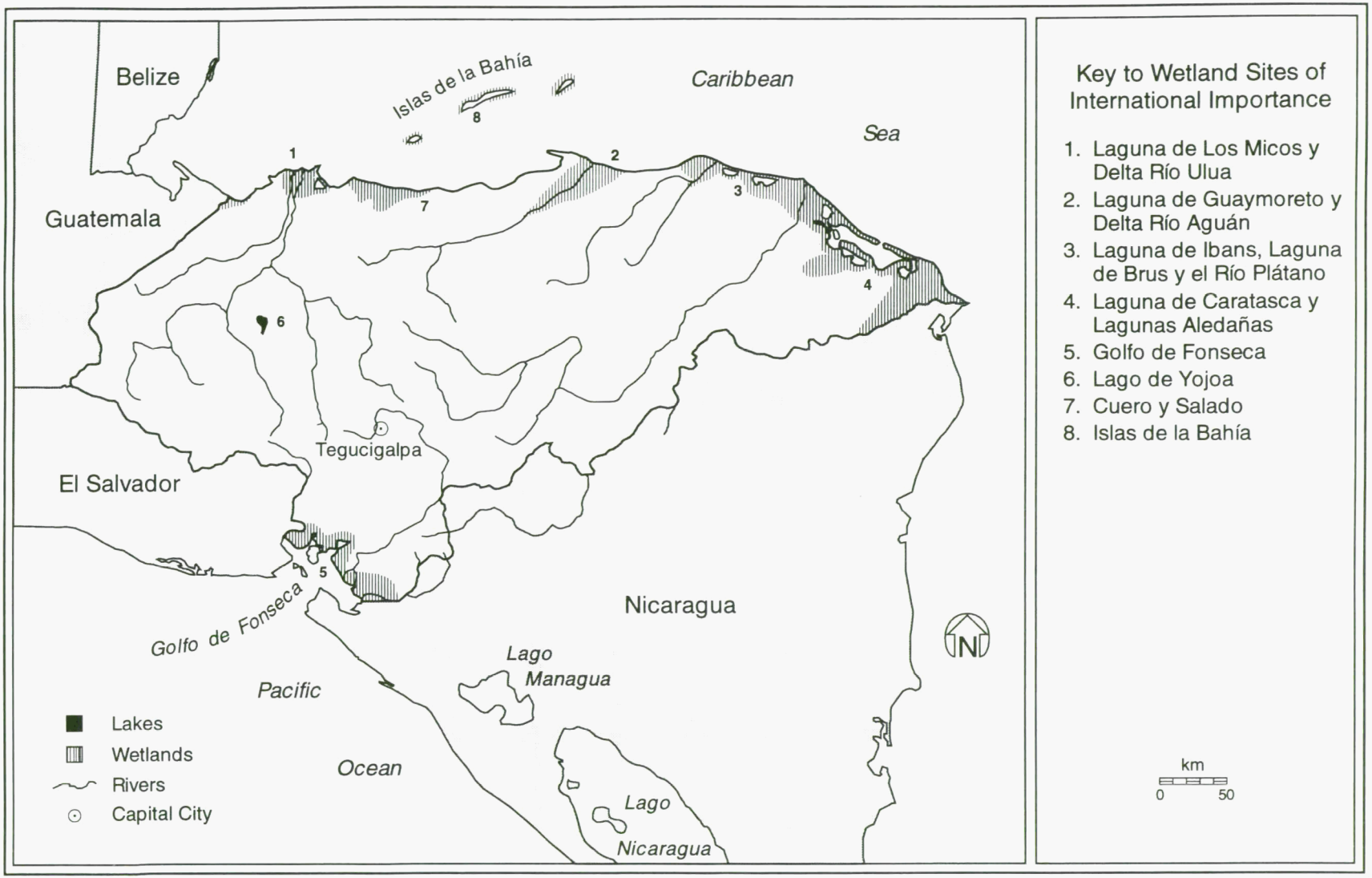


Figure A-4. Wetlands of International Importance in Honduras

- the Cuero y Salado National Wildlife Refuge, designated as the first Ramsar site in Honduras in June 1993, which consists of a complex of interconnected freshwater canals, inundated forest and *pantanos*; and

- the Río Kruta Biological Reserve which is composed of vast inundated savannahs between the mouths of the Río Cocos and Río Kruta.

A recent change in administration of the National Parks Service has left them with inadequate funds to properly manage any of the officially declared protected areas in Honduras. Even laws, enacted to protect the mangrove forests along the Golfo de Fonseca, are not enforced.

In response to this move, the environmental NGO community adopted many of these national parks and has submitted proposals to international agencies for support. A number of community-based NGOs are involved in promoting the protection of wetland areas such as the Golfo de Fonseca on the Pacific coast and the Cuero y Salado wetlands on the Caribbean.

The Lago de Yojoa is a small lake in the interior highlands. While its wetlands support locally important fish communities, the popularity of this resort destination has resulted in the introduction of exotic sport fish species, the clearing of wetlands and an over-exploitation of existing fish and wildlife.

Other Critical Wetlands

Of the six wetlands described in the *Directory of Neotropical Wetlands* (Scott and Carbonell 1986), only a cursory treatment of the Golfo de Fonseca was made. Yet, based on numerous reports, it may be one of the most important, unprotected wetland areas along the Pacific coast of Central America.

Economically, the wetlands of the Golfo de Fonseca contribute significantly to the Honduran economy by supporting one of the largest concentrations of shrimp farms on the Pacific coast of Central America. Ideal conditions have encouraged a tremendous growth in this industry in recent years. Salt and tannin are also important products derived from these wetlands. The large remaining mangrove forest in these wetlands provides fuelwood for the inhabitants of the heavily populated regions around the Gulf. Biologically speaking, the Gulf wetlands are internationally-important resting sites for migratory and resident shorebirds and waterfowl populations. These wetlands also provide refuge to a number of endangered species, including caiman and crocodiles.

Very few details are available on the four wetland areas of major importance listed by W. Aguilar and M. Reyes in the *Directory of Neotropical Wetlands* (Scott and Carbonell 1986). These include: the Río Ulua Delta and associated lagoons, the Río Aguán Delta and associated lagoons, the Río Platano and its associated lagoons, and the Laguna de Caratasca. The sheer size and pristine nature make them important reserves for wetland biota representative of that portion of Central America.

MAJOR CONSERVATION PROBLEMS AND THREATS TO WETLAND HABITAT

Honduras has enjoyed relative peace while its neighbours, El Salvador and Nicaragua, have been embroiled in civil wars. Unlike Costa Rica, however, a strong movement to develop a system of conservation areas has not evolved. The following are conservation problems and current threats to Honduran wetlands:

- Scientific information on the state of wetlands in Honduras is completely lacking. This information is imperative for setting priorities and developing management strategies.

- There is insufficient trained personnel, logistic support, infrastructure and political motivation to develop and implement strategies for managing protected areas.

