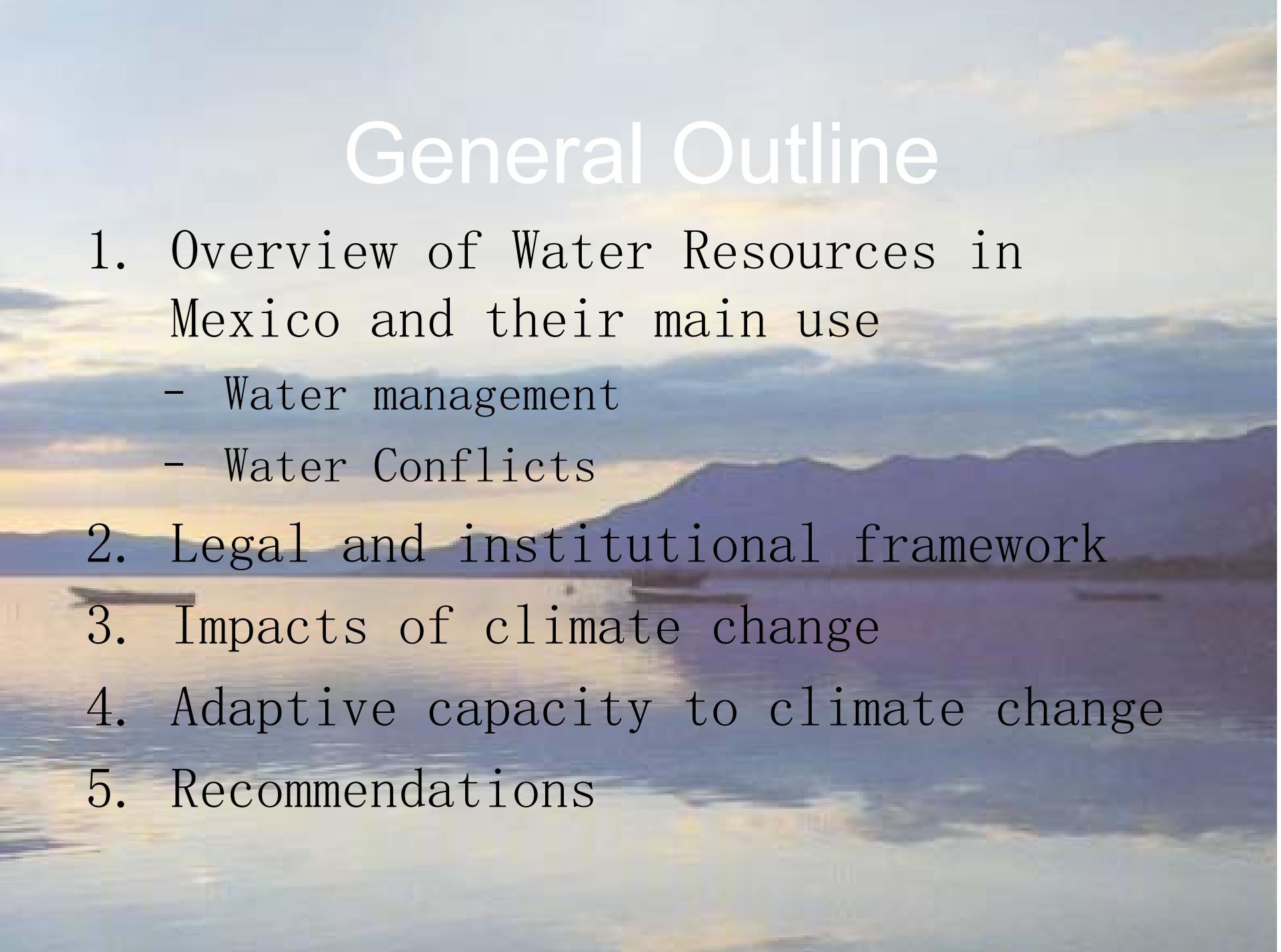
A photograph of a young girl with dark hair, wearing a green short-sleeved shirt with colorful embroidery on the shoulders and a long red skirt with a blue hem. She is standing on a grassy field at night, holding a bubble wand and creating a long, thin stream of bubbles that curves across the frame. The background is dark.

WATER AND CLIMATE IN MÉXICO

Fernando González¹
and
Víctor Magaña^{1,2}

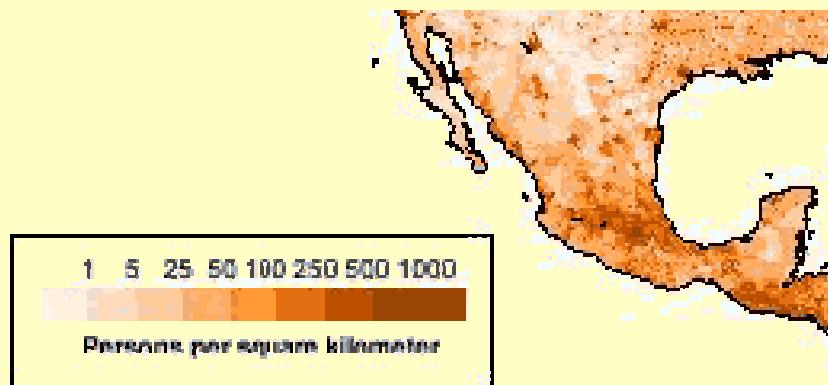
*1 Universidad Nacional Autónoma de México
2 Instituto Nacional de Ecología*



