



## Wetlands and Environmental Assessment

*Wetlands are among the most threatened ecosystems in the world because they have traditionally been regarded as wastelands and invariably offered opportunities for alternative use, especially agriculture. Increasingly, however wetlands have come to be regarded as valuable resources, providing many goods and services critical to environmentally sustainable development; they are also of crucial importance to conserving the world's biodiversity.*

*This Environmental Assessment Sourcebook Update provides guidance on the use of EAs in Bank-funded projects and programs likely to affect wetlands. It highlights the importance of wetlands, potential impacts likely to be generated by development activities and indicates the appropriate type and scope of assessment and environmental planning and management. It also includes a number of case studies. This Update complements Chapter 2 of the EA Sourcebook and Update No. 20 "Biodiversity and Environmental Assessment."*

### What are Wetlands?

The Convention on Wetlands of International Importance, especially as Wildlife Habitat ("The Ramsar Convention," 1971), a treaty for the conservation and sustainable use of wetlands, provides a broad definition of wetlands. This treaty has been ratified by 128 countries and states that, "wetlands, are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters." This definition also embraces coastal areas (including coral reefs and sea grass beds) that are covered separately in the World Bank *EA Sourcebook Update* No. 7: Coastal Zone Management and Environmental Assessment. As many national laws also provide relevant definitions of this term, they must be considered when relevant to Bank EA work.

### Distribution

Although wetlands are widely distributed, they are concentrated in certain regions of the world, includ-

ing north-east Europe, central Siberia, coastal areas of south-east Asia, central North America, the Amazon and Pantanal catchments of South America, and the floodplains of central Africa. Published global estimates range from 5.3 to 8.6m km<sup>2</sup>, the latter figure representing over 6 percent of the Earth's land surface. However, it is estimated that half of the wetlands of the world have been lost during the last century.

Typical wetlands in tropical coastal areas include mangroves and salt-marshes, while swamp forests are found along inland river courses. Peatlands (such as bogs, fens, mires) are especially typical of cool, humid zones. In desert regions, wetlands include spring-fed oases, temporary wetlands and hypersaline water bodies, while vast expanses of tundra occur in polar regions (mainly around the Arctic Circle).

### Functions, Benefits, and Value of Wetlands

Wetlands perform functions which provide direct or indirect benefits of value to humanity, including flood control, water purification, shoreline stabilization and the control of erosion (Box 1). They also sup-

port considerable numbers of fish and other wildlife and countless people depend upon them for their livelihood. For centuries, benefits provided by wetlands have been taken for granted, while the fact that there are very few “charismatic” species occupying wetlands means that their conservation has received low priority.

### Ecological values

Not all wetlands perform the same functions or produce the same kind of benefits to humans. Some are highly productive systems providing a variety of benefits, while others may yield fewer benefits though still represent ecosystems of high value and worthy of conservation. Many peatlands are of low primary productivity and low biodiversity, yet their global value as ‘carbon sinks’ (or stores) is highly significant. On the other hand, estuaries and mangroves are among the most productive of all ecosystems, providing a great variety of benefits. For example, it has been calculated that the productivity of estuaries is around 50 times that of a grassland and 8 times higher than a wheat field.

Ecological values derived from the natural functions of mangroves include rich biological diversity and provision of spawning and nursery grounds for many fish and invertebrate species. However, mangroves are also valuable for their many direct and indirect benefits. For example, wood for building materials and fence-poles, materials for fish traps, and pulp and particle board can be produced on a large scale; they also provide fuel (firewood and charcoal), shellfish, crustaceans and fish (which are harvested both traditionally and commercially), recreational opportunities, honey, and fodder for domestic animals.

In some cases, the ecological values of wetlands may be affected—both upstream and downstream—even at considerable distances. Such is the case of the Pantanal, shared by Brazil, Bolivia, and Paraguay, which acts as an enormous “sponge,” absorbing the flood peak and thus reducing erosion and flooding downstream. The system also supports some 550 fish species of high endemism, many of which are commercially valuable. These are mostly migratory and highly sensitive to temperature variations and would be irreversibly affected by construction of dams and channels, pollution and overfishing.

