

INTEGRATED NATIONAL ADAPTATION PILOT: STRENGTHENING THE RESILIENCE OF THE COASTAL WETLANDS IN THE GULF OF MEXICO TO CLIMATE CHANGE (THROUGH IMPROVED WATER RESOURCE MANAGEMENT)



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National Institute of Ecology (INE)



INE is a decentralized body of the Ministry of Environment and Natural Resources (SEMARNAT).

INE has under its mission the coordination of research on environmental issues, in order to provide data, ideas, proposals, and technical inputs for decision-making to support the environmental and natural resources management of Mexico.

Regarding Climate Change INE is in charge of:

- ❖ Developing and integrating the National Communications of Mexico to the UNFCCC
- ❖ Up-dating of National Greenhouse Gas Inventories
- ❖ Technical studies on GHG mitigation
- ❖ Vulnerability assessments and adaptation options to climate change.

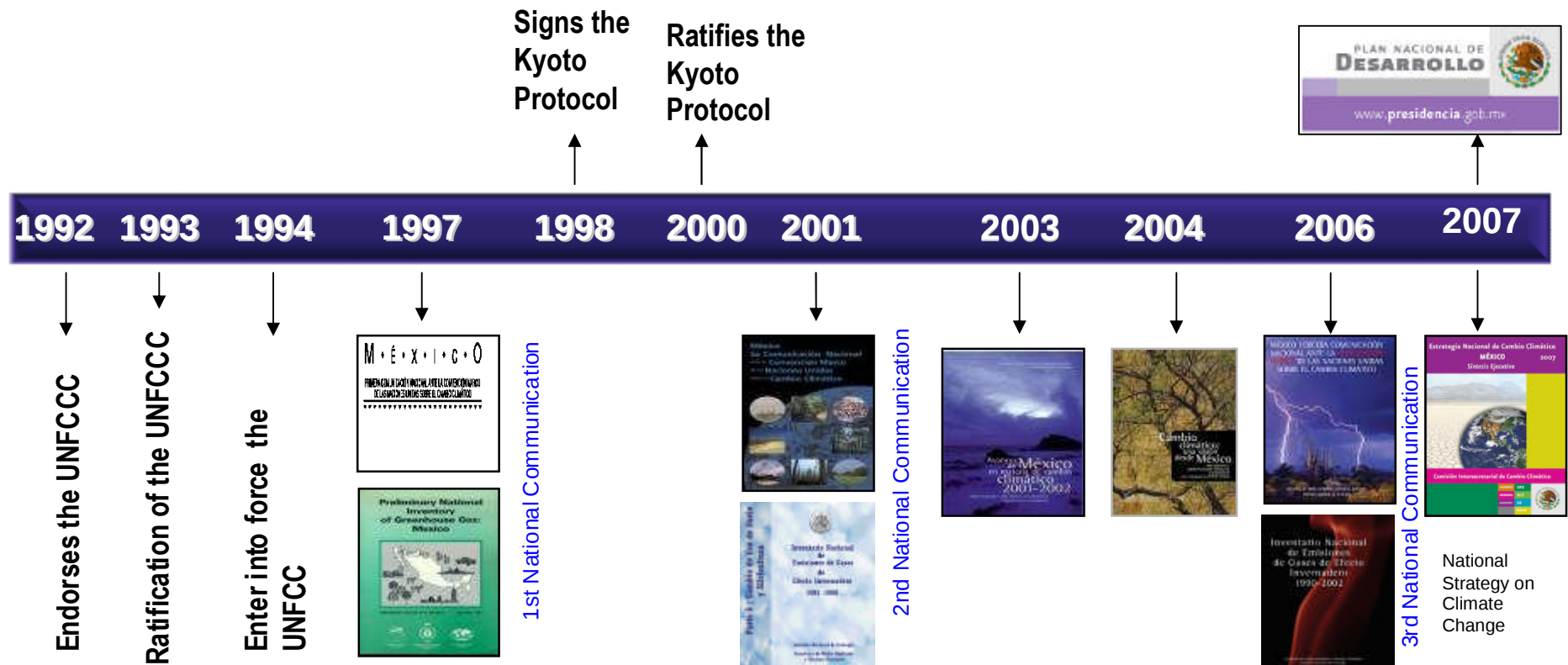


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Mexico's Activities on climate change

Mexico has made efforts to comply its commitments under the United Nations Framework Convention on Climate Change (Articles 4.1 and 12.1).