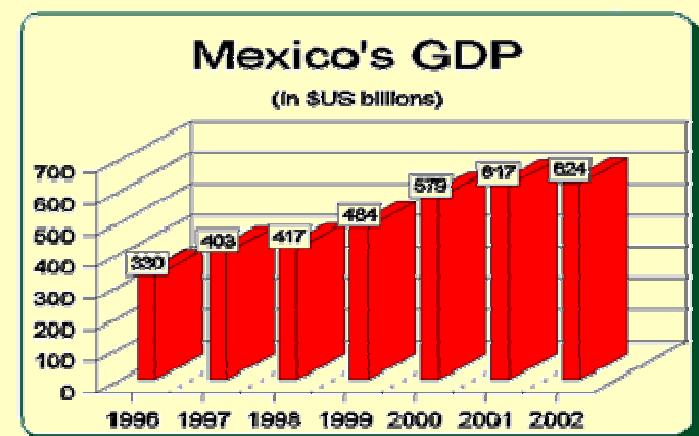
General Outline

1. Overview of Water Resources in Mexico and their main use
 - Water management
 - Water Conflicts
2. Legal and institutional framework
3. Impacts of climate change
4. Adaptive capacity to climate change
5. Recommendations

- Mexico is a country of two million square kilometers with 103 million inhabitants. This compares to a population of about 25 million in 1950, an increase of 4 times in 55 years



GDP has increased more than 10 times.
Both population and the economy are projected to continue growing at annual rates of about 1.5% and 3.0 %, respectively.

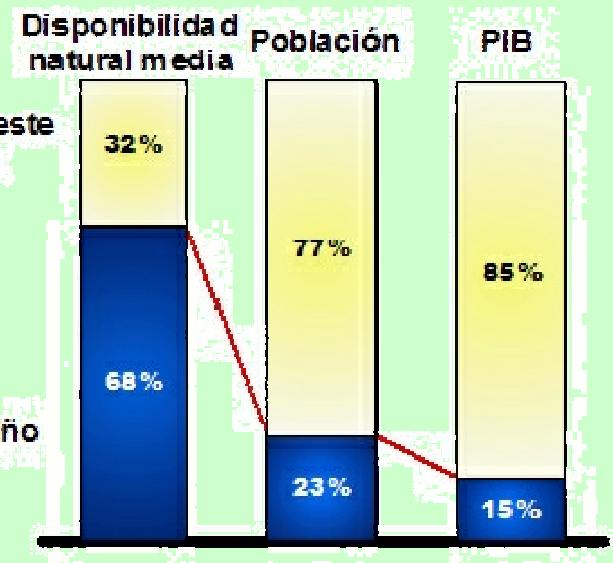
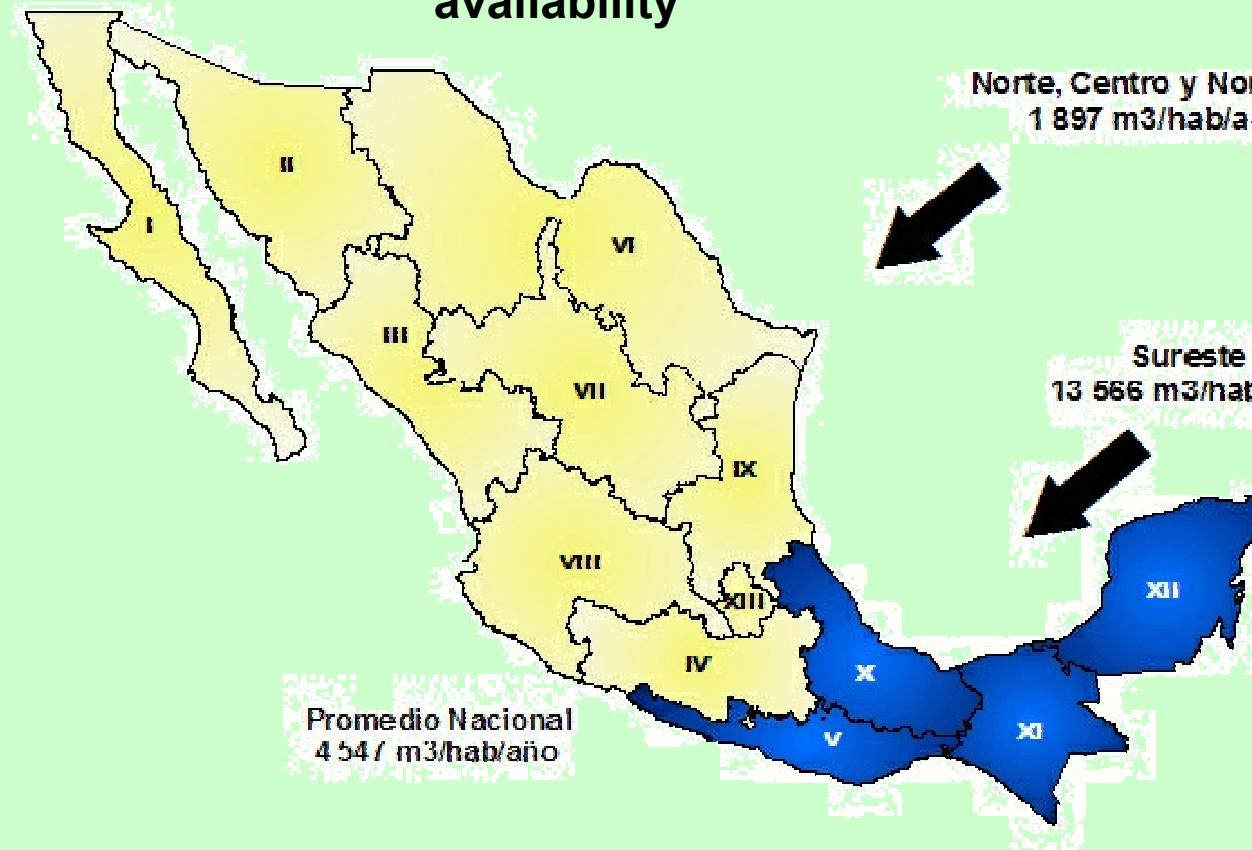


