

**PROJECT INFORMATION DOCUMENT (PID)  
CONCEPT STAGE**

Report No.: AB3333

<b>Project Name</b>	Strengthening the resilience of the coastal wetlands in the gulf of Mexico to Climate Change impacts through improved Water Resource Management
<b>Region</b>	LATIN AMERICA AND CARIBBEAN
<b>Sector</b>	General water, sanitation, and flood protection sector (100%)
<b>Project ID</b>	
<b>GEF Focal Area</b>	Climate change
<b>Borrower(s)</b>	Responsible Agency: Instituto Nacional de Ecologia
<b>Implementing Agency</b>	Responsible Agency: Instituto Nacional de Ecologia
<b>Environment Category</b>	<input type="checkbox"/> A <input checked="" type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> FI <input type="checkbox"/> TBD (to be determined)
<b>Date PID Prepared</b>	February 2, 2006
<b>Estimated Date of Appraisal Authorization</b>	June 20, 2006
<b>Estimated Date of Board Approval</b>	April 1, 2007

1. Key development issues and rationale for Bank involvement

**The Global climate is changing rapidly.** The 2001 Third Assessment Report of the Intergovernmental Panel for Climate Change (IPCC) concluded that, with the continuing emission of GHG (greenhouse gases), the mean surface temperature may increase between 1.5 and 5.8 degrees Celsius during the next 100 years. Documentation being used in the preparation of the Fourth Assessment Report, due to be released by the year 2007, corroborates the range of the projected increase.<sup>1</sup> A change of this magnitude is unprecedented and will result in significant impacts to be felt at a global scale. Along with changes in mean climatic conditions, the biosphere potentially faces irreversible and catastrophic system impacts associated, for example, with the reduction of thermohaline circulation, the melting of the Greenland ice sheet (Epstein 2005), the subsidence of small islands, increases in intensity of hurricanes (Webster et al. 2005), the elimination of permafrost in Siberia and northern Canada and affect ecosystem integrity. Climate change is the most serious challenge being faced by the global ecosystem. Global warming will affect all species and exacerbate the stresses already being experienced by ecosystems, as recently documented in the Millennium Ecosystems Assessment Report (MEAR 2005). Thus, climate change may further accelerate both the ongoing impoverishment of global biodiversity caused by unsustainable use of natural capital, and the processes of land degradation.

**Mexico has been identified as particularly vulnerable to the impacts of global climate change** (First and Second Communication, NC1/NC2 to the UNFCCC), many of which are irreversible. These impacts include continuous increase in the sea surface temperature of the

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<sup>1</sup> The reference emission scenarios (SRES) have been criticized for overestimating future emissions. However, the post-SRES literature shows an even higher emission range (IPCC, FAR workshop, February 2005).

Gulf of Mexico, continuous sea level increase, more high intensity hurricanes, changes in water precipitation cycles and others. Given the long term irreversible character of these changes and the nature of the impacts, **it is imperative for Mexico to start a process of adaptation.** The NCs have assessed the vulnerability to climate change focusing in areas and sectors seen as particularly fragile to climate impacts: water resources, forestry, agriculture, coastal zones, in particular wetlands, drought and desertification. Key areas of concern are the impact on water resources and specifically on the coastal region of the Gulf:

**Mexico's water resources are being and will continue to be seriously affected by climate impacts.** Water is one of the most important natural resources for the country, and is considered to be a matter of national security. **The severity of Mexico's water problem is very serious.** Half of the water consumed from underground sources is extracted from 102 already overexploited aquifers. In three out of 13 hydrologic-administrative regions water availability values fall below 1,700 m<sup>3</sup> per capita per year, and are considered insufficient to meet human and environmental needs. Net precipitation, according to some global circulation studies may decrease over the northern half of the country. Besides, since at present all water uses in the country are vulnerable to climatic fluctuations, the situation is anticipated to worsen under conditions analyzed by the IPCC, under the SRES scenarios. The management of water resources would become more complex, exacerbating cross-border allocation of resources. Results from recent studies<sup>2</sup> on the vulnerability of hydrologic regions in Mexico suggest that potential changes in air temperature and precipitation may have a dramatic impact on the pattern and magnitude of runoff, on soil moisture and evaporation. Global warming will also impact the aridity level of some hydrologic regions.