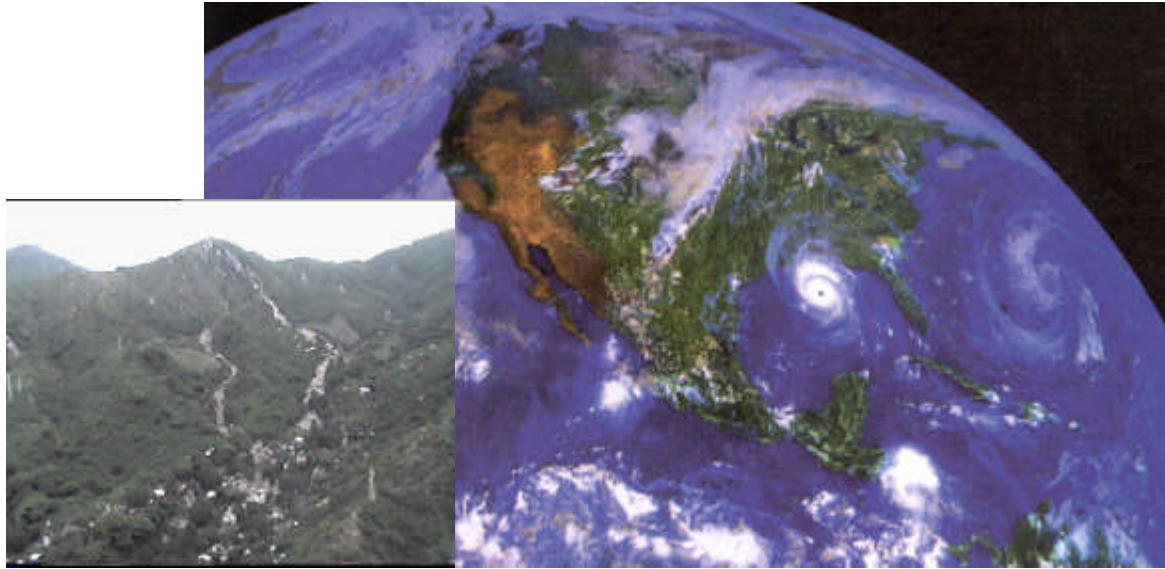


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Mexico and Climate Change

Mexico, due to its geographical location, topography and socio-economic aspects, is particularly vulnerable to the impacts of variability and climate change.



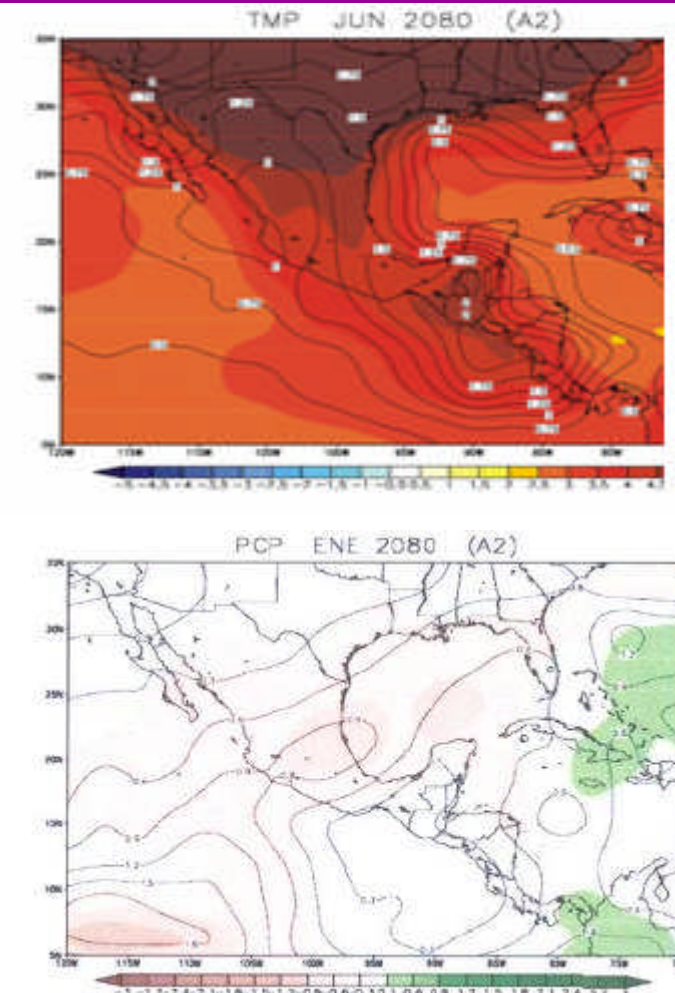
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Climate change scenarios for Mexico:

