FRESHWATER ECOSYSTEMS IN LATIN AMERICA AND THE CARIBBEAN

Gonzalo Castro, Ph.D.
World Wildlife Fund-US
Steven Parcells
Florida Center for Environmental Studies

SUMMARY

Although wetlands and freshwater ecosystems more generally are among the most biologically diverse and productive ecosystems in the world, they continue to be neglected and misunderstood. A number of governmental and non-governmental organizations are embarked on programs within the Western Hemisphere to reverse this trend. Fundamental to the efforts of all of the groups is the focus on practical, on-the-ground improvements in conservation and resource management to understand where bottlenecks to conservation are rooted in policy. The Florida Environmental Studies Center and the World Wildlife Fund in collaboration with other development assistance agencies seek to document and communicate project results about tropical and sub-tropical water-dominated ecosystems, especially those projects that can influence future decisions on water resource management and policy.

The effectiveness of conservation investments in the LAC region can be greatly enhanced through a science-based assessment of conservation priorities. This paper identifies and examines the conservation status of aquatic ecoregions of Latin America and the Caribbean.

Substantial progress has been achieved in the conservation field during the last two decades. Although conservation is clearly winning important battles, if current trends continue, sustainable development in the water sector will not be achieved. An effort to conserve the aquatic resources for the Latin America and Caribbean region must therefore take into account those forces that shape the fundamental changes in land-use patterns and development.

Freshwater Ecosystems in the LAC Region: Very Rich, Highly Threatened, and Poorly Understood

From Mexico to the tip of South America, 33 countries of the LAC region sustain vast and varied ecosystems and 421 million people. From the coastal estuaries and deltas of Mexico, the lakes of Central America, the rivers and oxbow lakes of Amazonia, and the Pantanal of Brazil, Bolivia and Paraguay, to the freshwater marshes of the Argentina pampas and high Andes, and the mudflats of the Suriname coast, LAC is a region of vast and diverse freshwater ecosystems. The *Directory of Neotropical Wetlands* provides an inventory of sites known or thought to be of greatest importance. It lists more than 500 such sites in the LAC region.

However, the general geographic picture of freshwater ecosystem distribution in the LAC region is poorly understood. Although there is a good understanding of where some of the major freshwater habitats exist, no systematic overview has been undertaken to date to determine patterns of ecological importance and priorities for the region as a whole. In Mexico, there is growing understanding of the abundance and distribution of freshwater resources. A map identifying important freshwater ecosystems exists, providing a good general glimpse at the issue. For Central America, there is a good general overview prepared by the North American Wetlands Conservation Council and funded by the Canadian International Aid Agency (CIDA). This document identifies the most important freshwater ecosystems and discusses the major issues affecting them. In South America, Wetlands International (previously Wetlands for the Americas) is currently conducting the first comprehensive assessment of the freshwater resources of the region.

Notwithstanding their critical importance, many freshwater ecosystems are considered useless. Widespread ignorance about the important benefits that wetlands provide to human societies has contributed to this notion and has promoted their destruction and degradation. The coterminous U.S. has lost approximately 55 percent of its original wetlands. By the 1980's, twenty-two states had lost more than 50 percent of the wetlands in their borders -- a

loss equivalent an area larger than the size of California. This translates into a loss of one acre every minute for the last two hundred years.

Although reliable figures are not available for other countries in the hemisphere, evidence indicates that freshwater ecosystems are rapidly being destroyed and degraded everywhere. The primary cause of this loss is habitat alteration, fueled by rapid population growth and unwise development trends, both planned and unplanned. Urban development and tourism, for example, are having devastating effects on many coastal areas, such as the province of Buenos Aires in Argentina, southern Brazil, and parts of Ecuador, Colombia, and Venezuela. Rural development is affecting wetlands in the whole region. In southern Brazil, northeast Argentina (Entre Rios and Corrientes provinces) and Uruguay (Banados del Este), for example, extensive freshwater ecosystems are begin transformed into rice fields. In Argentina, one of the few remaining native wet grasslands in the Pampas region (Bajos del Salado) may soon disappear as new technologies are introduced to drain the area for eucalyptus plantations, with little consideration for the long-term groundwater needs of the regions. Shrimp farms have replaced once-extensive mangroves in many coastal areas, particularly in Mexico, Central America, and Ecuador. The unfortunate irony is that healthy mangroves are nurseries for the shrimp larvae that the shrimp industry depends upon, to say nothing of their importance for coastal fisheries and nutrient capture, and in preventing coastal erosion.