### Box 1. Functions and benefits of wetlands

Functions	Benefits
Nutrient, sediment and contaminant retention	Improved water quality (e.g. for drinking, guaranteed trophic system support)
Water storage	Flood water control
Velocity reduction	Erosion control, shoreline stabilization, storm protection
Base flow maintenance	Water supply (e.g. for drinking, agriculture, transport, recreation)
Aquifer recharge	Water supply
Maintenance of biological diversity and trophic systems (food chains)	Supply of plant and animal products (e.g., food, timber, fodder, medicines), wildlife - based education, research and recreation opportunities
Maintenance of connectivity between terrestrial and aquatic ecosystems	Support of fisheries; creation of new land (e.g., mangrove expansion)

### Socioeconomic values

Healthy wetlands, performing their natural functions adequately, can help sustain the quality of life and the social stability of nearby rural communities. This is particularly the case in developing countries, where habitat destruction and unsustainable resource use result in loss of a subsistence/sustainable way of life, loss of job opportunities, changes in social structures and traditions, and eventual migration and displacement to large cities.

In Africa, many rural communities depend on floodwaters to enrich soils with nutrients for their traditional cultivation and grazing practices. Should the natural flooding and/or the traditional land-use practices be modified, not only could there be drastic ecological changes, but the social impact on the people whose lives have been shaped by this rich and dynamic wetland cycle, may be altered forever.

Conversely, the construction of dams can radically alter the hydrological functioning of wetlands, leading to reduction or loss of benefits and values, in addition to actual displacement of human communities. For example, the regulation of the Volga River in Russia has resulted in reduction in volume and duration of spring flooding crucial for agriculture, disrupted migration of fish, reduced sediment supply to the Volga Delta, and led to the concentration of pollutants behind dams. In West Africa, many dam projects have harmed wetlands through depriving floodplain regions of annual flooding, leading to overgrazing of marginal land and increased livestock mortality. In Nigeria, fish catches and floodplain harvests were more than halved in an area extending 200km downstream of the Kainji Dam.

Wetlands provide means for transportation, such as in the Llanuras del Rio San Juan on the Caribbean coast between Nicaragua and Costa Rica, where the river and swamp forest channels are the sole means of transportation. At Lake Titicaca, between Bolivia and Peru, the Uros people have lived for centuries on floating islands built of “totorá” (a kind of reed) where families live and use boats for traveling between the islands. Fish (mainly of the endemic genus *Orestias*) provide most of the animal protein for local communities, being caught for subsistence purposes using artisanal methods. Much of this traditional fishing and life style is being lost due to the introduction of commercial exotic species and modern fishing methods.

### Wetland Loss and Degradation

Wetlands are perhaps the most vulnerable of ecosystems and thus among the most degraded. The flow of water through wetland means that problems originating even far away from a particular area can have highly negative impacts on its natural functioning which, in turn, can be transmitted downstream.

Most developed countries have lost a large percentage of their wetlands, but in developing countries the situation is of equal concern. In the Philippines, 67 percent of the country’s mangroves were lost between 1920-1980 to shrimp and milkfish ponds, and in Nigeria the floodplain of the Hadejia River has been reduced by over 300 km<sup>2</sup> as a result of dam construction. In Brazil, most estuarine wetlands have been degraded as a result of pollution.

In many cases, not only have the benefits of development schemes turned out to be far less than expected, they have resulted in irreversible damage to communities dependent upon a healthy wetland. In Ecuador, for example, the clearance of mangroves for shrimp farming has reduced the population of shrimp larvae available to stock them. In northern Cameroon an irrigation project along the Logone river has greatly reduced the extent and duration of flooding downstream. Fisheries collapsed and it is no longer possible to grow floating rice. Although local inhabitants are trying to shift to other farming and agriculture practices, they lack the skills and traditional uses of those resources.

In a recent analysis of fish faunas from several countries representing all continents, it was concluded that at least 20 percent of freshwater fish species are seriously threatened or already extinct. Declines resulted primarily from cumulative effects of long term factors such as habitat loss (competition for water, drainage and pollution), introduction of exotic species, commercial exploitation and obstruction of spawning migration by dams.

### Bank Policy, Procedures, and Guidelines

The Bank’s Environmental Assessment Operational Policy (OP 4.01), requires the systematic screening of environmental impacts in all its financially-supported projects for significant environmental impacts. Project screening and subsequent environmental assessment must consider the possible adverse impacts of projects on wetlands, and where such impacts are confirmed, mitigation measures and/or compensation measures must be proposed.