Expected changes in temperature and precipitation

- Very likely that mean temperature in Mexico will increase by 2 to 4°C by 2020, 2050 and 2080, mainly in the northern part of Mexico.
- In the Winter, very likely that precipitation will decrease by 15% in the central part of the country, and by 5% in the region around the Gulf of Mexico.
- In the Summer, precipitation may decrease by 5% in the central part of Mexico.
- Delays on the beginning of the rain season are expected, and the season will likely extend to the Autumn in many parts of the country.

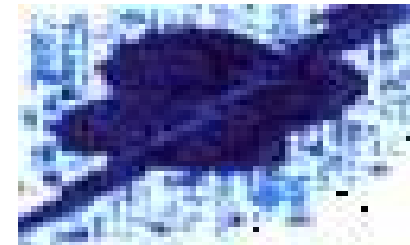


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Expected impacts of climate change in Mexico

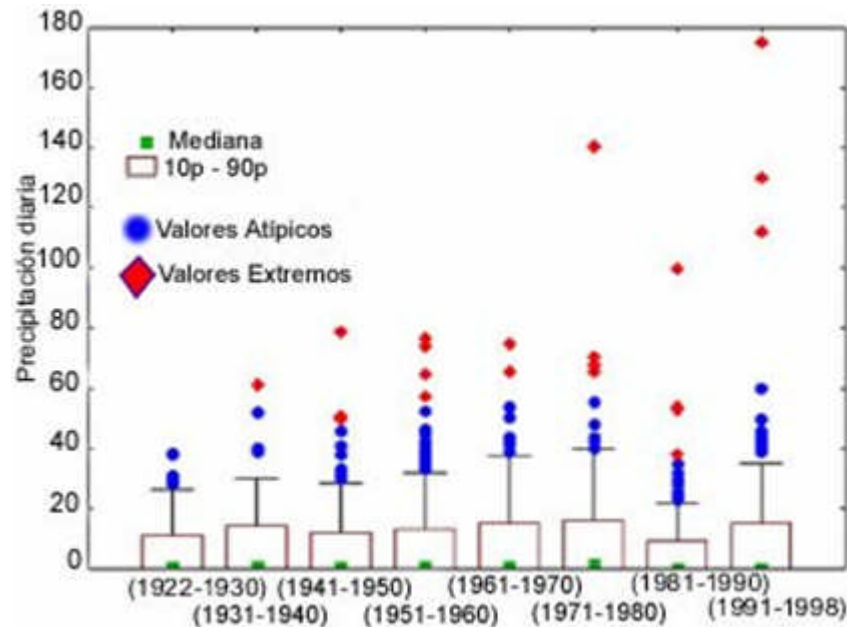
- Sea surface temperature in the Caribbean, the Gulf of Mexico and the Pacific Ocean may increase by 1 or 2°C, which may increase the probability of stronger hurricanes.
- The hydrological cycle will intensify, with an increase on heavy rains and storms, and longer and more frequent drought episodes. The most recent climate observations in Mexico also suggest so.
- Forest fires may increase in number.
- Grasslands, xerophytes and forests extension and distribution on the Mexican territory will be affected. By 2050, between 53 and 62% of all vegetation cover will be exposed to different climate conditions compared to nowadays.