Source: Mexican Ministry of Finance

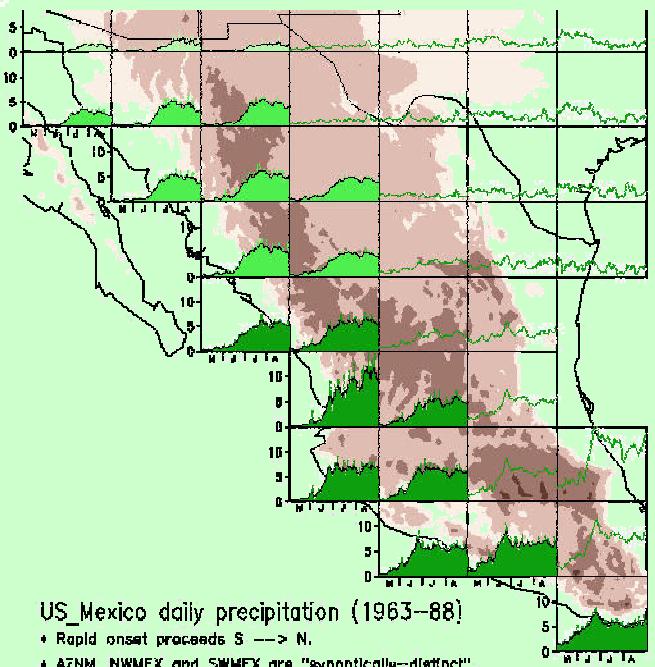


Because of its geographic location and orography, Mexico is subject to a variety of meteorological phenomena including: winter storms, thunderstorms, and tropical cyclones which result in intense rainfall that frequently lead to severe flooding

Spatial distribution of water availability



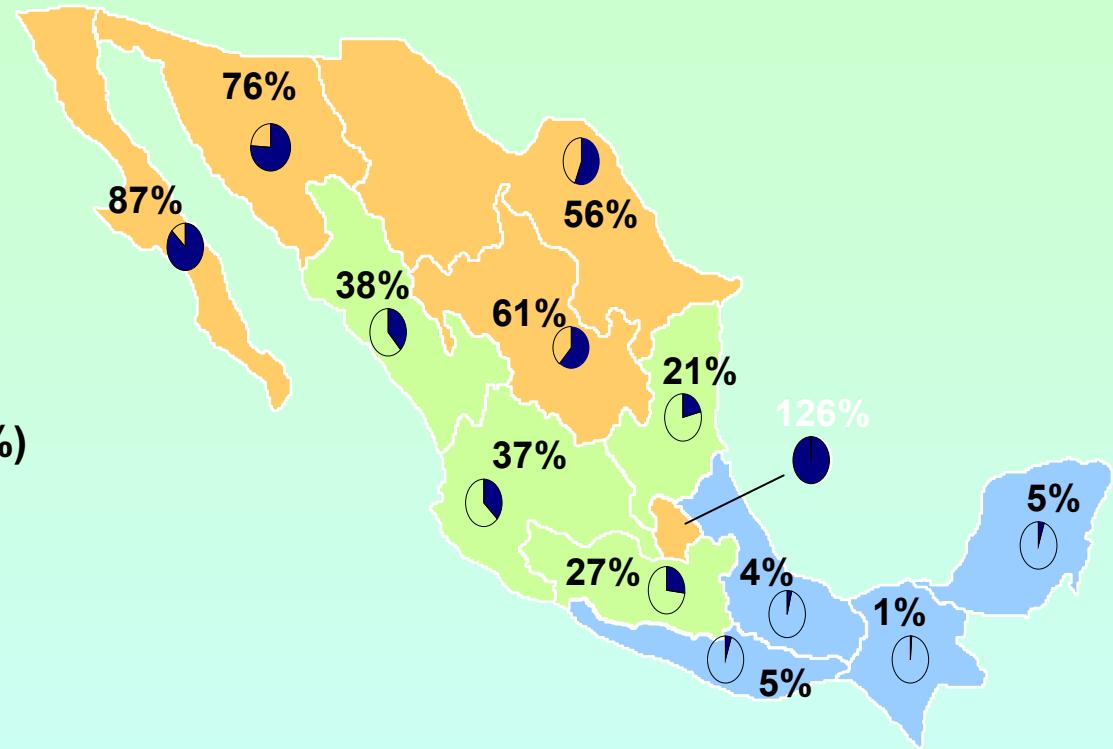
Population and economic activities are inversely related to water availability. Less than a third of total runoff occurs within the 75% of the territory where most of the country's largest cities, industrial facilities and irrigated land are located. Consequently, surface runoff and groundwater are becoming insufficient to support the high growth rates and economic activity, resulting in disputes over surface water usage and in overpumping of the aquifers.



Water Problems in Mexico

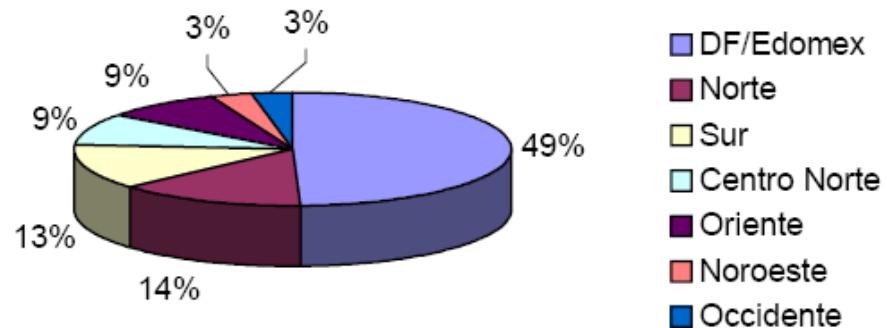
Water Stress

- Intense (>40%)
- Medium to intense (20% - 40%)
- moderate (10% - 19%)
- weak (<10%)
- Level of stress



- Development and water availability
- Aquifer over-pumping
- Pollution
- Extreme events (e.g., drought)
- Water Conflicts

Regions where water conflicts took place between 1992-2002



Water Conflicts

In the Valley of Mexico, there is a conflict for water between the Federal District and the State of Mexico. The water dispute resulted in a legal conflict for water rights. The conflict lasted for several years until the new authorities of the State of Mexico decided to remove the demand from the Supreme Court of Justice looking for a joint solution.