**Coastal regions, and in particular wetlands, are very vulnerable to sea level increases, intensification of hurricanes, fluctuations in water regimes and storm surges.** The impacts of climate change are affecting the integrity and functionality of wetlands. Wetlands in the Gulf of Mexico have been identified by INE as the most critical and most threatened by anticipated climate changes The NC1 and NC2<sup>3</sup> and other studies have documented ongoing changes in the wetlands of the Gulf of Mexico and have raised urgent concerns about their integrity. These wetlands perform very important environmental functions that are critical to economic activity over a wide area of the country. Located in the lower reach of the Gulf's main water tributaries, wetlands are considered the most productive ecosystems in the country. **Their behavior and fate are closely linked to the water, quantity and quality, production in the upper watersheds.** Changes in the distribution and characteristics of river flows will affect the biological functioning of the wetlands, impacting the economy of coastal areas<sup>4</sup>. The functionality and conservation of the wetlands depend on

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<sup>2</sup> Mendoza, Victor, Elba Villanueva, and Julián Adem. "Vulnerability of basins and watersheds in Mexico to global climate change." *Climate Research*, Vol. 9: 139-145, 1997. Conde C, D Liverman, M Flores, et al, "Vulnerability of rainfed maize crops in Mexico to climate change." *Climate Research*, Vol. 9,: 17-23; 1997.

<sup>3</sup> National Communications to the UNFCCC one and two, 2001, 2004.

<sup>4</sup> The Gulf of Mexico is home to more than 75% of all coastal wetlands in Mexico. In these geo-forms originate 45% of all shrimp caught, 90% of the country's oysters and no less than 40% of commercial fishing volume. Wetlands provide many environmental services, including regulation of the hydrological regime; human settlement protection through flood control, protection of the coastal region, help in mitigating storm impacts; control of erosion; conservation and replenishing of coastal groundwater tables; reduction of pollutants; regulation and protection of water quality; retention of nutrients, sediments, and polluting agents; providing sustenance for many human communities settled along the coast; and habitats for waterfowl and wild life. Total mangrove surface calculated for the Gulf of Mexico reaches 545 000 Ha, in 2000; and it is being lost at a rate of at

**the environmental and water management in extended areas;** coastal wetlands play an important role in the water cycle and have an incidence on the vulnerability of near coastal assets in Mexico. Sea level increases in the Gulf of Mexico are modifying the saline equilibrium forcing sea water into the boundary layer of freshwater. Anticipated modifications in precipitation patterns in the North of Mexico will affect natural drainage systems, further deteriorating the natural water balance of these systems. Further, weakened marshlands and mangroves will be less likely to stand increased weather variability and weather events in the Gulf of Mexico. Increases of 40% in the number of high intensity hurricanes and landfalls in the Gulf of Mexico over the baseline period of 1961-1970 have been registered during the last ten years, with the potential to cause serious ecosystem disruption, property and human losses. The ecological and economic consequences of all these impacts can be staggering.

**The threat is particularly worrisome as the Gulf of Mexico possesses one of the richest, more extensive and productive ecosystems on Earth: coastal wetlands, which cover an area of over 14,000 sq. km.** The Gulf of Mexico coast is flanked by 27 major systems, estuaries, bays and coastal lagoons that serve as shelter, feeding, and reproduction areas for numerous species that represent the most important riverside fisheries. On the other hand, the coastal swamps of Tabasco and Campeche are home to 45 of the 111 endemic species of aquatic plants registered for Mexico, which makes one of the most important reserve for aquatic plants in the world (Caso *et al.*, 2004)<sup>5</sup>.