Dams and channelization are also potentially undermining the functions and values of freshwater ecosystems, with little consideration given to fisheries and other wetland resources that local communities depend on. There are already 885 dams over 15 meters high in South America, of which 516 are in Brazil. The Parana River has 23 dams constructed or under construction. Plans for making the Parana and Paraguay rivers navigable for large ships (the Hidrovia Project) may result in the complete alteration of the rivers' hydrological regimes and serious degradation of wetland resources.

To quote Our Own Agenda (see Annex I), "Latin America's main hydrographic resources are today chemically and biologically contaminated. Several rivers in Columbia, among them the Medellin and the Bogota, are biologically dead (totally lacking dissolved oxygen); large agricultural zones have been biologically and chemically contaminated by coffee residue and pesticides, as is the case in the Qunidio, Antiquia, Tolima, and Risarlda coffee growing regions and the Meta rice-growing region; and waters in the Sogamosa Valley and the Magdalena, Dagua and Nechi rivers have been contaminated by industry and mining. Large quantities of agricultural contaminants are disposed of in streams flowing into the Caribbean Sea in which there is clear evidences of phosphorus, nitrates potassium, pesticides (DDT, DDE) and highly organic effluents that are used in an indiscriminate fashion and are highly contaminating. Similar conditions prevail through Latin America."

River contamination is also widespread in major industrial cities such as Buenos Aires, Bogota, Lima, and Sao Paulo. Major oil spills may be causing insidious problems along the coasts of Patagonia, Venezuela, Colombia, southern Brazil, and central Chile. The recent cholera outbreak in Latin America demonstrated the magnitude of problems that can be caused by the lack of clean water and contaminated wetlands. These losses erode many important benefits and impinge upon their ability to serve as critical habitats for biodiversity.

Institutional Initiatives In Freshwater Ecosystem Conservation

There are a number of institutional fora and organizations that are currently addressing the challenge of water resource sustainable development. A brief listing is provided in Annex I, but more detailed information can be obtained by contacting either the Florida center for Environmental Studies or WWF-US. "Our Own Agenda," produced by the Latin American and Caribbean Commission on Development and Environment is particularly important as it directly addresses the issues of the region from a regional perspective.

Need for an Assessment of LAC Aquatic Ecosystems: the Santa Cruz Initiative

Background

Despite the large numbers of organizations involved in wetland development in the region, until relatively recently, no region-wide systematic approach to the conservation of freshwater ecosystems, including wetlands, for Latin America and the Caribbean has taken place. In late 1993, Wetlands International (WI) (formerly, Wetlands for the Americas) approached USAID for funding to compile and publish the first comprehensive ecological assessment and policy review directed at setting a conservation agenda for

South America's vast and diverse wetlands. WI's goal was to "to use the results of this assessment to inform and stimulate the formulation of policies and programs by national and international development and conservation institutions whose activities currently have, or could have, significant impacts on South America's wetlands."

This initial proposal was approved by USAID in 1994. Through the addition of several other grants, WI hired approximately 15 consultants to carry out this assessment (which later was expanded to include Central America and the Caribbean). In March 1994, WI developed a Work Plan that outlined the goals, objectives, format and time tables from which the consultants would direct their investigation. This document was titled *The Wetlands of South America: An Agenda for the Conservation of Biodiversity and for Policy Development*.

Other parties became active participants in the assessment process and included IUCN, the Ramsar Bureau, International Waterfowl and Wetlands Research Bureau (now, also incorporated under Wetlands International), Manomet Observatory (in Massachusetts), Wildlife Habitat Canada , the Tinker Foundation and the Peruvian Society for Environmental Law.