Water conflict on transboundary resources between Mexico and the US.



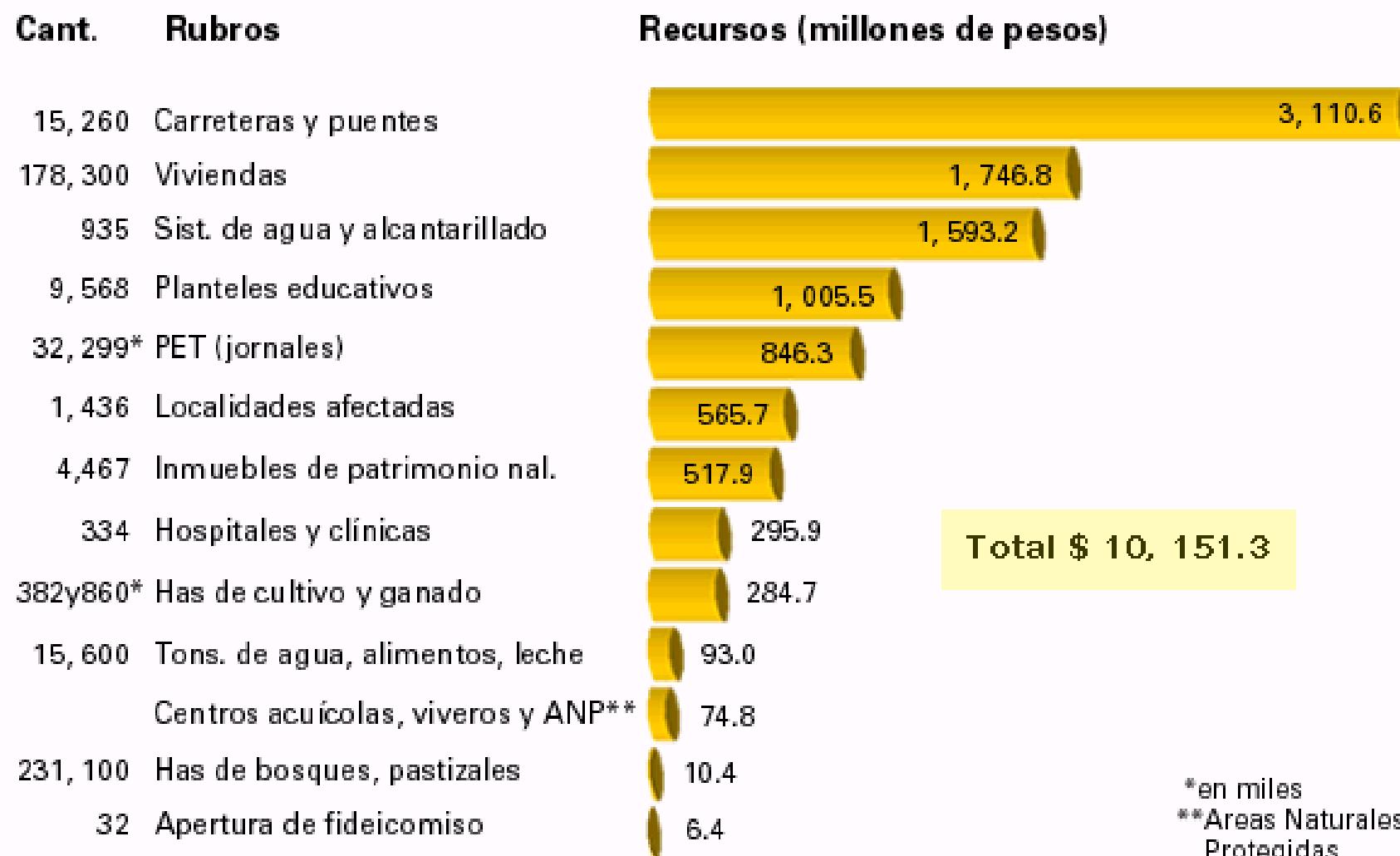
Under an international treaty from 1944, both Mexico and the US commit to exchange transboundary water resources in the Colorado River and the Rio Grande (Rio Bravo).

Mexican authorities were unable to deliver water in the Rio Grande due to a severe drought that lasted for several years. The 5 years term to deliver a certain amount of water was exceeded and the drought continued forcing Mexican authorities to distribute the limited amounts of water among Mexican farmers.

The treaty does not consider severe drought explicitly. Through a series of negotiations the Mexican government committed to pay the total amount of water in the coming years. The problem was solved but if more severe droughts occur under climate change, the problem could repeat and worsen.

What's the cost of a hurricane?