- The break-up of the *Asociación Hondurena de Ecología* (Honduran Ecology Association) (AHE) has left a vacuum for a strong, vocal leader on environmental issues. Poor financial management and ideological differences within the group are cited as reasons for the association's break-up.

- In the Golfo de Fonseca, a significant increase in shrimp farming is destroying important mangrove swamps and polluting the coastal waters. There are fears that the government is encouraging further expansion of this lucrative industry. Already, it is estimated that over 280 km^2 ha of shrimp farms are present along the coastal area. In 1989, a study by USAID estimated the area could only support a maximum of 200 km^2 of shrimp farms. Local opposition to the commercial shrimp farms is growing.

- Commercial fruit and vegetable production, along the central and northwestern Caribbean coast of Honduras, relies on the heavy application of agro-chemicals—some that are banned in North America. According to Canadian technicians working near La Ceiba, dead marine turtles are frequently encountered washed up on the beaches near large fruit plantations. They attribute the turtle deaths to the toxic effects of the agro-chemicals used to control pests in these plantations.

- A thriving market in illegal skins and exotic wildlife flourishes along the Caribbean coast. Caiman and alligator skins are harvested without control and tens of thousands of parrots and macaws are trapped and exported annually.

SPECIFIC VALUES AND FUNCTIONS OF HONDURAN WETLANDS

The values of the wetlands of Honduras have not been quantified, but based on the benefits derived from the fishing and shrimp farming industries on the Pacific coast, it is obvious that wetlands contribute to the success of these harvests. Several examples of important functions and values of Honduran wetlands are listed below.

- The wetlands of Golfo de Fonseca are biologically and economically important. The 46 000 ha of mangrove forests are an important fuel wood resource and are critical habitat for fish and crustaceans harvested by local fishermen. These are important sites for resident and non-resident wildlife species such as the marine turtle, shorebirds and caiman. The growing shrimp industry relies heavily on capturing shrimp larvae, which in turn, depend on mangrove swamps for protection.

- Wetlands along the 500-km Caribbean coast are critical habitats for fish and crustacean reproduction and ensure the natural re-stocking of shrimp and lobster caught by mechanized fleets trawling offshore.

- The wetlands in the vicinity of Río Cocos are important refuges for wildlife species, scarce in other parts of the country. The largest reported population of manatees in the Caribbean breeds in the many freshwater canals that traverse these wetlands.

- Areas like Cuero y Salado and the Río Platano Biosphere Reserve already attract tourists. There is potential for Marino Punta Sal National Park and the vast expanses of the Río Kruta Biological Reserve to do the same.

CANADIAN ASSISTANCE TO HONDURAN WETLAND INITIATIVES

The Canadian International Development Agency (CIDA) was recently approached by the Cuero y Salado Foundation for funding to develop activities in the wetlands of the Cuero y Salado Wildlife Refuge. CIDA is waiting for more concrete proposals from this group before considering financial support. Fortunately, the group's activities have received a great deal of publicity and interest from other sponsors is inevitable.

ORGANIZATIONS AND INSTITUTIONS INVOLVED IN WETLAND INITIATIVES

Corporación Hondurena de Desarrollo Forestal—COHDEFOR

The **National Parks Service** has the task of developing the national parks system and a strategy for the conservation of wildlife. Their priorities include the management of several wetland areas, notably Punta Sal National Park and Cuero y Salado Wildlife Refuge. The recent transfer of the National Parks Service from the *Dirección General de Recursos Naturales Renovables* (the Renewable Natural Resources Directorate) (RENARE) to COHDEFOR did not coincide with a transfer of a budget. COHDEFOR is responsible for financing the Department's operational budget. At present, it counts on little more than personnel.

The **Tropical Forestry Action Plan** (TFAP) of Honduras has received strong Canadian support for its development. According to COHDEFOR, Honduras is the most advanced of the Central American countries in the development and implementation of this action plan. No specific mention has been given to wetlands.

Fundación Cuero y Salado—FUCSA

This non-governmental group is a collection of local *campesinos*, professionals and government people working to promote the sustainable development of the Barras de Cuero y Salado wetlands near La Ceiba. Both the IUCN and CATIE are assisting this group in developing a management plan for the area.

Universidad Nacional Autónoma de Honduras—UNAH

The biological department of this university undertakes various investigations in wetland areas with students. Several knowledgeable professionals are on staff who have extensive experience in the conservation areas throughout Honduras.

World Conservation Union—IUCN

Working with CATIE, the IUCN is helping local groups develop wetland management skills. The IUCN has not established a local office here.

Centro Agronómico Tropical de Investigación y Enseñanza—CATIE

CATIE is coordinating a socio-economic study with the Cuero y Salado Foundation on the effects of the human population within the Cuero y Salado Wildlife Refuge. This appears to have been initiated under the IUCN Wetland Program.

United States Agency for International Aid—USAID

The United States has financed many environmentally related projects and studies throughout the country. In particular, the USAID is helping to finance the development of the Río Platana Biosphere Reserve with the World Wildlife Fund. Although this area is largely tropical forest, a portion of the coast contains important wetland

areas that should be protected. The United States has also financed several environmental studies including the *Environmental Profile of Honduras* (USAID 1989) which includes a section on coastal wetland areas.

Comité para la Defensa y Desarrollo de la Flora y Fauna
del Golfo de Fonseca—CODDEFFAGOLF

This active NGO (the Committee for the Protection and Management of the Flora and Fauna of the Gulf of Fonseca) has tasked itself with the protection of the environment while ensuring the development of the local communities. Its members consist of over 5 000 fishing families aided by professional advisors. This group was formed in response to the degradation of the Gulf from increasing shrimp farming activities.

Asociación Hondurena de Ecología—AHE

This NGO group was once the focus of the environmental movement in Honduras. Recent internal problems have weakened its involvement in environment issues. However, in the future, the group may undertake environment projects.

WETLANDS IN NICARAGUA

NATIONAL STATISTICS

Surface Area:	140 000 km^2
Population:	3 870 000 (WRI 1992)
Population Growth:	3.3%/year (IICA 1989)
Area Forested:	42 820 km^2 (TFAP 1991)
Deforestation Rate:	1 250 km^2/year (TFAP 1991)
Total Wetland Area:	5 600 km^2

WETLAND AREAS OF NATIONAL AND INTERNATIONAL IMPORTANCE

General Description

Milton Comacho described 17 important wetland sites in Nicaragua for the *Directory of Neotropical Wetlands* (Scott and Carbonell 1986). A more recent detailed study by the *Instituto de Recursos Naturales de Nicaragua* (Nicaraguan Institute of Natural Resources) (IRENA) estimates that wetlands cover four percent of the country (Figure A-5).

Physiographically, Nicaragua is unlike its neighbours. In the centre of the country lie two of Central America's largest lakes: Lago de Nicaragua and Lago de Managua. Scattered around both lakes are internationally-important wetlands of varying size and composition. These two lakes are drained by the Río San Juan, which, at its source, meanders through large grass and palm wetlands before entering into extensive marshes and swamps along the Caribbean coast.