Several other policies are directly relevant to wetlands, such as natural habitats (OP 4.04), water resources management (OP 4.07), forestry (OP 4.36), indigenous peoples (OD 4.20) and involuntary resettlement (OD 4.30)—their essential features are presented in Box 2. Bank procedures, in turn, are supported by such international agreements as the Ramsar Convention and the Convention on Migratory Species of Wild Animals (“Bonn Convention” 1979)—Box 3. Investment projects in sectors such as agriculture, forestry, fisheries, energy, industry, tourism and urban and infrastructure development would be expected, where appropriate, to explicitly include biodiversity conservation in project objectives.

### Relationship to Bank Investments

The issue of wetland conservation is relevant to a great variety of Bank projects, including:

- Projects which affect the hydrology of a wetland, such as construction of a road or high dam, flood control, lowering of the aquifer drainage, and irrigation and other water supply systems
- Direct conversion of wetlands for ports and harbors, housing, navigation projects, agriculture and aquaculture (especially mangroves for shrimp culture)
- Projects which directly influence wetlands through disturbance of the natural environment, such as those causing pollutants to flow into wetlands, those posing the threat of introducing exotic species (aquaculture), those introducing physical disturbance by people and those contributing to acid rain or to a rise in sea level
- Watershed management conducted in other projects.

The Bank has significant experience with wetlands conservation and management issues through financing of various projects involving wetlands. Wetland management issues have played a major role in projects such as:

- The *Nakdong Barrage and Land Reclamation Project* in Korea, where the Bank financed a management

## Box 2. World Bank Policies Relating to Wetlands

- *Environmental Assessment OP 4.01* OP. 4.01 outlines Bank policy for the environmental assessment of Bank lending operations. The purpose of an EA is to improve decision making and to ensure that the project under consideration is environmentally sound and sustainable. The EA process facilitates identification of environmental consequences early in the project cycle and accounting for these in project selection, siting, planning, design and implementation. The policy requires, inter alia, systematic environmental comparison of alternative investments, sites, technologies and designs.
- *Natural Habitats Policy OP 4.04* Under this policy the Bank promotes and supports habitat conservation and improved land use by financing projects which further the conservation of natural habitats. The policy requires that a project which has substantial impacts on natural habitat must include appropriate mitigation measures, including direct support for conserving an ecologically similar area. The Bank does not support projects that involve the significant conversion or degradation of critical natural habitats such as wetlands.
- *Water Resources Management OP 4.07* Among priority areas for Bank assistance and involvement are the development of a comprehensive framework for designing water resource investments, policies, and institutions; restoration and preservation of aquatic ecosystems against over-exploitation of groundwater and resources; avoidance of water quality problems associated with irrigation investment; and establishment of strong legal and regulatory frameworks to enforce policies.
- *Forestry OP 4.36* Bank lending in the forest sector aims to reduce deforestation, enhance the environmental contribution of forested areas, promote afforestation, reduce poverty, and encourage economic development. The Bank expects governments to have adequate provisions in place for conserving protected areas and critical watersheds, as well as for establishing environmental guidelines and monitoring procedures. The Bank does not provide financing for logging in primary tropical moist forests.
- *Indigenous Peoples OD 4.20* This policy ensures that indigenous peoples (defined as social groups whose social and cultural identities are distinct from those of the dominant society, making them vulnerable to being disadvantaged in the development process), benefit from the project. It also ensures that potentially adverse impacts of Bank projects on indigenous peoples are avoided or mitigated. An indigenous peoples development plan is prepared, as appropriate, in tandem with the main investment project.
- *Involuntary Resettlement OP 4.12* Involuntary resettlement under this policy covers both involuntary displacement and the measures for mitigating the impacts of displacement. Any operation that involves land acquisition or is screened as a category A or B project for environmental assessment purposes is reviewed for potential resettlement requirements early in the project cycle to protect the livelihood of people who lose their land, their houses, or both. The objective of the Bank's resettlement policy is to assist displaced persons in their efforts to restore or improve former living standards and earnings capacity. To achieve this objective, the Borrower is required to prepare and carry out resettlement plans or development programs.