Afectaciones por Tipo de Daño

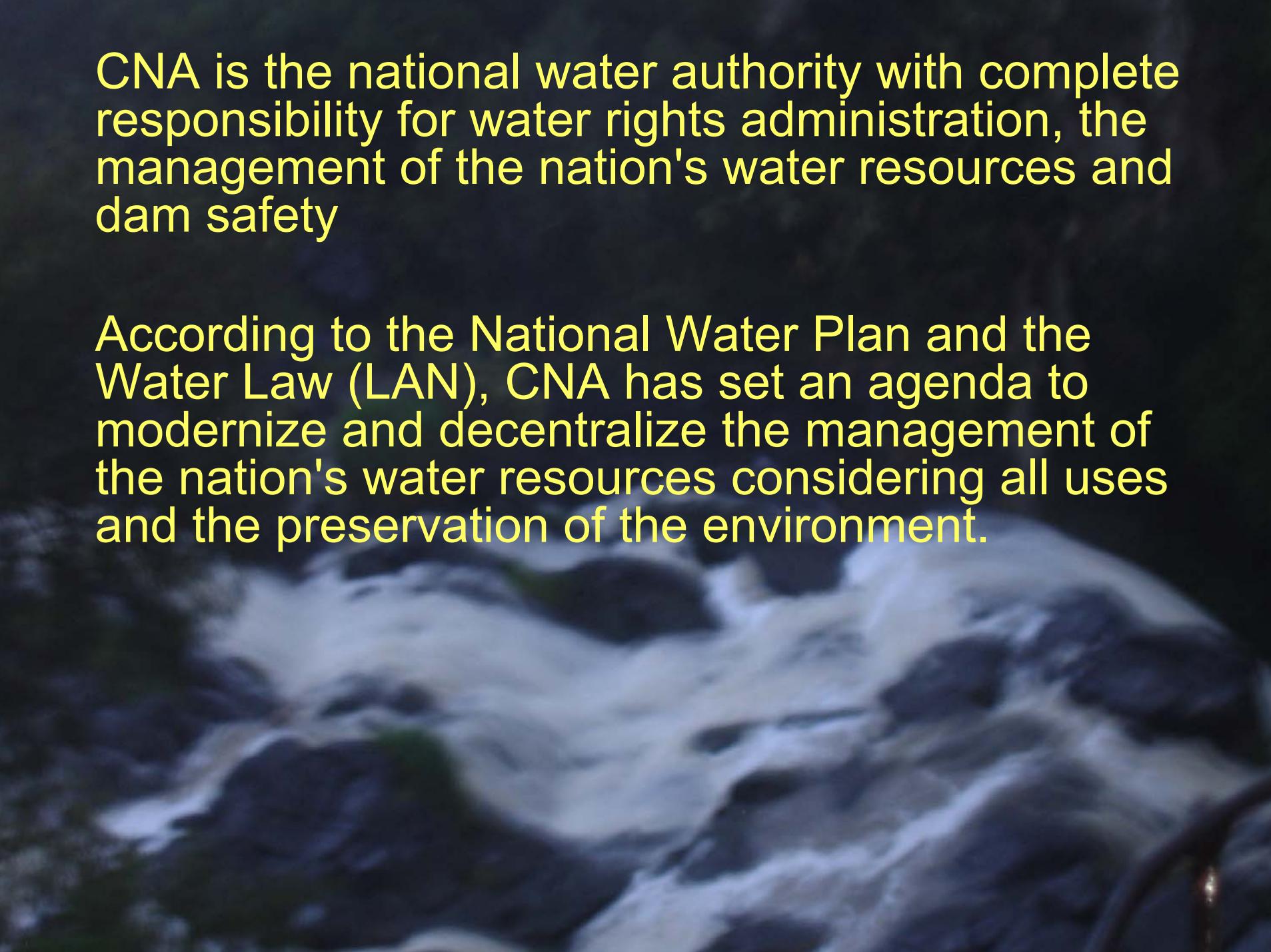


*en miles

**Áreas Naturales Protegidas

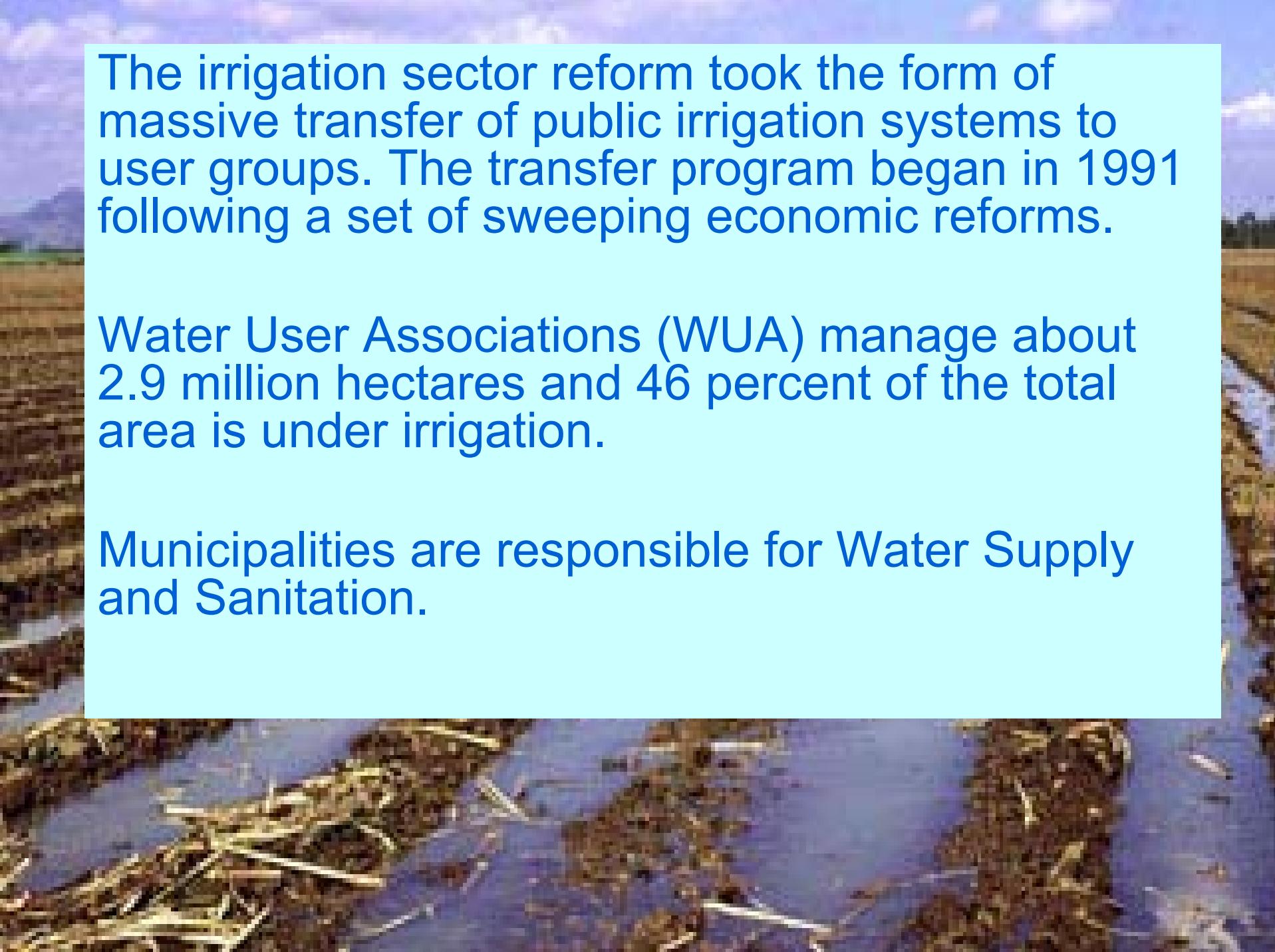
Institutional Framework

- Constitution and Water Law
- SEMARNAP
- CNA
- CFE
- FONDEN
- Civil Protection Agency
- CENAPRED
- Asociación Nacional de Usuarios del Agua
- Asociación de Organismos Operadores



CNA is the national water authority with complete responsibility for water rights administration, the management of the nation's water resources and dam safety

According to the National Water Plan and the Water Law (LAN), CNA has set an agenda to modernize and decentralize the management of the nation's water resources considering all uses and the preservation of the environment.