Wetlands lie along the entire length of Nicaragua's Caribbean coast, occasionally interrupted by stretches of sandy beaches and human settlements. The majority of these wetlands have not yet been inventoried and remain as much a mystery to the outsider today as they did at the turn of the century. Along the Pacific coast, only the northern section supports substantial mangrove forests. Isolated pockets along the dry and heavily-populated south coast, were decimated long ago.

Possibly the most important wetland areas, from both a biological and economical perspective, are associated with the Golfo de Fonseca, in the northwestern corner of Nicaragua. The mangrove forests that line this gulf form the largest expanse of mangrove along the Central American Pacific coastline (Gutierrez 1990). Recent scientific information on this area is scant. Large areas of suitable habitat for migratory shorebirds and waterfowl have been identified but few, if any, inventories have been conducted. The interior plateau of Nicaragua, which covers most of the country, does not contain many significant wetlands. Those existing have been altered by intense agricultural activity.

IRENA has just created a department to monitor the wetland situation. This initiative is the first of its kind in Central America and follows quickly on recent proposals, accepted by the government, to declare several key Nicaraguan wetlands as national wildlife refuges.

Protected Wetland Areas

Although IRENA has listed 14 protected wetland areas, only a handful have actually been monitored. A decade of civil war severely weakened the technical, financial and logistical capacity of IRENA to maintain any of its protected areas.

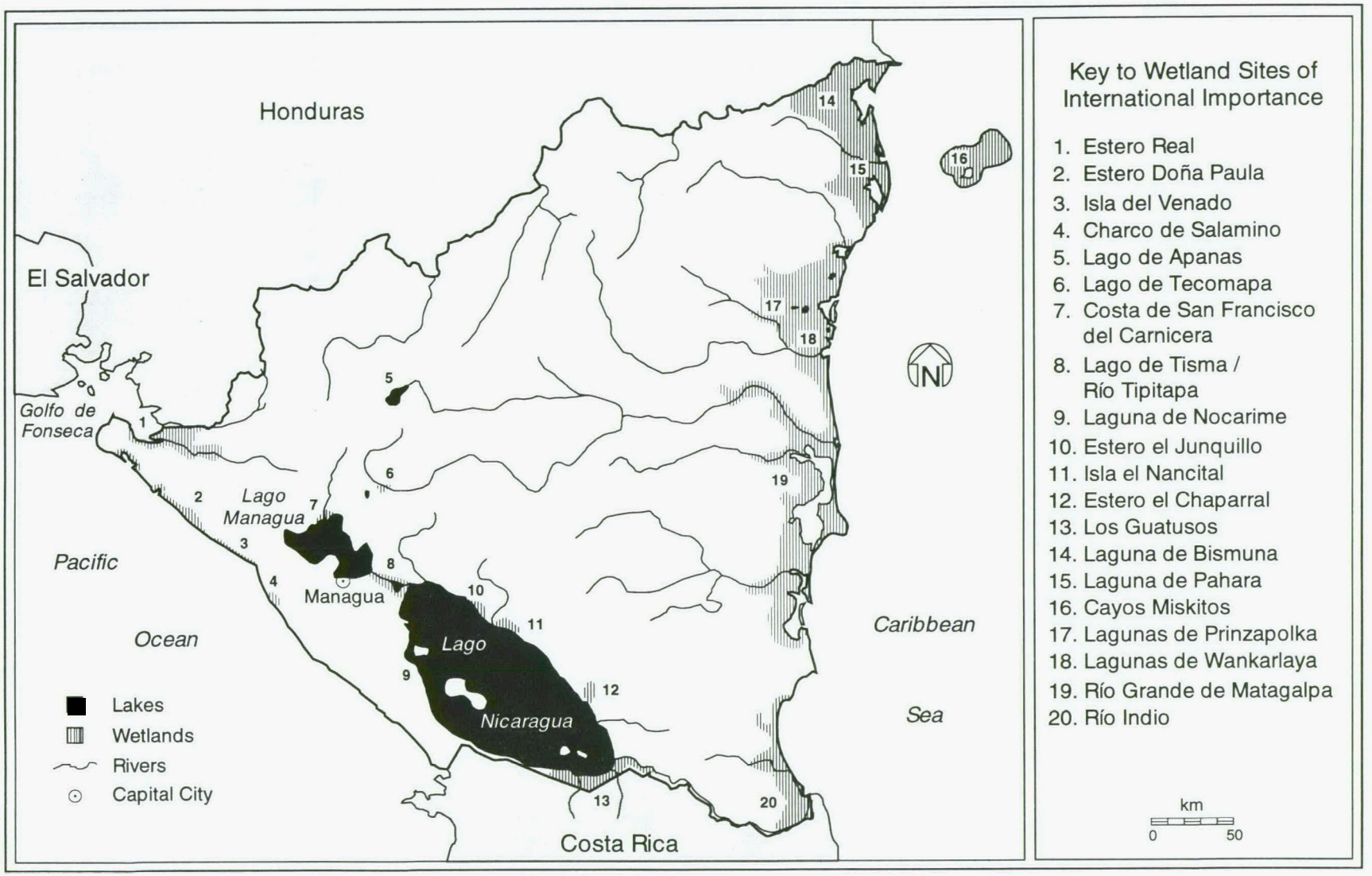


Figure A-5. Wetlands of International Importance in Nicaragua

The Lago de Tisma was Nicaragua's first declared protected wetland. Close to the capital city and a short distance from IRENA's headquarters, it is accessible and regularly monitored. Today, these wetlands are a source of fish and caiman caught by local fishermen and sold in nearby markets.

In 1990, two important wetland areas within the SI-A-PAZ project were officially declared protected zones. These were the Los Guatusos and the Río San Juan Delta Wildlife Refuges. A proposal is being considered to link the Guatusos and Caño Negro wetlands in a binational protected wetland area spanning the borders of Costa Rica and Nicaragua. This would be the first of its kind in Central America.

Relatively untouched, these areas are refugia for many endangered species including caiman, crocodile, manatee, four species of monkey and jaguar. Large flocks of North American wildfowl winter along the Guatusos wetlands and a rich diversity of resident and non-resident birds have been observed. The wetlands provide critical habitat for fish species which are actively caught and sold in local and regional markets. The "gaspar" is a prehistoric relic whose metre-long body, often weighing in excess of 20 kilograms, is highly sought after for its meat which is reputed to have the taste and texture of lobster.

In 1990, two more important wetlands, the Golfo de Fonseca and the Cayos Miskitos, were given special status in an attempt to control the rapid exploitation of their rich aquatic resources. The Cayos Miskitos represents the largest coral reef system to receive protected status in Central America.

The areas that are monitored are done so on the tightest of budgets and with the least number of staff. Official protection without financial or logistical support, continues to plague the good intentions of local natural resource managers.