Urgent actions are thus required to formulate adaptation policy actions and measures that can protect the environmental functions of the Gulf of Mexico wetlands and their rich biodiversity. The Federal and regional governments are thus focused on the need to formulate and implement development plans that take into account the impacts of climate change in coastal wetlands. Work on adaptation measures in these wetlands will illustrate how to address wider policy issues in the water sector.

The Bank/GEF. The World Bank in Latin America is playing a key role in the adaptation field. The region has the largest portfolio of any developing agency on adaptation (Colombia: Integrated National Adaptation Program, P083075 and Dominica, St. Lucia and St. Vincent: Implementation of Adaptation Measures in Coastal Zones, P090731; Regional Andes Adaptation Program for Glacier Dependent Ecosystems and Central America: Addressing Impacts of Intensification of Hurricanes in the Caribbean Coast). The project would thus benefit from World Bank-assisted preparation activities for projects that dwell on adaptation issues.

In 2005 G8 participants, including the Bank (The Gleneagles Communique, 2005), acknowledged the seriousness of the challenge posed by climate change and reaffirmed the urgency of adaptation efforts. The leading industrial nations made the commitment to work with developing countries to improve their resilience and to integrate adaptation goals into sustainable

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least 1% annually since 1976 (higher estimates reach 2.5% per year; INE, September 2005: "Evaluación preliminar de las tasas de pérdida de superficie de manglar en México"). Global circulation models coincide on identification of the Gulf of Mexico as the most vulnerable coastal region for impacts from climate change. While other coastal areas will also be prone to similar impacts, the limited resources available and the higher concentration of impacts justify the selection of this zone as focal point for the proposed project.

<sup>5</sup> Caso, M., I. Pisanty y E. Ezcurra 2004: Diagnóstico ambiental del Golfo de México. Vol. I y II. INE/Semarnat

development strategies. In this context, the World Bank was requested to develop a strategy on climate change for Mexico and formulate an investment framework. In both the strategy and the framework it is clear that adaptation to climate change is priority number one for Mexico. The proposed project was identified as the critical activity of the adaptation agenda.

## 2. Proposed objective(s)

**The project development objective is** to formulate and implement adaptation policy actions and specific measures in representative systems of Gulf of Mexico wetlands in order to protect their environmental functions and their rich biodiversity from climate change related impacts, and improving the knowledge base to ascertain with a higher level of certainty the anticipated impacts from climate change on the country's water resources, with a primary focus on coastal wetlands and associated inland basins.



Source: Ortiz Pérez y Méndez Linares. 1999.<sup>6</sup>

## 3. Preliminary description

- a) **Identification of national policies to address the impacts of climate change on water resources at the national level (global overlay).** This component will complement government efforts –supported by the Bank and other IFI- to improve the technical, institutional and financial arrangements for effective and efficient water resources management. In particular the project will identify and assess current and feasible policy options and measures that could be adopted at a national level to incorporate the anticipated impacts of climate change on existing water supply and conservation programs (global overlay). Based on projected impacts of climate change on water availability at the annual and seasonal level, the component will update the diagnosis of current impacts and produce a comparative analysis of alternative options and recommended policy measures.
- b) **Evaluation of current and anticipated effects of climate change on the integrity and stability of Gulf of Mexico wetlands.** The project would support efforts for: i) Inventorying the present state of the wetlands, in both their biophysical and socio-economic aspects; ii) Evaluating the impact that climate change may have on their climatic and hydro-dynamic