The irrigation sector reform took the form of massive transfer of public irrigation systems to user groups. The transfer program began in 1991 following a set of sweeping economic reforms.

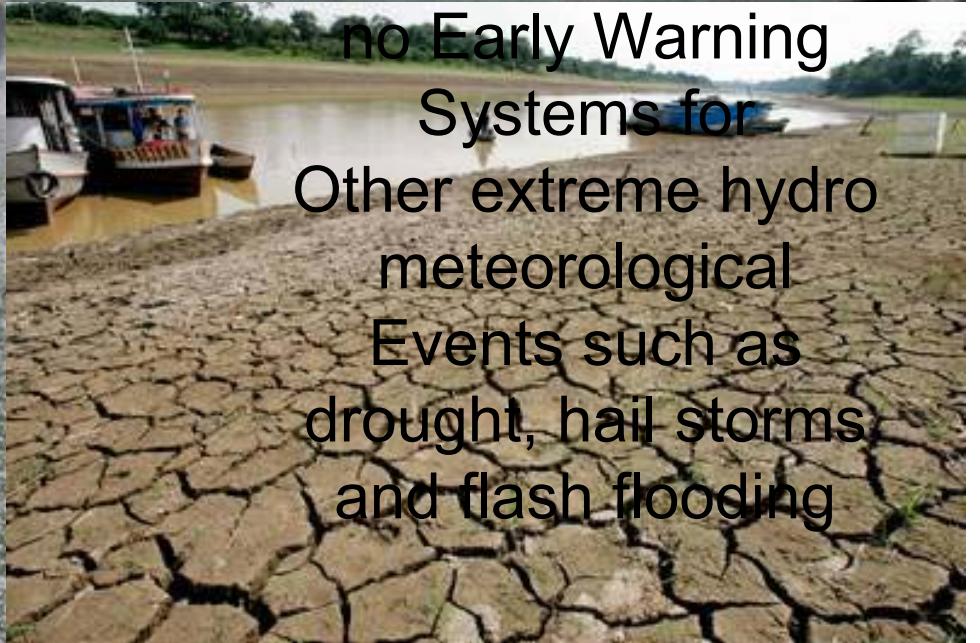
Water User Associations (WUA) manage about 2.9 million hectares and 46 percent of the total area is under irrigation.

Municipalities are responsible for Water Supply and Sanitation.

The Mexican Early Warning System for tropical cyclones has proven to be a powerful tool to reduce the loss of lives. Implemented in the year 2000, the number of deaths decreased from hundreds to only a few (2 or 3 per event)



However, there are no Early Warning Systems for Other extreme hydro meteorological Events such as drought, hail storms and flash flooding