Other Critical Wetlands

Along the entire length of the Caribbean coast lie numerous wetlands of unknown size and status. These include the Lagunas de Bismuna and Lagunas de Pahara, and the wetland complex associated with the Río Grande de Matagalpa. There are extensive wetlands along the lower reaches of the Río Prinzapolka. A number of wetlands are also found along the eastern shore of Lago de Nicaragua. These areas are important sources of wildlife skins (caiman, ocelot) and fish for local markets.

MAJOR CONSERVATION PROBLEMS AND THREATS TO WETLAND HABITAT

Nicaragua has suffered through a decade of civil war. The repercussions on the environment have been generally negative. However, during this period of conflict, many wetlands were inadvertently protected by combat zones. Bitter fighting discouraged local populations from carrying on traditional activities such as fishing and hunting in these areas. In some cases, many people fled from combat zones or were forcibly relocated to "safer" regions. Rebounding wildlife populations were the first indications of the natural recuperation of many wetland areas.

Unfortunately, as a result of the war, many natural resources experts left Nicaragua to pursue careers elsewhere. This, coupled with the rising costs of war and the United States embargo, forced the government to severely cut back many government departments, including the Ministry of Natural Resources. With the cessation of hostile activities in 1990, wetlands once again faced a resurgence in human interventions which include the clearing and draining of important wetland habitats. A list of other threats to Nicaraguan wetlands are outlined below.

- Severe government cutbacks to IRENA have limited the monitoring and implementation of management plans for newly-declared protected wetland areas.

- A lack of coordination between sectors with jurisdiction over wetland resources is resulting in the implementation of conflicting activities.

- The 1991 inventories of the Caribbean coast, conducted by Victor Cedeño, Coordinator of the IUCN Wetland Program in Nicaragua, concluded that excessive sedimentation carried down from the deforested highlands by the major rivers, was affecting many coastal wetlands. The sedimentation of wetlands can cause a decrease in salt and freshwater aquatic species reproduction, destroy important wildlife habitat, and reduce the sheltering effect of wetlands on coastal communities.

- Over-harvesting of fisheries stock in the Cayos Miskitos, the Golfo de Fonseca and other coastal regions, threatens the ecological balance of key marine wetlands. The Nicaraguan government lacks the equipment necessary to prevent over-exploitation by national and foreign fishing vessels.

- The pursuit of endangered wildlife species continues in wetlands throughout Nicaragua and trade in these animals flourishes with the worsening economic situation.

- Mangrove areas along the Pacific are being irrationally exploited to provide fuelwood and tannin, and cleared for the construction of shrimp ponds and salt pans. According to Evenor González, a specialist on mangrove habitats from the National University in León, it is common to see one group of *campesinos* using the entire mangrove tree exclusively for fuelwood, while another group nearby is extracting mangrove bark for the production of tannin, leaving the rest of the tree unused.

- Seasonal fires are a tremendous threat to the extensive wetlands of the Los Guatusos Wildlife Refuge. Set by ranchers to encourage new growth of pastures and by poachers to flush wildlife, these fires are whipped up by strong winds and extensively damage wildlife and vegetation.

SPECIFIC VALUES AND FUNCTIONS OF NICARAGUAN WETLANDS

Wetlands play a small but vital role in Nicaragua. The economic values derived from these habitats support many human communities, particularly those along the inland great lakes and the Pacific coast. Specific values and functions include:

- Mangrove forests shelter shrimp larvae during important stages in their life-cycle. Shrimp are an important species caught in Nicaraguan waters and earn needed foreign exchange on the export market. Larvae are also used to stock the growing number of commercial shrimp ponds.

- Although unstudied, the extensive wetlands around Lago de Nicaragua are prime reproductive habitat for fish species.

- Wetlands supply a lucrative, illegal trade in caiman and crocodile skins which are then converted into fashion-wear in Granada and Masaya.

- Freshwater wetlands on Lago de Nicaragua receive excessive amounts of river-laden sediments and agro-chemicals, originating from the deforested Costa Rican countryside.

- The natural state of many Nicaraguan wetlands protect a rich biodiversity that has not been readily exploited. Many migratory species from North America spend a period of their year in these wetlands, especially shorebirds and waterfowl.

- Wetlands have the potential to become tourist attractions if political and economic stability are achieved.

CANADIAN ASSISTANCE TO NICARAGUAN INITIATIVES

A review of the wetland situation in Latin America was undertaken by Walter Glooschenko, formerly a professor from York University in Toronto. In this study, Glooschenko (1989) describes the ecological damage being inflicted on Nicaraguan wetlands. The Organization for Canadian Solidarity and Development also supported a Canadian ecologist who worked with IRENA technicians to develop a proposal nominating the Guatusos wetlands as a Ramsar site.

ORGANIZATIONS AND INSTITUTIONS INVOLVED IN WETLAND INITIATIVES

Instituto de Recursos Naturales de Nicaragua—IRENA

The **Department of Protected Areas** (IRENA) is responsible for regulating, maintaining and studying wetland areas in Nicaragua. This newly-created Department is in the process of identifying all the wetlands of Nicaragua with the objective of developing a strategy for their sustainable management. So far, a list of 51 wetland areas has been established. IRENA has been lobbying district mayors to support the conservation of wetland areas. In León the mayor has already given support to the patrolling of the Isla de Venado. IRENA priorities support projects in the Cayos Miskitos, Los Guatusos and the Golfo de Fonseca. IRENA is also responsible for the newly-declared system of protected areas (under the SI-A-PAZ Project) along the border between Nicaragua and Costa Rica. Several of these areas are internationally-important wetlands and have been proposed as future Ramsar sites.

Under the Tropical Forestry Action Plan (TFAP) for Nicaragua, wetland conservation is not considered a priority, but rather, is part of a process that will integrate the conservation of important ecosystems, such as wetlands, with rational development of natural resources. Priority areas under consideration by IRENA include the Cayos Miskitos, Los Guatusos and the Golfo de Fonseca.

National University of Nicaragua—UNAN

The UNAN is working in coordination with the IUCN on the **Heroes and Martyrs Project** near León. This project aims to implement a sustainable development plan for conserving the remaining mangrove swamps of the Isla Juan Venado—an area protected by law and identified in the *Directory of Neotropical Wetlands* (Scott and Carbonell 1986) as an important wetland site in Nicaragua.

World Conservation Union—IUCN

The regional wetland program of the IUCN has lead practical workshops in wetland management and has supported ABEN (see below) in undertaking the first diagnostic study of the Los Guatusos Wildlife Refuge (one of the newly-declared areas along the border of Costa Rica and Nicaragua). Scholarships have also been awarded to individuals who have pursued post-graduate studies in the management of wetland areas. The IUCN has established good links with the NGO community in Nicaragua and has maintained a high profile in the country.

Asociación de Biólogos y Ecólogos de Nicaragua—ABEN

ABEN (Association of Biologists and Ecologists of Nicaragua) was hired in 1991 to undertake a diagnostic study of the Los Guatusos Wildlife Refuge. ABEN has since undergone changes and has spawned two groups: *Fundación de Conservación y Desarrollo* (Conservation and Development Foundation) (FUNCOD) and *Consejo de Biólogos y Ecólogos de Nicaragua* (Council of Biologists and Ecologists of Nicaragua) (COBEN).