<sup>6</sup> Ortiz Pérez, M.A. y A. P. Méndez Linares. 1999. Repercusiones por ascenso del nivel del mar en el litoral del Golfo de México. En: Gay García, C. (Editor y Compilador) México: una visión hacia el siglo XXI. El cambio climático en México. \*Versión electrónica, con textos revisados. Impreso 1999, revisado 2003

characteristics and on changes in the estuary systems and the extension of the wetlands, coastal areas and determining effects on biotic processes, the composition and distribution of native resident species and of migratory species, on flooding and on expansion of the Gulf of Mexico “dead zone”; iii) Comparing climate change impacts on wetlands with the impact on wetlands caused by land use change and poor water management strategies; iv) Simulations of possible distribution scenarios of indicative species as consequence of climate change, by means of models that predict comparatively among selected site,; v) Determining the impact on the populations of native and migratory species, due to the quality and quantity of water at each of the selected sites, and, vi) Identifying high-priority wetlands (including those used by migratory and resident birds) within the area of study which are currently protected, as well as those most likely to be impacted by climate change and other multiple stressors.

c) **Implementation of pilot adaptation measures.** The project would support:

- **Planning and implementing wetland restoration strategies**, taking into account sand dynamics and hydrology. In those sites where hydro-dynamics have been affected by climate change, land use change, or soil degradation, initial activities will include the removal of soil or sand sediments obstructing water flows and the provision of continental water through the waterways that feed the wetland in question, enough for their restoration. In those wetlands that require it, native aquatic flora will be reintroduced.
- **Preparing plans of action in which climate change adaptation measures and resource management programs are integrated for the protection of threatened habitats/species.**
- **Restoring of mangrove swamp ecosystems by establishing adequate management programs** like permanent/seasonal closed areas as well as by reducing/preventing changes in land use and promoting more efficient water management strategies. This would include the restoration of areas which may have been affected by economic activities or by the sedimentation of soils, the implementation of activities for restoration of mangrove hydro-dynamics, and the reintroduction of native species of mangrove.
- **Implementing specific adaptation measures to maintain water supply for productive sectors.** This will involve the adoption of water conservation and use measures for communities and municipalities around rivers and wetlands on water supply, water quality; urban, suburban and industrial waste water management in areas adjoining wetlands. The implementation of specific measures will follow cost-effectiveness criteria and would include consultation efforts with local communities for management and surveillance, as well as a process of routine assessment of the impacts of any implemented activities.
- **Develop mechanisms to promote sustainable land-use patterns that maintain the functional integrity of wetland ecosystems in the region.** Promoting the sustainable use for wetlands and keeping the environmental and ecosystem services for native and migratory species as well as sustainable economical activities tuned to the specific characteristics on each area.

4. Safeguard policies that might apply

*[Guideline: Refer to section 5 of the PCN. Which safeguard policies might apply to the project and in what ways? What actions might be needed during project preparation to assess safeguard issues and prepare to mitigate them?]*

The safeguards Environmental Assessment (EA) (OP 4.01), Natural Habitats (OP 4.04) and Forests (OP 4.36) might apply under this project.

Under the EA the impact of the following activities will be reviewed: the removal of soil or sand sediment obstructing water flows, the provision of continental water through the waterways that feed the wetland in question, the restoration of areas which may have been affected by economic activities or by the sedimentation of soils, the implementation of activities for restoration of mangrove hydro-dynamics, adoption of water conservation and use measures.

Although the project appears to comply with the spirit and letter of the Natural Habitat and Forests policies, activities focusing on the protection of threatened habitats/species, the possible re-introduction of native aquatic flora, and the reintroduction of native species of mangrove will be assessed during project preparation from a biodiversity standpoint.

The Pest Management (OP 4.09) safeguard is not expected to be triggered because the project is not expected to (i) lead to increased pesticide use; (ii) support pest management practices that could be risky or unsustainable from an environmental or health standpoint; or (iii) procure any pesticides.

The triggering of social safeguards is not expected to be triggered under this project. However, during the project preparation it will be reviewed if the project might cause a limited access to the use of natural resources, through the consideration of permanent/seasonal closed areas for the restoration of mangrove swamp ecosystems as well as through reducing/preventing changes in land use and promoting more efficient water management strategies.

#### 5. Tentative financing

Source:	(\$m.)
BORROWER/RECIPIENT	16
GLOBAL ENVIRONMENT FACILITY	8
Others (to be confirmed)	8
Total	32

#### 6. Contact point

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