PRONÓSTICO DE ESCURRIMIENTOS

AGOSTO DE 2000

Se esperan escurrimientos por arriba de la media sólo en la Región Pacífico Sur



Impacts of Climate Variability



Floods and Droughts

Environmental: Forest Fires, Dry rivers and Lakes

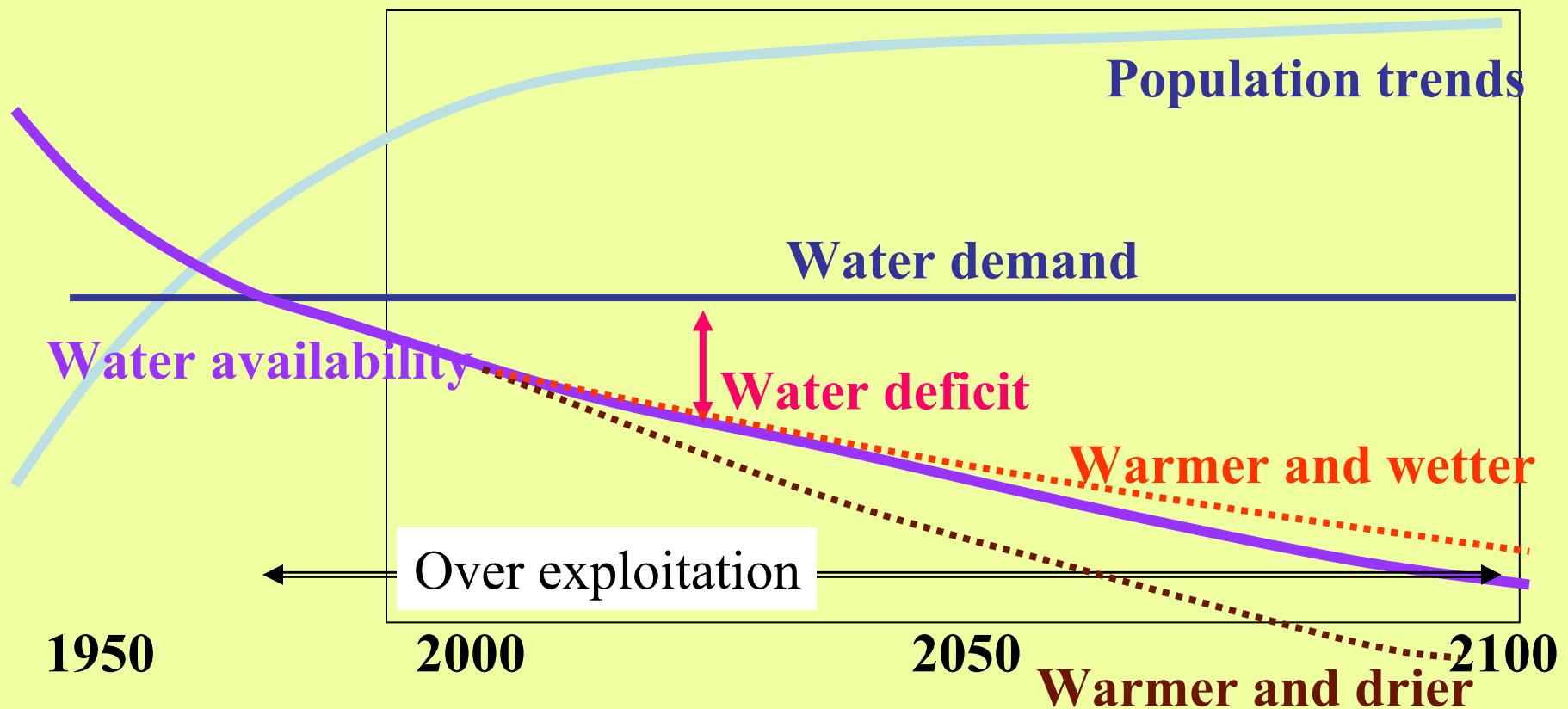
Economic Losses: Agriculture, Energy, Water Supply and Sanitation

Social Conflicts: Vulnerability of poor regions



Trends in population and water availability in Hermosillo, Sonora (qualitative)

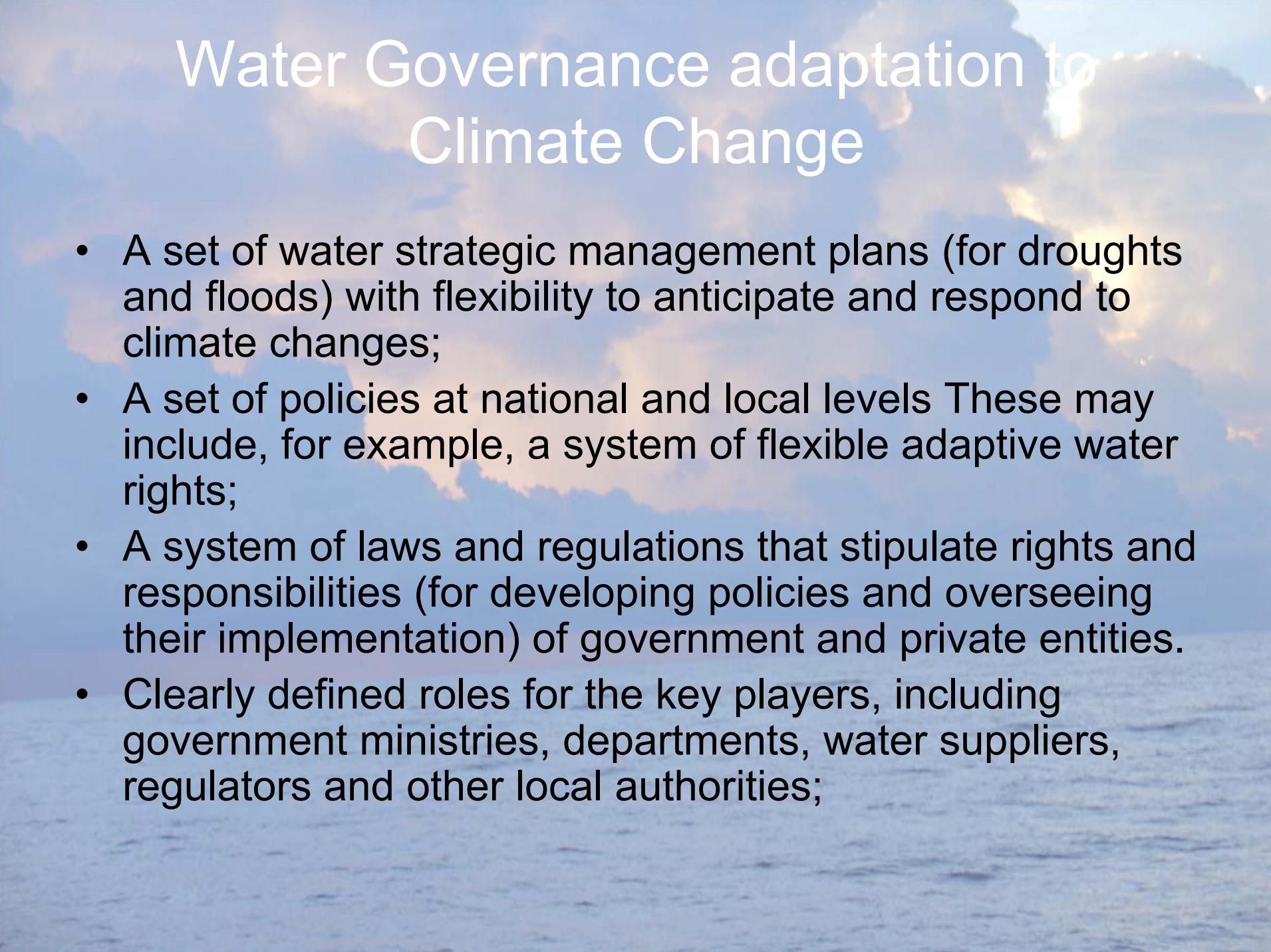
- Population grows but at a slower rate (2.5%); by the 20??(1%)
- Water availability will decrease (under no climate change)
due to population growth only.
- Water demand remains constant (250 lt/dy/per) with no adaptation
- Water deficit will increase (without adaptation)