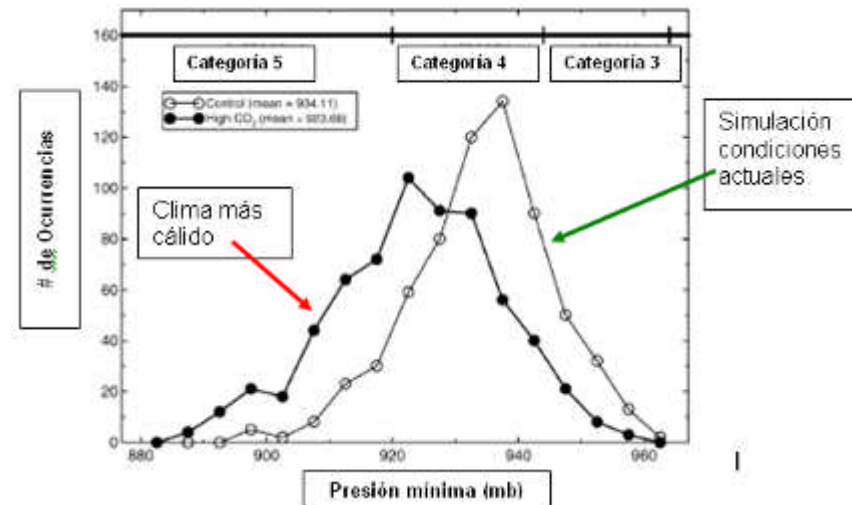
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Expected Impacts in extreme hydro-meteorological phenomena under climate change



Trends in extreme rain events in Motozintla, Chiapas.



Increased likelihood of more intense hurricanes (Category 4 and 5)

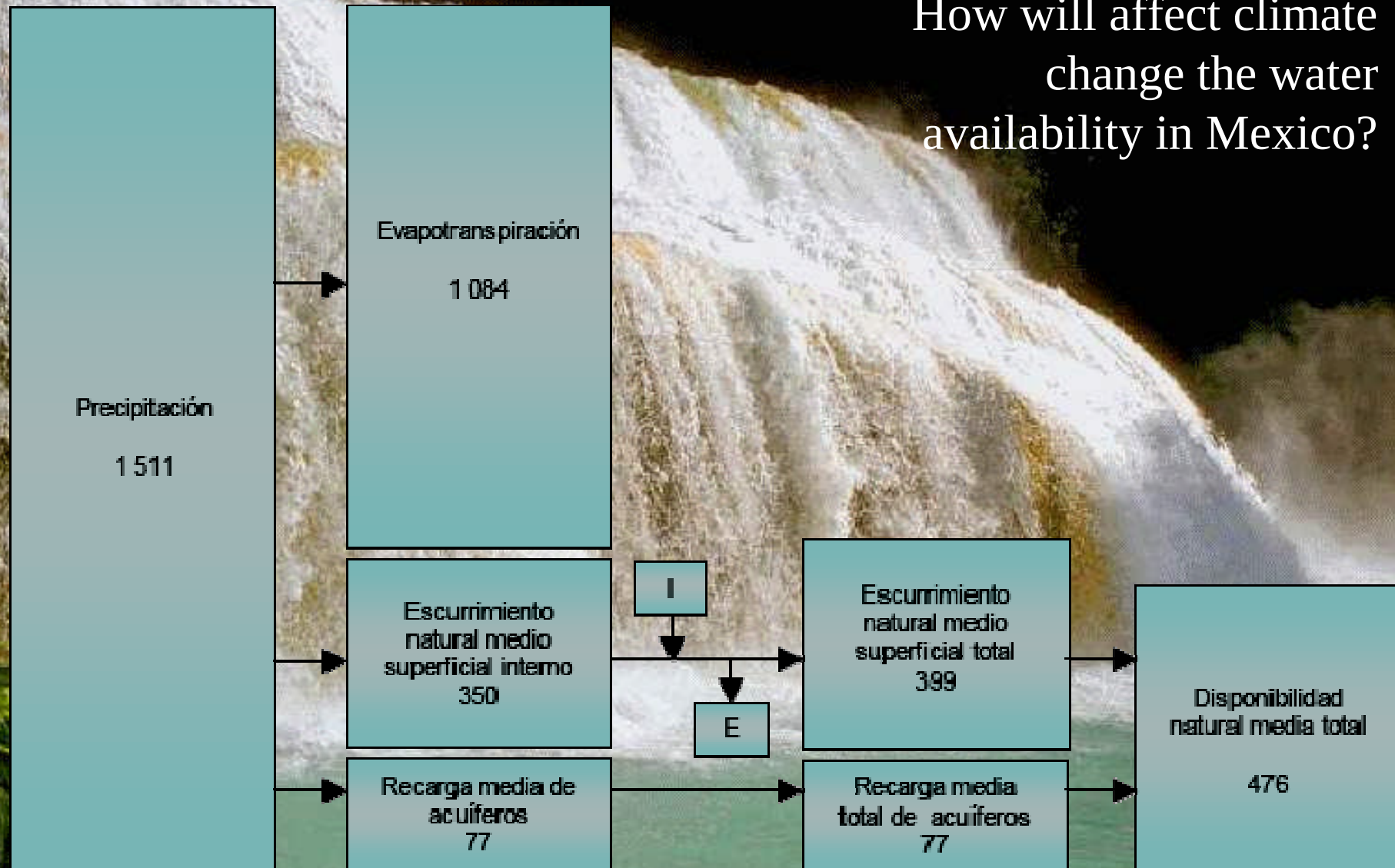
Expected changes are consistent with those projected under CC according to the IPCC.