Movimiento Ambientalista Nicaraguense—MAN

The MAN (Nicaraguan Environment Movement) has not worked directly on wetland projects but has the professional and administrative capability to do so. In 1992, MAN and ABEN formed the two largest environmental groups in the country.

Centro Agrónomico Tropical de Investigación y Enseñanza—CATIE

CATIE and the IUCN work together to coordinate the Regional Wetland Program of the IUCN. CATIE is giving technical and financial support to a wetland project which proposes to investigate the mangrove-rich Estero Real of the Golfo de Fonseca.

Conservation International Canada—CI-C

The CI-C has proposed the development and implementation of a management plan for the Cayos Miskitos and adjacent mainland wetlands and rainforest. Still in the proposal stage, matching funds have been promised by USAID. CI-C is interested in combining community development with research and investigation, and will execute this project jointly with the Mikupia—a local group of Miskito Indians interested in the conservation of important natural areas such as the Cayos.

WETLANDS IN PANAMA

NATIONAL STATISTICS

Surface Area:	77 082 km^2
Population:	2 420 000 (WRI 1992)
Population Growth:	2.1%/year (IICA 1989)
Area Forested:	31 820 km^2 (TFAP 1991)
Deforestation Rate:	410 km^2/year (TFAP 1991)
Total Wetland Area:	Unknown

WETLAND AREAS OF NATIONAL AND INTERNATIONAL IMPORTANCE

General Description

A thorough evaluation of Panamanian wetlands in the *Directory of Neotropical Wetlands* (Scott and Carbonell 1986) was provided by Francisco Delgado. In this report, Delgado identifies 22 internationally-important wetland areas. These sites are located on a map of Panama in Figure A-6.

The majority of important Panamanian wetlands are found along the Pacific coast, particularly along the shores of protected estuaries fed by major river systems draining the Pacific watersheds. These wetlands are characterized by mangrove forests, brackish lagoons and expansive tidal flats. The Caribbean wetlands are generally restricted to the northwest and differ from the mangrove-dominated Pacific wetlands by raphia palm-dominated forest swamps.

Panama's wetlands are potentially the most important habitat in Central America for migratory shorebirds. Strategically located midway between their breeding grounds in the Canadian Arctic and their wintering habitat in South America, these wetlands are critical feeding and resting areas for migratory shorebirds. An abundant invertebrate food supply along the Pacific coast attracts millions of migrants annually to the coastal beaches of the Bahía de Panamá.

Panama contains the largest reserves of mangrove forest in Central America (approximately 1 581 km^2). These forests are important reserves for local fuelwood and construction material.

In 1990, the Panamanian government took steps to officially recognize the importance of wetlands by declaring the Bahía de Montijo as Panama's first Ramsar site. Panama also nominated a second Ramsar site in June 1993—the 164.1 km^2 San San-Pond Sak. This may be an indication of Panama's interest to provide greater protection for its wetland resources.

Protected Wetland Areas

Panama's system of national parks protects approximately eight percent of its total surface area. However, the 12 846 km^2 of protected area includes very little wetland habitat.

The Bastimentos Marine National Park, in Bocas del Toro (132 km^2), protects small mangrove forests on the Caribbean. Sarigua National Park (80 km^2) protects mangrove habitat that is increasingly being depleted by a growing shrimp farming industry along the Pacific coast. Several smaller areas have been declared protected in the Bahía de Parita to preserve important breeding and feeding habitat for resident and migratory birds. The Forest Reserve of Canglon (316.5 km^2) also protects large areas of catival swamp forests in the estuary of El Real de Santa Maria.