## Box 3. The Ramsar and Bonn Conventions

Conservation and sustainable use of wetlands cannot be achieved without effective cooperation at an international level. Global environmental treaties provide important mechanisms for such cooperation. One of the challenges facing the international community at present is to find means of maximizing synergy between different agreements, while making the most efficient use of scarce resources. The Convention on Wetlands of International Importance, especially as Waterfowl Habitat, was adopted in Ramsar, Iran, in 1971, and came into force in 1975. Contracting parties commit themselves to:

- Designate at least one site that meets the Ramsar criteria for inclusion in the "List of Wetlands of International Importance" (by 2000, more than 1,096 sites covering over 87 million hectares had been listed)
- Include wetland conservation within their national land-use planning, so as to promote the wise use of all wetlands within their territory
- Establish nature reserves in wetlands and promote training in wetland research, management and wardening
- Consult with other Parties about implementation of the Convention, especially with regard to transfrontier wetlands, shared water systems, shared species and development projects affecting wetlands.

The Bonn Convention on the Conservation of Migratory Species of Wild Animals, in force since 1983, obligates parties to protect endangered migratory species and to try to conclude international conservation agreements for vulnerable species that are not yet endangered. It also encourages member states to conserve and restore habitat areas for migratory species, especially wetland areas.



study, changed the design of the project and set loan agreement conditions to safeguard a wetland of international importance threatened by the project

- The *Southern Conveyor Project* in Cyprus, where plans were made to restore Akrotiri Lake, an important wetland
- The *Pakistan National Drainage Program*, aimed at improving the efficiency of the country's irrigation and drainage system, included a national wetlands survey and development of a Wetlands Management Plan to protect established wetlands
- Those within the context of the *Environmental Program for the Mediterranean* where conservation management of the most important wetlands in that region have been identified
- The *Floodplain Management Project* in the Brazilian Amazon aims to identify and pilot development activities that are ecologically and economically sustainable and to establish policies for the management and conservation of Amazonian wetlands, including their fisheries
- The *Ceará Integrated Water Resources Management Project* in an arid part of Brazil, finances a monitoring program to ensure that water resources management practices do not adversely affect estuarine mangrove and other aquatic ecosystems.

## Environmental Assessment — Use and Application

The existence of an important wetland in or near a project area should determine the need for an environmental assessment (EA), particularly if it is downstream of the project. The impact of a project upon a wetland or any other aquatic ecosystem, may be felt far beyond its boundaries. Equally, a disturbance outside a wetland may also affect its functioning. Thus, an EA should take into account the existing and future relationships between a wetland and neighboring ecosystems. This may necessitate expansion of the geographical coverage of the EA and generation of sufficient data on hydrological, ecological and socio-economic linkages to capture all significant potential environmental impacts.

Where a particular project is likely to impact a wetland, the following issues are usually relevant:

- Is the area on the Ramsar list? (List available from the RAMSAR internet site—see page 10.)
- Will there be significant changes in the hydrology of the wetland?
- Will the project pollute or increase nutrients or induce physical disturbance in the wetland?

- Will the wetland or any portion of it be converted or will there be a change in use? (See OP 4.04 Natural Habitats.)
- What is the present socio-economic value of the wetland? What would be the sustainable yield under better management? What is the replacement cost of the goods and services of the wetland if it were destroyed?
- What institutions can or could manage or protect the wetlands? What are their capabilities and limitations?
- Are local people willing and able to adapt their traditional practices to the likely changes in the wetland resulting from the project.

In conversion of wetlands for agriculture, the costs associated with the loss of the wetlands should be incorporated into the economic analysis of the project.

Project specific, sectoral and regional EAs may be employed depending upon the area of coverage and complexity of likely impacts generated by the proposed project or projects. Approaches to the use of sectoral and regional EAs are detailed in EA Sourcebook Updates 4 and 15.

## Project Specific EAs

For project specific EAs, the following should be kept in mind. (Box 4 provides a checklist of action points within the project cycle):

### Project screening

Before the Bank decides to support preparation of a project or program that could affect the natural environment, a decision is made regarding the appropriate type and scope of environmental analysis. This may be achieved through environmental screening into one of three categories according to the degree of potential impacts (category A for significant impacts; category B for limited impacts; category C for minimal or no impacts and category FI if the project involves investment of Bank funds through a financial intermediary in subprojects that may result in adverse environmental impacts).

### Category A

Projects located in or near sensitive wetland areas and involving activities likely to generate significant impacts should normally be classified as EA category A, and the appropriate option is normally a project-specific EA.

Project-specific EA is normally the most relevant approach when the Bank becomes involved at a relatively advanced stage where the definition and preparation of investments are the main concern.