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How will affect climate
change the water
availability in Mexico?



De Importaciones de otros países 48.9
E = Exportaciones a otros países 0.43

Fuente: Subdirección General Técnica.

The availability of water resources is likely to be one of the anticipated major problems due to changes in the hydrological cycle under climate change.

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Objective

- ❖ Reducing vulnerability to the impacts of climate change on water resources, with a focus on inland basins and associated wetlands.
- ❖ Identify national policies to address the impacts of climate change on water resources at national level, to assess current and future effects of climate change on the integrity and stability of wetlands of the Gulf of Mexico, and implement pilot adaptation measures to protect its environmental functions and biodiversity to the impacts related to climate change.



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Background

- ❖ **Mexico has been identified as particularly vulnerable to the impacts of global climate change** (First, Second and Third National Communications to the UNFCCC), **most of them will be irreversible.**
- ❖ **Wetlands provide environmental goods and services and perform very important environmental functions** that are critical for economic activity and civil protection in a wide region of the country.
- ❖ **The wetlands of the Gulf of Mexico have been identified** by the National Institute of Ecology (INE) / Ministry of Environment and Natural Resources, **as the most critical and threatened ecosystem by the effects of climate change.** They are vulnerable to increases in sea level, intensifying hurricanes, fluctuations in water regimes and storm surges.



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Considerations

- ❖ INE and the Metropolitan Autonomous University, with technical and financial support of GEF through the World Bank, developed the preparation phase of a multi-year adaptation project.
- ❖ The funds for the project were covered by the WB, through the bloc PDF-B.
- ❖ Funds PDF-B covered project studies and a workshop.
- ❖ The technical studies were coordinated by INE and the WB.



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Cont...

- ❖ The Project team coordinated its work with other project activities such as INAP and SPA, to generate synergies, to learn and not to duplicate efforts in activities during the implementation and preparation phases,
- ❖ The preparation phase allowed assessing the effects of climate change on the integrity and stability of wetlands of the Gulf of Mexico, and
- ❖ It allowed to identify adaptation measures to be implemented in the short term (multi-year phase) to protect its biodiversity and environmental functions to the impacts related to climate change.



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Estimated costs for project preparation

Sources of Co-financing, Bloc PDF-B			
Co-financing (source)	Classification	Type	Amount (USD\$)
GEF		Donation	300,000
INE/SEMARNAT	Agency applicant	In kind	200,000
WB		Donation	50,000
Other Mexican government agencies		Federal Fund	55,000
GEF/UNDP		Funds for study of the Third National Communication	75,000
Total Co-financing			680,000



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Activities carried out with PDF-B funds

Project Coordination
Analysis of adaptation measures
Socio-economic analysis
Logical Framework for the project and promotion and development of a participatory planning workshop
Biophysical and ecological diagnosis and support system for decision-making
Climate scenarios (Modeling)
Anthropogenic impacts (baseline study) Land Use
Analysis and institutional and funding
Anthropogenic impacts (baseline study) Water Use



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Pilot wetlands identified

The selection process considered:

- Experience and knowledge of experts that participated in the project;
- Evaluation of its importance related to the representativeness of each ecological region, with some ecological and biological priority of the wetland according to criteria of SEMARNAT, CONABIO, CONANP, RAMSAR Site, and the Council for the Conservation of Wetlands of North America;
- The state of preservation, alteration and the human presence - since the minimum density, until the construction of urban and industrial infrastructure; the level of involvement that could face under climate change scenarios, due to increase in temperature and in the sea level, changes in runoff and intensification of extreme hydro-meteorological phenomena.