At the same time that WI has initiated its assessment of wetlands in LAC, the World Bank contracted the Conservation Science Program of WWF-US to carry out a study to identify geographic priorities for *biodiversity* conservation based on the integration of the biological distinctiveness and conservation status of ecoregions in LAC. A second objective of the study was to create an approach that would be rigorous enough to be incorporated into the conservation planning exercises of LAC countries and other donors active in the region. The WWF, however, limited its analyses to terrestrial ecoregions and produced -- *A Conservation Assessment of the Terrestrial Ecosystems of Latin America and the Caribbean* (Dinnerstein, Olsen, Graham, et al. World Bank, 1995).

Among other accomplishments, the study identifies these three advances in conservation biology:

- A hierarchial scheme that divides LAC into major ecosystem types, major habitat types, and 191 ecoregions to ensure that representation is maintained at an appropriate biogeographical scale for rational conservation planning;
- A transparent method that incorporates the principles of landscape ecology to assess that snapshot conservation status of the ecoregions of LAC; and,
- A method for integrating biological distinctiveness of ecoregions with their conservation status designed to identify regional biodiversity priorities for conservation in each major ecosystem type and to promote bioregional representation.

At the same time that the World Bank was initiating its study, USAID requested that the Biodiversity Support Program (BSP) coordinate a priority-setting exercise to assist USAID in identifying geographic areas of high priority for biodiversity investments in LAC. This study was conducted by the Wildlife Conservation Society, The Nature conservancy, World Resources Institute, Conservation International, and the WWF Conservation Science Program, and a large group of regional experts. A major gathering was held in Miami in November 1994.

Again, and not surprisingly, while much was known about the ecosystems and ecoregions of terrestrial systems, the final report (*A Regional Analysis of Geographic Priorities for Biodiversity Conservation in Latin America and the Caribbean*, USAID, 1995) excluded marine, freshwater, and mangrove ecoregions from its analysis. A freshwater sub-group was formed in Miami, and a follow up meeting was set for Santa Cruz, Bolivia in the fall of 1995 to coincide with the Wetlands International's review of its assessment of wetlands in the LAC region.

The Santa Cruz Workshop

The Santa Cruz Workshop was sponsored by Wetlands International, along with World Wildlife Fund-US, the Biodiversity Support Program, the U.N. Environment Programme and the U.S. Agency for International Development and was held over a four day period in September 1995. It focused on creating a rigorous framework for setting priorities to conserve aquatic ecosystems and biodiversity in the LAC region. There were approximately forty freshwater and wetland experts in attendance.

The objectives of the Santa Cruz workshop were the following:

- To provide a forum of discussion for WI's LAC Wetlands Assessment.
- To draft a "fine" assessment of LAC Wetlands in order to provide a final WI report.
- To identify freshwater ecosystem priorities ("coarse filter") for the LAC region.

- To fine-tune a GIS map of LAC freshwater ecosystems.

The progression of topics at the Santa Cruz workshop were roughly the following:

- Defining and Mapping of Ecoregions in LAC (4 sub-groups[1]).
- Defining Final Aquatic Ecoregions.

- Defining and Mapping of Sub-units: Basins and Wetlands (BWs).
- Assessing Biological Importance of BWs.
- Assessing Conservation Threats to BWs.
- Assessing Conservation Threats to Ecoregions.
- Assessing Policy Aspects.
- Developing Priority Rules.
- Assessing Priority Rules.
- Discussing Final Priorities.

The fundamental assumption of the workshop was that effectiveness of conservation investments in the LAC region can be greatly enhanced through a science-based assessment of conservation priorities. The approach used for terrestrial systems basically integrated information on the biological importance (i.e. "the degree of distinctiveness of the biodiversity of a region assessed at varying biogeographical scales") of different areas and conservation status (i.e. "the current state or ecological integrity of a region modified by projected threats"). The workshop focused in part on developing adequate indicators specific to freshwater systems. The workshop also created regional classifications and maps for LAC aquatic ecosystems. The participants then sought to integrate data layers (i.e., biological importance and conservation status), develop decision rules, and identify priorities among ecoregions and sub-units.