#### Box 4. Checklist of Action Points within the Project Cycle and EA Process

<i>Project cycle</i>	<i>Environmental assessment process</i>	<i>Action points for wetlands</i>
<b>Project identification</b>	<b>Preliminary examination</b> Scoping and screening Panel of experts (if necessary) Terms of reference Team selection	Follow national wetland policy (NWP) Address national water and wetland issues identified in NWP Consult wetland sites inventory Review legal procedures/regulations
<b>Project preparation</b> Prefeasibility study Project planning and detailed design	<b>EA preparation</b> Public consultation/awareness Identification of development alternatives Baseline studies Impact prediction Impact assessment Mitigation plan Identify monitoring needs Need for strengthening EA capacity Need for an advisory panel	Consult wetland specialists Include wetland specialists in team Identify water and wetland issues in project area Describe wetlands in area (baseline survey) Assess wetland functions, uses and values Consult communities, wetland users and NGOs Assess significant potential impacts of projects on wetlands Identify indicators to evaluate progress and implementation Develop mechanisms for wetland management, training and financing
<b>Project appraisal</b>	<b>EA review</b> Review EA report Public consultation Peer Review of EA	Continue consultation with communities, wetland users and NGOs Confirm issues and arrangements for their proposed treatment
<b>Project approval</b> Negotiation Loan signing	Incorporate environmental provisions into project documents	Consult wetland and environmental law specialists
<b>Project implementation</b> Implementation and supervision Implementation of mitigation and enhancement measures Monitoring project performance	<b>Environmental monitoring</b> Monitoring of mitigation and enhancement measures Monitoring of environmental indicators Monitoring of socio-economic indicators <b>Scheduling, costing, reporting</b>	Develop joint-management measures for wetlands with wetland user communities, if appropriate Implement agreed indicators/evaluation framework Monitor wetland management, ecological integrity and use
<b>Project evaluation</b> Project completion report Evaluation by OED	<b>Environmental audit</b> Effectiveness of mitigation and enhancement measures Recommendations for follow-up	Carry out wetland ecosystem and wetland users socio-economic surveys
<b>Follow-up activities</b> Design new project activities, if needed	Adjust mitigation and management measures	Ensure institutional and financing mechanisms to sustain wetland management

EA terms of reference (TORs) should include economic analysis of environmental costs and benefits of alternative investment options. For example, if a proposed agriculture project emphasizes conversion of wetlands of agricultural production, an alternative approach such as intensification of

production in existing areas, conversion of other land types, or crop rotation may be considered.

#### *Category B*

For category B projects, the appropriate type and scope of a more limited environmental analysis will depend greatly on the type of project and its location.

In many cases, a pinpointed assessment of the effects of planned small-scale construction activities and a mitigation plan may be the most relevant level of environmental analysis. In other cases, preparation level of guidelines, criteria, or standards may be better (for example, for the construction or operation of small-to-medium scale aquaculture facilities). In some circumstances, a limited regional analysis of the administrative framework in terms of institutional responsibilities, capacity, training and resource needs may be the more appropriate solution. Developing an environmental management plan (for example, using a geographic information system) may also be part of category B environmental analysis.

### **Category FI**

A proposed project is classified as category FI if it involves investment of Bank funds through a financial intermediary; Bank policy requires that FIs are subject to the same rigor and expectations of environmental performance in design and implementation as regular investment projects (see *EA Sourcebook Update 27: "Financial Intermediary Lending and Environmental Assessment"*).

### *Policy, legal, and administrative framework*

It is critical to take account of those aspects of the national policy, legal and institutional framework, and sector-specific policies, regulations and institutional arrangements likely to influence project activities.

A number of international agreements may be relevant to the environmental assessment and should be reviewed for their possible application to the proposed project. (See *EA Sourcebook Update, No. 10: International Agreements on Environment & Natural Resources: Relevance and Application in Environmental Assessment*).

Equally, a number of Bank policies and procedures expressly or indirectly require consideration and generally reinforce OP 4.01 Environmental Assessment (See Box 4).

### *Baseline conditions*

An EA should provide baseline data for assessing the potentially positive and detrimental impacts of the proposed project. To take account of the seasonal (and inter-annual) variations that occur in a wetland, data may be needed on each season (and on conditions during normal and exceptional years). Equally, the multi-purpose character of wetlands requires data and information to assess the impact of a project on each resource, attribute and function of a wetland and to consider the interests of local communities dependent upon a wetland.