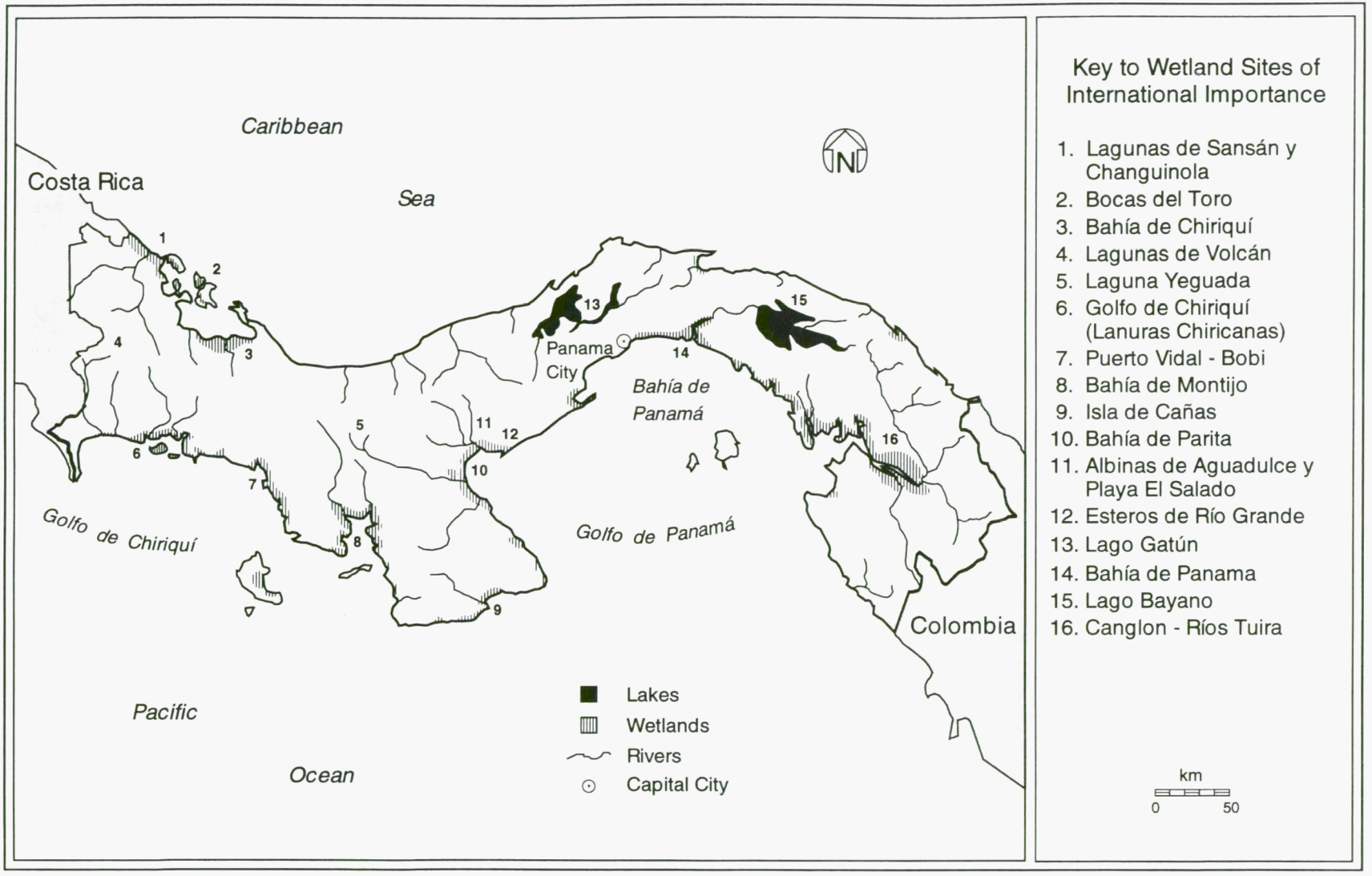


Figure A-6. Wetlands of International Importance in Panama

In 1990, the Bahía de Montijo was declared a protected Ramsar site (807.6 km^2) and represents the largest protected wetland in Panama. Although other priority wetland sites exist, such as the Bahía de Panamá and Chitre, these areas are heavily affected by human activities and represent greater risks to manage than the more remote Bahía de Montijo.

Other Critical Wetlands

A number of large important wetland areas were also identified by Delgado and documented in the *Directory of Neotropical Wetlands* (Scott and Carbonell 1986). Most of these areas remain unprotected and unstudied.

Very little is known about the large areas of unprotected mangrove forests in the estuaries of Chiriquí and the Río Tuira region or of those in the Lagunas de las Bocas del Toro. Although these three sites include a major portion of the country's mangrove forests, they continue to suffer from irrational exploitation and contamination from agricultural and industrial waste.

Recent surveys along the Bahía de Panamá indicate that this vast stretch of coastal wetlands and tidal mudflats is a critical site for migratory shorebirds. Unfortunately, human and industrial pollution emanating from Panama City, continues to severely contaminate the Pacific coast and its resources.

MAJOR CONSERVATION PROBLEMS AND THREATS TO WETLAND HABITAT

The serious fuelwood crisis, excessive contamination and dwindling wildlife populations are forcing natural resources managers to take a second look at incorporating wetlands into management strategies. This is evident in the Tropical Forest Action Plan (TFAP) which identifies several key wetlands that require conservation practices to ensure their sustainable utilization.

As is the case throughout Central America, the importance of managing wetland areas in Panama is only now being recognized. These habitats have long been regarded as wastelands and their conversion to more "productive" land has been promoted. A number of specific threats to wetlands are listed below.

- Untreated human and industrial waste from major cities continues to foul the coastal wetlands along the Pacific and, to a lesser degree, the Caribbean.
- Important industries, such as shrimp farming, are replacing mangrove forests with shrimp ponds, salt pans and rice paddies.
- Pesticides, used extensively along the Pacific, have contaminated most of the major hydrological systems, and are undoubtedly, a residual component of most wetland ecosystems.
- The deforestation of mangrove wetlands to provide local fuel and construction wood continues unabated.
- Excessive hunting in marshes along the Pacific coast is threatening wildlife species, particularly wildfowl.
- A shortage of qualified personnel and financial resources hinders the conservation of designated protected wetland areas, such as the Bahía de Montijo.

SPECIFIC VALUES AND FUNCTIONS OF PANAMANIAN WETLANDS

Aside from their general importance, Panamanian wetlands have many specific functions and values some of which are listed below.

- Stands of catival, a tree species which grows in homogeneous stands in wetlands, occupy about 100 km^2 in the Canglon Forest Reserve near the Golfo de San Miguel. This species is an important source of high quality plywood.

- Orey is a valuable lumber species along the Caribbean coast and is found in many inundated lowland areas. Estimated reserves exceed 620 km^2 (TFAP 1991).

- Pacific coastal wetlands are critical "stop-over" sites for more than 15 species of migratory shorebirds. According to Francisco Delgado, the Bahía de Panamá may be the single most important wintering area for millions of shorebirds which migrate annually to and from the Canadian Arctic. Half the world's population of Western Sandpipers may pass through Bahía de Panamá, east of Panama City. Other important sites include the Bahía de Chitre and Chiriquí.

- Many wetlands are home to a unique variety of wildlife and plant species which could lead to future discoveries of important medicinal, agricultural, or industrial products.

- The San San-Pond Sak wetlands support a large population of the regionally endangered manatee (*Trichechus manutus*).

- The Pacific mangrove forests contain important reserves of fuelwood used by local human populations. Until now, their relative inaccessibility has protected them from exploitation. Increasing pressures from a growing population will place added stress on these reserves of fuelwood.

- The close proximity of important wetlands to major urban centres make them potential candidates for attracting a growing ecotourism industry in the region.

CANADIAN ASSISTANCE TO PANAMANIAN WETLAND INITIATIVES

The Latin American Program of the Canadian Wildlife Service recently collaborated with Panamanian scientists on studies to determine the importance of Panamanian wetland habitats to shorebird populations using the Pacific coastal wetlands on migration. The Bahía de Panamá was identified as a site of international importance for these birds. Unfortunately, problems with pollution and private ownership have discouraged the Government of Panama from declaring this area a Ramsar wetland of international importance. Pressure from NGOs to have it designated as a Ramsar wetland site continue.

ORGANIZATIONS AND INSTITUTIONS INVOLVED IN WETLAND INITIATIVES

Instituto Nacional de Recursos Naturales de Panama—INRENARE

The **National Parks Service** is responsible for the enforcement and regulation of protected areas. Current objectives include the establishment of new laws to better protect officially protected areas. A department within the Institute was set up to deal with the Ramsar Convention and the Convention on International Trade in Endangered Species (CITES).

Under the **Tropical Forestry Action Plan** (TFAP) and the direction of INRENARE, a strategy for the sustainable development of Panama's forestry resources has been completed. According to Dimas Arcia, the Panamanian coordinator for the TFAP process, considerable importance was placed on wetland ecosystems in the planning of project proposals. Four projects are directly related to the conservation of wetlands and their resources.

Smithsonian Tropical Research Institute

This research institution has been involved in marine studies which include studies on mangrove ecosystems.

Universidad de Veraguas

Courses on wetlands management are part of this university's curriculum. Wetland projects have been initiated in the Bahía de Chitre. The Canadian Wildlife Service has provided the University with equipment which has helped them to undertake banding surveys of migratory shorebirds.

University of Panama

Investigation on mangrove habitats is being undertaken by the Department of Ocean Sciences and Limnology.

Asociación Nacional para la Conservación de la Naturaleza—ANCON

ANCON (National Association for Nature Conservation) is a non-governmental group founded in 1985 to protect and conserve the biological diversity of Panama; it receives financial and technical support from The Nature Conservancy and the World Wildlife Fund. ANCON's activities focus more on the conservation of the tropical rainforests than wetlands, although it is involved with an environmental education program in the Bocas del Toro area. ANCON is included here because they are well organized and have the technical and financial capacity to undertake large projects.