Put another way, it was an effort to build a framework that divided LAC into ecoregions, and then sub-units of basins and/or wetlands, and allowed the participants to assign measures of biological importance and conservation status to each ecoregion and sub-units (generally a basin), thus positioning each unit within a decision-making matrix. The ecoregions and sub-units were all mapped (now digitalized) and described in detail by the participants.

1. Analysis of Biological and Habitat Distinctiveness utilized the following characteristics to rate each ecoregion and sub-unit:

- Ecosystem Diversity
- Ecosystem Uniqueness
- Biodiversity
- Endemism
- Productivity
- Habitat Size

2. Analysis of Conservation Status and Habitat Distinctiveness utilized the following characteristics for each ecoregion-region and sub-unit:

- Size
- Integrity
- Fragmentation
- Habitat loss
- Habitat remaining
- Water quality
- Hydrographic integrity
- Alteration of basin(s)
- Fragility
- Habitat conversion
- Intactness
- Current status
- Current threats
- Degree of protection

Dynamics of Workshop and Results

First, the Workshop was a important if for no other reason than it brought many of the top aquatic ecosystem ecologists in LAC together. The consultants to WI came with a wealth of knowledge included in their written reports. When mapping ecoregions and sub-units, the LAC experts had an excellent understanding of local and regional geography, had a thorough understanding of levels of ecosystem biodiversity, productivity, and endemism, and an excellent grasp of the human and non-human threats to the regions.

The WI report and the GIS-maps generated along with ecoregion and sub-unit descriptions, when completed, will provide an invaluable database to help produce the beginnings of a conservation strategy for aquatic ecosystems in Latin American and the Caribbean.

Second, the Workshop made a first attempt at integrating biological distinctiveness and conservation status of aquatic ecoregions which potentially is a very powerful analytic and strategic tool for determining the relative conversation importance of ecoregions and sub-units. The four sub-groups, as well as individuals within the sub-groups, however, often interpreted and weighted the importance of the characteristics within the biological distinctiveness and conservation status categories

differently, thus making consensus difficult.

Furthermore, developing decision rules and identifying conservation priorities among ecoregions and sub-units using a decision-making matrix became even more difficult. The lack of consensus in this area resulted in some striking final results. For example, the Patagonian ecoregion was given a higher priority for conservation than the Amazon basin.

One recurrent theme was whether or not the participants, because of the precedence of the terrestrial priority-setting exercise, had not sufficiently separated themselves from the terrestrial format. For example, ecoregions were the key "conservation unit" in the terrestrial model. Sub-ecoregion units or basins and/or wetlands may be more appropriate for freshwater aquatic ecosystems.

There was an underlying concern among some members of the Workshop Steering Committee that important scientific and decision-making parameters would be passed over or under-valued in the given (limited) time. For example, major habitat types of aquatic ecosystems (marshes, estuaries, peatlands, etc,) were not systematically integrated into the ecoregion hierarchal systems. Efforts are now being made to integrate habitat types into priority-setting process.

The Steering Committee of the Santa Cruz Initiative is planning on meeting in the early summer of 1996 to finalize the report. There will be a presentation of findings at the Buenos Aires, Second Inter-American Dialogue on Water Management in the first week of September 1996.

Conclusion

Wider trends affecting conservation in LAC -- including 1) the emergence of civil governments, and the subsequent proliferation of NGOs, 2) economic reforms and generally the strengthening of economies and, 3) the continued high rate of urbanization through LAC -- has caused various institutions including WWF and the Center for Florida Environmental Studies to re-examine priorities for aquatic ecosystems conservation. For example, WWF is moving away from trying to be "omnipresent" -- by working broadly and widely at a small scale in many areas and projects -- to playing a deeper catalytic role at the field and policy levels. WWF perceives this new role to be more proactive, rather than reactive, and involves the organization in developing and disseminating new ideas and approachers; leveraging changes through policy and knowledge, and taking a more substantive role in project implementation. This role puts greater emphasis on 1) identifying conservation priorities for large-scale funders, 2) starting projects which can serve as a demonstration from scaling up or replicating by other funders, 3) building up the conservation infrastructure that can take advantage of this increased funding, and 4) filling gaps in international support.