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Pilot wetlands identified

Pilot and control wetland

Coatzacoalcos River (Uxpanapan-Lagoon El Colorado). Veracruz

Papaloapan River-(Alvarado Lagoon). Veracruz

Cancún (Nichupte-Nizuc lagoon). Q. Roo

Panuco River. Corredor Sistema Lagunar: Altamira/Ciudad Madero/Tampico. Tamaulipas

Sistema Lagunar Carmen -Pajonal-Machona (Río San Felipe, Pajonal y Santa Ana). Tabasco

Punta Allen (Sistema Lagunar Boca Paila). Q. Roo

San Fernando River-Lagoon la Nacha. Tamaulipas

Sistema los Petenes. Campeche



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Climate change scenarios

The wetlands of northern Gulf of Mexico will face increases in temperature from 1° to 4 °C, reduction in rainfall from 0 to 10%, increase in evaporation from 5 to 15%, hurricanes, cold fronts and storms more intense and sea level rising.

Wetlands in the center of Gulf of Mexico will face increases in temperature from 1° to 4 °C, variations in rainfall from -5 to +10%, cold fronts and storms more intense and sea level rising.

Wetlands in the Caribbean of Mexico will face increases in temperature from 1° to 3 °C, reduction in rainfall from 0 to 10%, hurricanes, cold fronts and storms more intense and sea level rising.



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Climate change scenarios

REGION/ PERIODS CHANGE CLIMATE	T ($\Delta^{\circ}\text{C}$) PCP (%) Δ EXTREME EVENTS IMPACT	T ($\Delta^{\circ}\text{C}$) PCP Δ EXTREME EVENTS IMPACT	ΔT ($^{\circ}\text{C}$) ΔPCP EXTREME EVENTS IMPACT
<i>Río San Fernando</i>	1 - 2 $^{\circ}\text{C}$ apr – sep -5 to +5 % Waves of heat + evap (5%) + storms, cold fronts hurricanes more intense	2 - 3 $^{\circ}\text{C}$ apr – sep -10 to 0 % Waves of heat +evap (10%) Droughts + storms hurricanes more intense + rising in sea level cold fronts	3 - 4 $^{\circ}\text{C}$ apr – sep -10 to -5 % +evap (15%) Droughts + rising in sea level hurricanes more intense Waves of heat + storms
<i>Rio Papaloapan</i>	1 – 2 $^{\circ}\text{C}$ may – sep -5 to +10 + storms, cold fronts more intense Waves of heat	1 – 2 $^{\circ}\text{C}$ may – sep -5 to +10 + storms, cold fronts more intense, Flooding Waves of heat	2 – 3 $^{\circ}\text{C}$ may – sep -5 to +10 + storms, Flooding cold fronts more intense Waves of heat
<i>Cancún</i>	1 – 2 $^{\circ}\text{C}$ jun – oct -5 to 0 hurricanes more intense + storms, cold fronts more intense	1 – 2 $^{\circ}\text{C}$ jun – oct -5 to -0 hurricanes more intense + rising in sea level Flooding + storms, cold fronts more intense	2 – 3 $^{\circ}\text{C}$ jun – oct -10 to -5 hurricanes more intense Flooding + rising in sea level + storms more intense



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Change in land use

- Alteration of land use modifies the water balance and alters the fragile ecosystem dependent on water resources.
- The land use changes can have significant impacts on regional climate and exacerbate the impacts of climate change.
- Based on the results of trends in land use (1976 - 2000), was defined that the main causes of change (attractors) for wetlands (identified as hydrophilic vegetation) for 5 of the 8 sites identified, is the **conversion of these areas to grasslands, the activity of agriculture and the expansion of human settlements.**



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Change in land use

- Changes in land use projected for 2020, are associated with deforestation by farming activities and urban growth, altering the albedo, the roughness of the terrain and the moisture retained in the soil.
- The projection of land use to 20 years show a reduction in areas with higher density of vegetation such as different types of forest, the disappearance of mangrove forests and an increase in areas with vegetation rala, such as grasslands.
- This change is very important because vegetation poorest causes less infiltration and increases in runoff. It also reduces friction between the runoff and the soil surface, increasing the speed of flows.