Fundación PANAMA

The Fundación PANAMA is the most established environmental organization in Panama. It has grassroots support from *campesino* groups, indigenous peoples, students, professionals and the business community. Recent administrative and political problems have forced a re-organization of the foundation. Fundación PANAMA is affiliated with a number of NGOs that are working in wetland conservation. These include the *Colegio de Ingenieros Forestales* (College of Forestry Engineers) in the catival swamp forests of Canglon and the Audubon Society on shorebird banding along the Pacific coastal wetlands.

World Conservation Union—IUCN

The IUCN has identified five important wetland areas in Panama: San San-Pond Sak, Bocas del Toro, the Bahía de Montijo, Chame and Canglon. A strategy for Bocas del Toro, including the wetland areas, has been developed. Small workshops on wetland management were given recently in the Bocas del Toro as part of a regional initiative by the IUCN's Central American Wetland Program to promote wetland conservation.

APPENDIX 2: THE CANADIAN FEDERAL POLICY ON WETLAND CONSERVATION

The following excerpt is taken from *The Federal Policy on Wetland Conservation* (Government of Canada 1991) which outlines seven strategies for wetland conservation. The seventh strategy specifically addresses Canada's international commitment to promoting wetland conservation.

Strategy No. 7: Promoting International Actions

The Federal Government will promote conservation and sustainable use of wetlands internationally, and encourage the involvement of other nations and international organizations in wetland conservation efforts.

- Ensure that *Canadian international assistance programs*, such as those administered by the Canadian International Development Agency and the International Development and Research Centre, are based on sustainable development principles and promote the maintenance and enhancement of wetland functions. Promote pro-active strategies such as that emphasized in the Canadian International Development Agency's Environmental Policy.

- Provide *technical and advisory assistance to wetland conservation efforts in other countries*, particularly for those wetlands used by wildlife populations shared with Canada.

- Continue to support and implement Canada's commitments under the *international conventions and agreements* that contribute to the global conservation of wetlands and their function and encourage other nations to become signatories to such conventions and agreements.

- Strengthen Canada's role in international wetland conservation, by requiring *regular review* of Canadian progress on international conventions with relevance to wetlands, and by *identification of gaps or weaknesses* in honouring international commitments and responsibilities.

- Promote wetland conservation through continued strong commitment to the *Ramsar Convention* on Wetlands of International Importance, the World Heritage Convention and international agreements and treaties.

- Continue to support implementation of *bilateral and multilateral agreements and similar arrangements* that promote conservation and sustainable use of wetlands such as the North American Waterfowl Management Plan, the Great Lakes Water Quality Agreement, the Western Hemisphere Shorebird Reserves Network, the International Biosphere Reserves Program, and new or existing agreements on marine and estuarine environmental quality, and emerging issues such as biodiversity and climate change.

- Provide leadership in global wetland conservation through *development and transfer of models, tools, information and expertise* to other nations.

- Ensure that Canadian representatives on *international inquiries and commissions* have an adequate understanding of wetland issues so as to promote wetland conservation in their consideration of the implications of transboundary management issues and opportunities for the sustainable use of wetland resources.

APPENDIX 3: INDIVIDUALS CONTACTED FOR INFORMATION

CANADIAN CONTACTS

Elizabeth Agnew	World Wildlife Fund Canada
Caroline Caza	Wildlife Habitat Canada
Geoffrey Clare	Program Officer, ICOD
George Finney	Regional Director Atlantic, Conservation, Environment Canada
Mark Gawn	Environment Policy Specialist, CIDA
Lennox Hinds	Fisheries Specialist, CIDA
Colleen Hyslop	LAP Coordinator, CWS
Amanda Jones	Nature Conservancy of Canada
Sherry Kozak	Director, Video Series
Ron Leger	Director, Management for Change Program, CIDA
Anne Levesque	Advisor, CEN
George Mulamootil	Professor, University of Waterloo
Jeanne Pagnan	Arctic Flora and Fauna Secretariat, Environment Canada
James Patterson	IWRB; Ducks Unlimited Canada
Doug Pollock	Canadian Wildlife Service
John Roper	Forestry Specialist, CIDA
Clayton Rubec	National Coordinator, Wetland Conservation, CWS
Kendel Rust	Director, Anglophone NGO Section, CIDA
Ken Towle	Canadian Coordinator, CI-C
Steve Wendt	Chief Migratory Birds, CWS
Georgina Wigley	Senior Specialist in Environment, CIDA

INTERNATIONAL CONTACTS

Max Finlayson	Assistant Director, IWRB
Curt Freese	Representative, WHSRN
Walter Glooschenko	Environmental Consultant
Mark Halle	Director of International Wetland Program, IUCN
Hervé Lethier	Technical Officer, Ramsar Bureau
Lawrence Mason	Chief of International Affairs, USFWS
Mike Moser	Executive Director, IWRB
Claudia Sobervilla	The Nature Conservancy
Bruce Stein	Director, Latin America Science Program, TNC
Lilian Valle	Program Assistant for Latin America, WWF
Monica Herzig Zurcher	Technical Officer, Ramsar Bureau

CENTRAL AMERICAN CONTACTS

Michel Belisle	Regional Central American Representative, CARE
Virgilio Cozzi	Regional Director, IUCN
Enrique Lahmann	Coordinator, Central American Wetland Program, IUCN
Jorge Rodriguez	Regional Coordinator, TFAP Central America

Costa Rica

Juan Bravo	Professor, Universidad Nacional de Costa Rica
Oscar Brennes	Assistant Director, WWF
Monserrat Carbonel	Professor, Universidad Nacional de Costa Rica
Pascal Girot	Professor, CSUCA, Universidad de Costa Rica
Luis Hurtado de Mendoza	Coordinator, International Cooperation, MIRENEM
Guillermo Jimenez	TFAP, Costa Rica, MIRENEM
José Maria Morio	Technical Advisor, IUCN
Wilfran Morrillo	Director del Area de Conservación Tempisque, MIRENEM
Juan Carlos Romero	National Coordinator, PACA
Alexandra Saenz	Forestry Technician, MIRENEM
Alberto Salas	National Director, IUCN
Julio Sanchez	Museo Nacional de Costa Rica
Lesbia Sevilla E.	TFAP, Costa Rica, MIRENEM
Carlos Vega	Director of CCO, CIDA

El Salvador

Emiliano Aguilar	Representative, Prohumedales
Jorge Garza	Director of CCO, CIDA
Vicky Guzman de Luna	Director General, ASAPROSAR
Roberto Hasbun	Director, Parques Nacionales, CENREN
Alfredo Hernández	Executive Director, TFAP, El Salvador
Jorge Acosta Hernández	Administrator, AMAR
Juaquin F. Larios	Representative, CATIE
Melanie Machado	Servicio de Parques Nacionales, CENREN
José Tubino	El Salvadoran Representative, TFAP
Benjamin Yanes	Professor, Universidad de El Salvador
Roberto López Zepeda	Director, Biology Department, Universidad de El Salvador