In the LAC region, the conservation community has largely ignored freshwater ecosystems and focused largely on terrestrial systems, particularly rainforests. The few initiatives concentrated around freshwater are far from sufficient to meet the increasing needs. Multilateral development organizations and bilateral aid agencies increasingly are aware of the connections between ecosystem conservation and sustainable water resources management. The World Bank's relatively recent *Comprehensive Water Resource Policy* and the Global Environmental Facility's (GEF) most recent operational directive accurately and conclusively make the connection. Some progress in the understanding of these issues and on the kind of policies required is making progress.

In order to protect the important societal benefits of aquatic ecosystems, it behooves the conservation community to have the best possible understanding of the functions and values of aquatic ecosystems in the LAC region in order to provide greater leadership and guidance to decision makers. This should be achieved through research, information exchange and education with an objective to establish a conservation priority-setting system to facilitate investment in the sustainable management of water resources in the region.

ANNEX I

Caring for the Earth

Produced by the International Union for the Conservation of Nature (IUCN), United Nations Environmental Program (UNEP), and World Wildlife Fund (WWF), this successor to the World *Conservation Strategy* is a global blueprint for achieving a sustainable society. It addresses freshwater conservation from the perspective of maintaining the integrity of the water cycle.

Agenda 21

This massive and comprehensive document served as

the basis of the 1992 Rio Earth Summit. It is considered an international "soft law," designed to guide human societies in achieving economic, social, and environmental sustainability. Chapter 18, titled *Protection of the Quality and Supply of Freshwater Resources: Application of Integrated Approached to the Development, Management, and Use of Water Resources*, deals with all aspects related to freshwater. It builds upon previous international efforts to rationalize a global water strategy, including the Mar del Plata Action Plan emerging from the United Nations Water Conference of 1977; and the recommendations from the International Conference on Water and the Environment, held in Dublin in 1992.

Agenda 21 lists a series of proposed programs to achieve the sustainable use of water resources, setting targets and estimated annual costs for the 1993-2000 period.

The Global Biodiversity Strategy

Prepared by World Resources Institute (WRI), IUCN, and UNEP, the *Global Biodiversity Strategy* is a general global framework for conservation with emphasis on biological diversity. Although this document does not address freshwater separately, there are several action points related to freshwater within each of its seven goals.

Our Own Agenda

Produced by the Latin American and Caribbean Commission on Development and Environment, with the support of the Inter-American Development Bank and United Nations Development Program (UNDP), this document develops a blueprint for the sustainable development for the Latin American and Caribbean region. The emphasis on a sustainable development model appropriate for the LAC region becomes obvious from the following excerpt: "We must define our own environmental agenda. If we fail to evaluate objectively the problems and opportunities presented by the region's natural heritage, we cannot establish priotities for action and we will assuredly err in designing the strategies that we believe can provide us sustainable development."

A model for the rational utilization of water resources emphasizes regional differences in water availability. Although, as a whole, the LAC region is endowed with very rich water resources, there are many regions within LAC that will face severe water shortages in the future.

International Financial Institutions (IFIs) which make substantial loans to LAC in the water sector include:

The World Bank

The World Bank is placing heavier emphasis on the sustainable management of water resources. Based on the substantial experience gained from $34 billion invested in water projects throughout the years, the World Bank recognizes that current practices are not sustainable from either an economic or an environmental perspective. In order to better guide the $18.3 billion it is planning to invest in water resources in the next five years, it has developed a new policy on water resources management (Operational Policy 4.07).

In addition to its attempts to incorporate environmental considerations and ecosystem conservation within its water projects, the World Bank also supports water resources conservation through its participation in the Global Environmental Facility (GEF).

The Inter-American Development Bank (IDB)

The IDB is in the process of developing a water resource policy. Currently substantial lending is allocated each year to water resource management and environmental projects. During 1990-1993, for example, a total of $3.656 billion was allocated to operations specific to address environmental and natural resources issues. A total of 36 projects related to water supply and sanitation are under consideration for the 1994-95 period.

Organization of American States (OAS)

The OAS currently does not have a specific freshwater policy. Throughout the years, however, the OAS has placed emphasis on improving water resources management in the LAC region, including numerous studies on water basin planning and management.