Wetland inventories have been completed for all continents and should be consulted in deciding the need for baseline information (see the bibliography). Whenever possible, ecosystem boundaries or catchment areas should be used for deciding the boundaries of an EA—administrative or political boundaries being avoided as these often cut across natural boundaries and frustrate accounting for all project costs and benefits.

### *Environmental impacts*

The project's impacts depend upon the nature of the project and the location of the project's area in relation to the hydrogeographical basin. However, it is the case that projects prepared for areas outside wetlands pose greater risks for wetlands (see Box 5). If a wetland has to be unavoidably damaged or lost as a result of a development project, actions should be developed in accordance with the Bank's Natural Habitats Policy (OP 4.04).

### *Public consultation*

The importance of local community involvement is now well recognized in long-term wetland conservation and management programs. Accordingly, EAs should assess the importance and value of wetlands to affected local communities, especially specific groups such as women, fishing families, livestock owners, etc. The EA should include a process of con-

#### **Box 5. Impacts of Projects Proposed for Areas Outside Wetlands**

- Projects whose features and situation in the hydrographical network supplying water to a wetland might affect (a) its hydrological regime (volume of inflowing water, seasonal dynamics, etc.); (b) the quality of inflowing water (nutrients sediments, pollutants, etc.); and/or (c) the migratory movements of aquatic species (e.g., obstruction of fish migration routes).
- Projects considered for nearby sites and have the potential to (a) lead to an increase in human population in and around the wetland and the sub-sequent increase in pressures on wetland resources (firewood, fodder, water, wildlife, etc.); and/or (b) introduce new animal or plant species in the wetland.
- Projects which, no matter where they may be implemented, have the potential to affect (a) the migration of wildlife associated with the wetland (e.g., obstruction of migration routes by roads, canals, etc.); (b) the migration, composition (breeds) or size of the livestock using wetland.

Source: Roggiri (1995) *Tropical Freshwater Wetlands: A Guide to Current Knowledge And Sustainable Management*.

sultation with these groups to assess wetland uses and to develop joint mechanisms for sustainable management of wetlands likely to be affected by the project. (See *EA Sourcebook Update*, no. 26: “Public Consultation in the EA Process: A Strategic Approach.”)

### *Mitigation plan*

The EA should recommend broad options for eliminating, reducing to acceptable levels, or mitigating environmental impacts. Such recommendations should draw upon findings from analysis of policy, legal and institutional issues as well as the analysis of impacts and alternatives. Mitigation and wetland management measures should be developed in consultation with affected communities and built into the project.

Options to avoid potentially adverse impacts or to mitigate or compensate for those that are unavoidable include any or all of the following:

- Selection of alternative sites to avoid impacts on wetlands
- Design features to prevent disruption of flow patterns and hydrologic regimes critical to conservation of the wetland (e.g., flow regulating works, road crossings on trestles or pilings rather than on embankments)
- Enhancement and/or protection of other wetlands in substandard condition to offset losses at the project site
- Artificial construction of wetlands to replace areas lost (where experience has shown that the wetland type in question can, in fact, be constructed)
- Strengthening institutions to manage and protect wetlands
- Including local NGOs in the institutional arrangements for wetlands conservation
- Promoting development of national wetland incentives and management strategies
- Requiring wetland concerns to be considered in national and local planning and land use decisionmaking processes
- Environmental education programs to disseminate knowledge on importance of wetlands.

If a wetland has to be unavoidably damaged or lost as a result of a development action, compensation should be sought in accordance with the Bank’s Natural Habitats OP 4.04. This might involve replanting of mangroves in an adjacent bare area to replace those cut down or some creative management measures to ensure that neighboring remaining wetlands are better protected and/or extended. (See Box 6.)

### **Box 6. Cartagena Water Supply, Sewerage and Environmental Management, Colombia**

One activity under the project’s Environmental Management Plan (EMP) is the restoration, conservation and management of the Ciénaga de Tesca wetland ecosystem to ensure long-term sustainability. The project finances legal and technical feasibility studies for the creation of a legally protected area, management plans, environmental education programs in surrounding communities, and awareness programs regarding solid waste disposal in water bodies, mangrove deforestation, and over-fishing. The proposed protected area will have natural and man-made limits such as the proposed road on the southern perimeter of the wetland and the pipeline corridor. The project will also finance an institutional strengthening program to ensure institutional capacity to implement the EMP, involving training workshops, study tours and specialization courses for relevant institutions on topics such as wetland management, pollution control, water quality monitoring and environmental audits.