Guatemala

Cesar Barrientos	National Representative, IUCN
Luis Castenada	Coordinator, TFAP, Guatemala
Alba Nidia Pérez	Biologist, CONAP
Blanca Aragon de Rendon	National Parks Service, DIGEBOS
Mario Marroquin Rivera	Project Officer, Canadian Consulate
Olga Isabel Valdez Rodas	Coordinator, CDC, CECON

Honduras

Christian Alix	Agroforestry Technician, Pringle and Roche
Gustavo Adolfo Cruz	Professor, Universidad Nacional Autónoma de Honduras
Edas Munos Galeano	Director of Department of Protected Areas and Wildlife, COHDEFOR
Manuel Hernández	Consultant, TFAP, Honduras
Jacques Poire	Forestry Advisor, COHDEFOR, CIDA
Diana Rivington	Sub-director, CIDA, Honduras
Darren Schemmer	Project Officer, CIDA
Sherry Thorn	Professor, Universidad Nacional Autónoma de Honduras

Nicaragua

Mauricio Araquistien	Director SI-A-PAZ Project, IRENA
Jacinto Cedeño	IRENA
Victor Cedeño	Coordinator, IUCN Regional Wetland Program, Nicaragua
Denis Corales	Coordinator, ECO-TFAP
Evenor Martinez González	Professor, Universidad Nacional Autónoma de Nicaragua
Jaime Rafael Guillen V.	Technical Director, FUNCOD/COBEN
Kamilo Jesus Lara B.	Vice-President, FUNCOD/COBEN
Felipé Rios	Director CCO, CIDA
Maria Virginia Sandino	National Representative, IUCN
Danilo Saravia T.	Director SI-A-PAZ Project, IRENA
Claudio Tremblay	Consultant, SWEDFOR

Panama

Ramón H. Alvarado	National Representative, IUCN
Dimas Arcia	Coordinator, TFAP, Panama
Dimas Botello	INRENARE
Inra Candanero	National Parks, INRENARE
Itzel Damaris	Executive Director, PANAMA
Georgina de Alba	Coordinator of Education and Conservation, Smithsonian Tropical Research Institute
Francisco Delgado	Professor, Universidad de Santiago; PANAMA
Graciela Palacios S.	Chief of Sciences Division, ANCON
Donald Sousa Guevara	Lawyer, Asociación Ecológica de Panamá

APPENDIX 4: LIST OF ACRONYMS

ABEN	Asociación de Biólogos y Ecólogos de Nicaragua
AHE	Asociación Hondureña de Ecología
AID	United States Agency for International Development
AMAR	Amigos del Arbol/Friends of the Tree
ANAI	Asociación de Conservacionistas de la Costa, Costa Rica
ANCON	Asociación Nacional para la Conservación de la Naturaleza, Panama
ASAPROSAR	Asociación Salvadoreña Pro-Salud Rural
CARE	CARE (International Relief Organization)
CATIE	Centro Agronómico Tropical de Investigación y Enseñanza
CCAD	Central American Commission on the Environment and Development
CCC	Caribbean Conservation Corporation
CCO	Canadian Cooperation Office, CIDA
CDC	Conservation Data Centre
CECON	Centro de Estudios Conservacionistas de Guatemala
CEN	Canadian Environment Network
CENREN	Centro Nacional de Recursos Naturales de El Salvador
CI-C	Conservation International-Canada
CIDA	Canadian International Development Agency
CITES	Convention on International Trade in Endangered Species
COBEN	Consejo de Biólogos y Ecólogos de Nicaragua
CODDEFFAGOLF	Comité para la Defensa y Desarrollo de la Flora y Fauna del Golfo de Fonseca
COHDEFOR	Corporación Hondureña de Desarrollo Forestal
CONAP	Consejo Nacional de Areas Protegidas
COTERC	Canadian Organization for Teaching and Research in Costa Rica
CSUCA	Confederación Universitaria Centroamericana
CWCTF	Canadian Wetlands Conservation Task Force
CWS	Canadian Wildlife Service, Environment Canada
DANIDA	Danish International Development Agency
DIGEBOS	Dirección General de Bosques y Vida Silvestre
DUC	Ducks Unlimited Canada
DUI	Ducks Unlimited Inc., United States of America
DUMAC	Ducks Unlimited, Mexico
ENGO	Environmental Non-government Organization
FINNIDA	Finnish International Development Agency
FUCSA	Fundación Cuero y Salado
FUNCOD	Fundación de Conservación y Desarrollo, Nicaragua
GDP	Gross Domestic Product
ICOD	International Centre for Ocean Development
IDRC	International Development Research Centre
IICA	Instituto Interamericano de Cooperación para la Agricultura
INGO	International Non-governmental Organization
INPESCA	Instituto Nicaragüense de la Pesca
INRENARE	Instituto Nacional de Recursos Naturales de Panamá
IRENA	Instituto de Recursos Naturales de Nicaragua
IUCN	World Conservation Union
IWRB	International Waterfowl and Wetlands Research Bureau
LAP	Latin American Program, Canadian Wildlife Service
LPBO	Long Point Bird Observatory

MAB	Man and the Biosphere Program
MAN	Movimiento Ambientalista Nicaragüense
MIRENEM	Ministerio de Recursos Naturales, Energía y Minas, Costa Rica
MRNH	Ministerio de Recursos Naturales, Honduras
NAWCC	North American Wetlands Conservation Council (Canada)
NAWMP	North American Waterfowl Management Plan
NGO	Non-government Organization
NORAD	Norwegian International Development Agency
NWWG	National Wetlands Working Group, Canada
ODA	Overseas Development Assistance
OMNR	Ontario Ministry of Natural Resources, Canada
ORCA	Oficina Regionale en Centroamérica, IUCN
OTS	Organization of Tropical Studies
PACA	Programa Ambiental de Centroamérica
PAIRE	Programa de Asistencia para Iniciativas Regionales
PANAMA	Asociación del Medio Ambiente de Panamá
RENARE	Dirección General de Recursos Naturales Renovables
RENARM	Proyecto Regional de Manejo de los Recursos Naturales y del Ambiente
SECPLAN	Secretaría de Coordinación, Planificación y Presupuesto, Honduras
SEDESOL	Secretaría de Desarrollo Social, Mexico
SI-A-PAZ	Sistema de Areas Protegidas por la Paz
SWEDFOR	Swedish Forestry Inc.
TFAP	Tropical Forestry Action Plan
TNC	The Nature Conservancy
UCA	Universidad Centroamericana
UNA	Universidad Nacional de Costa Rica
UNAH	Universidad Nacional Autónoma de Honduras
UNAN	Universidad Nacional Autónoma de Nicaragua
UNCED	United Nations 1992 Conference on the Environment and Development
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
USAID	United States Agency for International Development
USFWS	United States Fish and Wildlife Service
WCED	World Commission on Environment and Development
WHSRN	Western Hemisphere Shorebird Reserves Network, Wetlands for the Americas
WRI	World Resources Institute
WWF	World Wildlife Fund