In addition to several country-specific activities related to better freshwater management, the OAS is spearheading the Inter-American Water Resources Network (IWRN). The IWRN was born at the Inter-American Water Dialogue on Water Management, a "post-Rio" follow up meeting held in Miami in 1993. The IWRN aims at improving water resources management by enhancing technical cooperation, collaboration and communication throughout the Western

Hemisphere. It strives to integrated ecosystem considerations within national and regional water development strategies.

Bilateral Aid Agencies in North America with major program affecting water resources:

U.S. Agency for International Development (USAID)

Canada International Development Agency (CIDA)

Organization for Economic Cooperation and Development (OECD)

The Development Assistance Committee for OECD has finalized its "Guideline for Aid Agencies for Improved Conservation and Sustainable Use of Tropical and Sub-Tropical Wetlands," (Guidelines on Aid and Environment Report No. 9), as well as "Guidelines for Aid Agencies on Global and Regional Aspects of the Development and Protection of the Marine and Coastal Environment," (Guidelines on Aid and Environment Report No. 8). These guidelines aim at improving the aid policies of industrialized countries with regards to wetlands (and marine and coastal environments). It reviews definitions, benefits, threats, and suggests two fundamental policies for development agencies to assist governments in the conservation and sustainable utilization of their wetlands.

International Treaties affecting freshwater Resources in LAC:

Ramsar

The Convention on Wetlands of International Importance as Waterfowl Habitat -- commonly referred to as the Ramsar Convention from its place of adoption in Iran in 1971 -- is the first of the modern global intergovernmental treaties on conservation and wise use of natural resources. It is the intergovernmental treaty which provides the framework for international cooperation for the conservation and wise use of wetland biomes.

Convention of Nature Protection and Wildlife Preservation in the Western Hemisphere

Convention of Biodiversity

Some Non-governmental Conservation Organizations that have major freshwater programs in LAC:

World Wide Fund for Nature (World Wildlife Fund)

Founded in 1961, WWF is the largest conservation organization in the world. It has national organizations or representatives in more than 50 countries and works in more than 100 countries worldwide to protect endangered wildlife and wildlands. WWF's efforts to conserve nature over the last ten years has increasingly identified the requirement to factor in local, community-based human needs into its projects and programs.

Wetlands International

Wetlands international, the world's leading wetland conservation organization, was created in 1996 by the integration of the Asian Wetland Bureau, the International Waterfowl and Wetlands Research Bureau, and Wetlands for the Americas. The achievements of the founding organizations date back 40 years and include the launch of the Ramsar Convention, major regional surveys and conservation programs for wetlands and wetland species, and the development of international programs.

International Union for the Conservation of Nature (IUCN) Program

The IUCN has been very active in wetland conservation in LAC region. In Central America, the focus is on sustainable management of wetland resources through the implementation of demonstration projects . In south America, the emphasis is on supporting countries in the development of National Wetland Conservation Strategies.

Other NGO Efforts in the LAC Region

Although not necessarily as part of a systematic approach of freshwater conservation the work of several other organizations is having an important impact on these ecosystems in the LAC region. Within the international NGO community, programs of Conservation International and The Nature Conservancy have significant implications for freshwater resources.

ENDNOTES

[1]This document is largely based on "Castro, G. 1995. A Freshwater Initiative for Latin America and the Caribbean". Unpublished Report, World Wildlife Fund, 23pp.

Founded in 1961, World Wildlife Fund (WWF) is the largest conservation organization in the world. Its mission is to achieve the conservation of nature and ecological processes by preserving genetic, species, and ecosystem diversity; ensuring that the use of natural resources is sustainable; and reducing pollution and the wasteful use of resources and energy.

[2]The Florida Center for Environmental Studies is a new institution. Its role is to bring the full resources of the ten universities of Florida to bear on the critical environmental management issues of the state and of tropical and sub-tropical, humid and sub-humid ecosystems worldwide. Although the Center is new, the experience now available to it is considerable. Over 800 faculty in the Florida State University System have environment related interests, and a large proportion of their expertise is in water dominated ecosystems.