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Identification of adaptation measures

The measures were identified based on the major threats and climate scenarios modeled by wetland, literature review, discussion with the working group and from the workshop held in Veracruz.

It was built an initial list of general adaptation measures for wetlands of the Gulf of Mexico that were identified and delimited according to:

- geography and landscape conditions of the Gulf of Mexico
- trends of environmental degradation (mainly land use changes)
- socio-economic conditions prevailing
- main threats identified with climate scenarios



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Identified adaptation measures

General Adaptation measures for the pilot sites		
Components	Suggested Adaptations	Elements of the programme's action.
Territory	Identification and contact of agents, actors and key institutions	Identification of sectoral, federal and state programs with territorialized impacts on the measures identified
	Restoration and Protection	The deterioration of current conditions and trends, are constraints on the current and future vulnerability, recovery of ecosystems and restoration of the hydrological cycles (intervene positively in them) is crucial.
	Spatial planning	Made through instruments; urban policy, ecological or environmental, civil protection (risks), industrial, rural development, planning state and sectoral (agriculture, livestock, fisheries, aquaculture, etc.)
Knowledge and information management	Early Warning System	Agreements for the initial formation of institutions and early warnings. Analysis and meetings with academic centers, community and government representatives. Agreements and training with media and NGOs.
	Information and knowledge (capacity building of adaptation).	Training human resources. Development of education and research programs. Schemes of efficient communication.
	Development of communication strategy (communication campaigns and awareness)	Contracts with designers, agreements and meetings, seminars and conferences. Awareness of trends of deterioration and CC scenarios as well as threats in the area.
Civil protection	Encourage for adaptation actions together with the institutional structure of civil protection as a project's partner initial.	To promote and understand that there is great potential if the actions are linked to the issue of civil protection. The environment speech is in transition towards a new conversion, where its value is intrinsically linked to civil protection.

Identification of specific adaptation measures

Threat	Who are vulnerable?	Which are vulnerable?	Why are vulnerable?	Suggested Adaptations	Stages
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Stages:

- 1 Preparation
- 2 Strengthening
- 3 Operation

These steps mark inherently certain requirements such as times and agreements, their selection were based on the criterion of consultants.



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Example of adaptation measures in the pilot sites San Fernando and Pánuco river to face major threats identified

Threat	Who are vulnerable?	Which are vulnerable?	Why are vulnerable?	Suggested Adaptations	Stages
Extreme events heat	Public health	Increased morbidity and mortality by waves of heat and dehydration. Increase and redistribution of vector-borne diseases such as mosquitoes (malaria, dengue, etc.). Decomposition of food.	Physical and biological characteristics mainly in children and old people.	Improving insulation systems, ventilation and temperature control in housing.	3
				Evaluate and promote agreements with the health sector and local governments to harmonize measures that do not affect the environment (pest control, water pollution and deforestation)	1
				Adjust building codes and adjust the existing infrastructure to improve the thermal balance of buildings	2
	Biodiversity and Ecosystems	Fires.	High temperatures cause stress on vegetation, combined with the indiscriminate use of fire.	Prevention and control of forest fires (help federal- state programs between environmental and agricultural)	2
				Establishment of biological corridors between protected natural areas and areas of natural vegetation preserved, to allow the migration of species and propagules to more suitable climatic zones.	3
	Agriculture	incremental Risk to Disaster. Agricultural	High temperatures cause stress and shrivel in crops.	Planning: Using varieties with low water requirements, livestock management schemes differentiated.	1
				Planning agricultural: research, promote and improve cultivation practices, changes in planting dates.	1
				Development of pilot projects with various funding sources and federal programs to address the risks.	2

Participation of indigenous communities

In Veracruz are identified indigenous communities of Huastecos, Chontales and Nahuas. The Chontal population took five municipalities in the state of Tabasco, on the Yucatan Peninsula is located Maya population, while in the state of Tamaulipas the indigenous population is virtually without presence.