### *Environmental monitoring plan*

The EA should provide guidelines for long-term environmental monitoring to ensure adequate implementation of agreed recommendations. A monitoring plan should use the findings of the baseline survey to measure progress in the mid-term review and final evaluation. It should also include measures to evaluate the effectiveness of the mitigation measures and any follow-up action.

### **Sectoral and Regional EAs**

Wetlands are affected by many different sectors and the dangers of one sector damaging another sectoral activity should be assessed, e.g. irrigated agriculture may affect the habitat of downstream fisheries. Accordingly, Sectoral EAs are being increasingly employed in irrigation and other water sectors to assess the environmental implications of long-term investments. They also provide analyses of legal, regulatory and institutional aspects of environmental management, including the protection of ecologically sensitive habitats and species. A Sectoral EA was carried out to develop an integrated water resources management system and legal and institutional strengthening of the water sector in the state of Ceará, Brazil. Another example of Sectoral EAs is provided in Box 7.

The best opportunity for Regional EA is provided where the Borrower is engaged in regional development planning at a stage when alternative development strategies can still be considered. However, a



### Box 7. Pakistan National Drainage Program

This program, aimed at improving the efficiency of Pakistan's irrigation and drainage system and ensuring its sustainability, included a Sectoral EA. The EA assessed the environmental impacts of current and proposed systems and developed a framework for program implementation of prioritized projects and for institutional strengthening and the establishment of appropriate legislation. Measures to mitigate adverse environmental impacts were recommended along with the adoption of an effective Wetlands Management Plan to ensure that endangered habitats within the Indus Basin are registered, monitored and managed according to the requirements of wetlands species. A Wetlands Survey was recommended to establish baseline conditions.

Regional EA can also be undertaken more downstream in the planning and investment process, as a tool to assess cumulative impacts and relationships between multiple activities (Box 8). Regional EAs provide a good base for project-specific EAs of individual investments.

### Borrower Implementation Capacity

Another approach to successfully mainstreaming wetland conservation into development planning is for countries to apply EA more broadly than for only Bank-financed projects. To this end, the Bank is assisting many client countries to incorporate EAs as standard practice through projects aimed at building institutional capacity, including regulatory development and training. Building capacity for mainstreaming wetland conservation involves sev-

### Box 8. Argentina Flood Protection

This project aims to promote the environmental sustainable development of several provinces by reducing or avoiding the economic losses caused by frequent floods throughout the Parana River Basin. It follows "a living with floods" approach, preserving natural floodplains as much as possible and adopting structural flood protection measures (dikes, canals) only where strictly necessary, as in urban areas. Environmental programs included in the project were designed as part of a Regional EA carried out for the entire Basin and consist of: environmental education and public awareness in communities benefiting from flood protection works; strengthening the environmental capacity of the implementing agencies as well as environment agencies; technical assistance for urban and environment management; and support for conservation initiatives in wetlands and other ecosystems.

eral elements: creating awareness among policy-makers and technical staff; enhancing skills and availability of "tools" for technical staff of government agencies; and promoting effective linkages between government agencies responsible for environmental and natural resource management and sectoral agencies responsible for agriculture, fisheries, forestry, tourism and others. In addition, mainstreaming within sectoral development programs has to be accomplished through collaborative local partnership.

The Bank is also strengthening collaboration with other multilateral and bilateral donor agencies with respect to EA, helping ensure that "good practice" standards for biodiversity conservation, including wetlands, are complementary across institutions.

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#### Addresses of International Organizations and Internet Sites

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This *Update* was written by Colin Rees, and benefitted from inputs by Isabel Braga and other Bank staff. The *EA Sourcebook Updates* provide guidance for conducting environmental assessments (EAs) of proposed projects and should be used as a supplement to the *Environmental Assessment Sourcebook*. The Bank is thankful to the Governments of Norway and The Netherlands for financing the production of *Updates*. Please address comments and inquiries to *EA Sourcebook Updates*, Environment Department, The World Bank, 1818 H St. NW, Washington, D.C., 20433.