The project identified that the indigenous population is often more vulnerable to climate disasters due to its thinking, culture, social cohesion, forms of organization and deep-rooted to the land.

Indigenous communities are directly impacted by adaptation measures identified.



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Publication of the project

INE is coordinating a consultancy to generate a publication that will comprise the outputs from the preparation phase of the project, in October, 2008 will be finished the book and will be an electronic file for consult in the Webpage of WB and INE.



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Next steps

- The continuation of the project began in 2008 and will end on September 30, 2009.
- The donation from the Japanese Government, through WB, is U.S. \$ 545, 000 dollars

Objective

To support Mexico's response to the impacts of climate change on water resources and coastal wetlands.

The project consider the generation of products aimed at diagnosing current condition and projecting the future status of wetlands considering the potential impact of extreme events. Special emphasis will be placed in the condition of the water sector in the coastal region of the Gulf of Mexico. Given the increasing population growth in coastal cities, work will analyze the impacts of climate change and extreme events in the safety of urban centers and ecosystems (wetlands) that provide environmental services to the population centers.



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Physicists impact assessment of current and future hurricanes and other hydro-meteorological events in the Gulf of Mexico coast

The work to develop as its main objective to support Mexico's response to the impacts of climate change on water resources and coastal wetlands, in particular **considering the impacts of extreme hydro-meteorological phenomena.**

Special emphasis will be placed in the condition of the water sector in the coastal region including both the effects of climate change in terms of changes in extreme hydro-meteorological phenomena (hurricanes, storm surges, heavy rainfall), such as those related to changes in the land use, pollution and overexploitation of water resources.

Given the increasing population growth in coastal cities, work will also analyze the impacts of climate change and extreme events in the safety of urban centers and ecosystems (wetlands) that provide environmental services to the population centers.



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Physicists impact assessment of current and future hurricanes and other hydro-meteorological events in the Gulf of Mexico coast

Much work will require management climate and hydrological models, which use the established cooperation agreements with groups working on:

- *Meteorological Research Institute of Japan,*
- *National Center for Atmospheric Research in the United States*
- *Georgia Institute of Technology.*

In the first instance will apply the **Earth Simulator**, to discuss in great space detail, some of the climate change scenarios of the Japanese model of the climate.

Moreover, once established mechanisms for interaction with the **North American Regional Climate Change Assessment Program (NARCCAP) from NCAR**, will have a larger number of high-resolution scenarios to give statistical stability and measure the uncertainty in the projections of change climate at the regional level.

Finally, we will work in conjunction with the **Georgia Institute of Technology** in the analysis of more intense hurricanes in the pilot basins of the Gulf of Mexico under study.



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Lines of Action

Socio-environmental Analysis

Wetlands-Diagnosis, assessment of socio-Environmental factors that affect the status of coastal regions, geographic information systems in ecosystems;

Climate change scenarios (Modeling)

Analysis of variability and climate change in Mexico, application of mesoscale models to study dynamic process of climate variability, generation of regional climate change scenarios, studies of vulnerability and adaptation to climate change.

Use of Water in basin. Impacts anthropogenic

- Analysis of saline intrusion into aquifers and groundwater recharge;
- Analysis of Water Quality and Geographic Information Systems in Hydrology;
- Analysis of processes in surface hydrology and models of extreme precipitation events and hydrology;
- Processes of circulation and transport in coastal lagoons, circulation models and water quality.



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Lines of Action

Land use changes. Anthropogenic impacts

- estimate scenarios of change in land use from the pilot sites and impacts on the hydrological cycle
- To carry out regular field trips.

Analysis of adaptation measures

- Rearrangement Territorial in basins, integrated management of watersheds and sustainable systems
- Work nearly with stakeholder from the wetlands pilot and include their participation.

Socio-economic Analysis

- estimate of the socio-economic costs of the expected impacts of climate change on human settlements, socio-economic activities and socio-ecosystems, for the coming decades.



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Identifying counterpart, NAWCA

As a co-financing of the multi-year project, it was submitted to the North American Wetlands Conservation Act (NAWCA) a project proposal for funding, through Conservation International Mexico A. C., the World Bank and INE.

The aim of this proposal is to cover the cost of some adaptation activities identified in the multi-year project to matching the funds that would provide the GEF.



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Thank you for your attention!

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