Policies and adaptation to climate change in the water sector

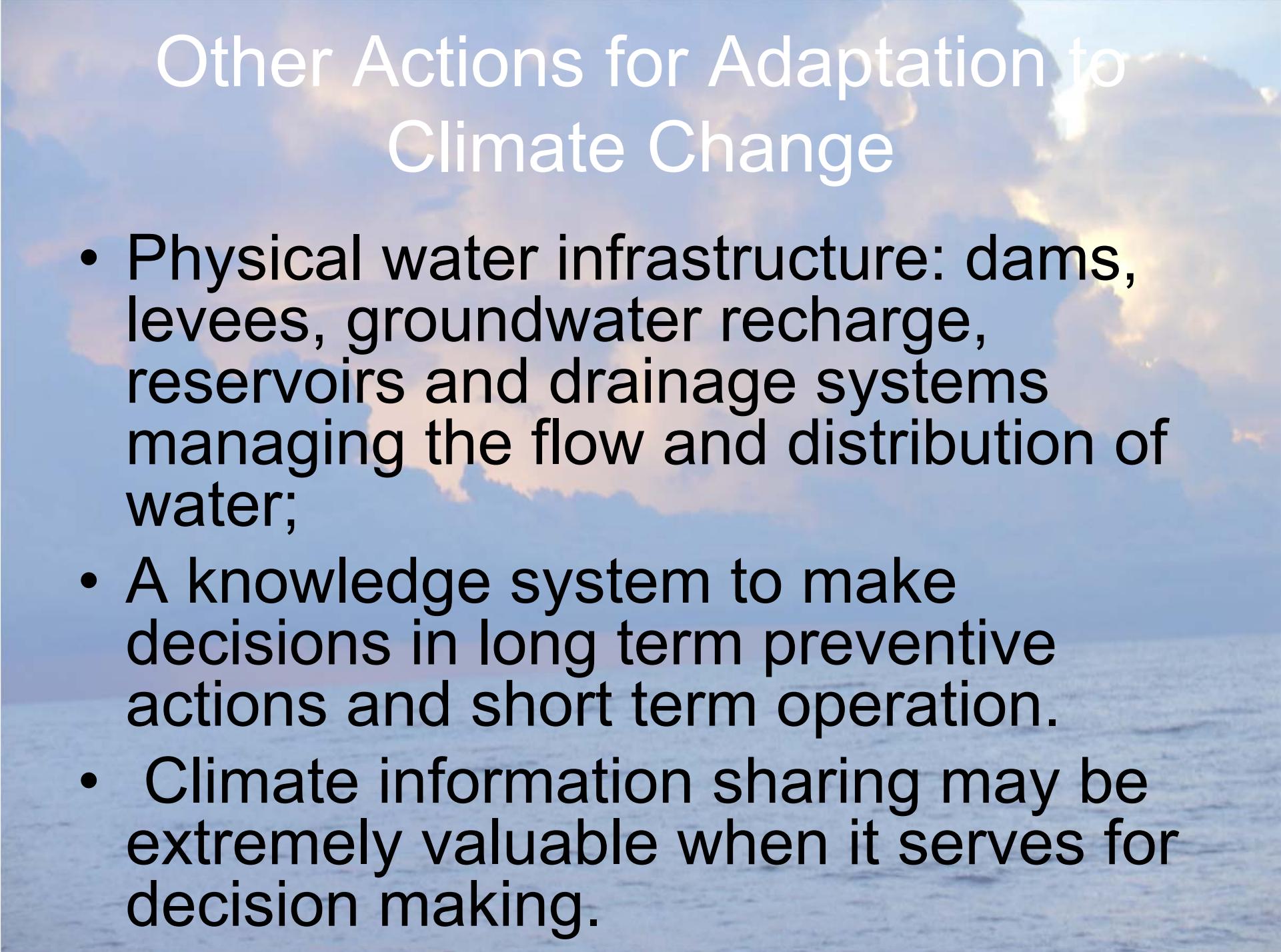
Within the National Water Plan 2000-2006 there is no explicit mention to Climate Change. However, a number of initiatives for adaptation :

- ✓ **Integrated management** of water (surface and ground), land, forests and biodiversity (Watershed Management)
- ✓ **Water Governance** Improvement to: Promote a more efficient water use, a new water culture for risk management and participation of all stakeholders.
- ✓ **Infrastructure:** Construction, adaptation and operation of to reduce risks of drought and floods.
- ✓ **Knowledge Systems** for Climate Forecast and early warning.



Water Governance adaptation to Climate Change

- A set of water strategic management plans (for droughts and floods) with flexibility to anticipate and respond to climate changes;
- A set of policies at national and local levels These may include, for example, a system of flexible adaptive water rights;
- A system of laws and regulations that stipulate rights and responsibilities (for developing policies and overseeing their implementation) of government and private entities.
- Clearly defined roles for the key players, including government ministries, departments, water suppliers, regulators and other local authorities;



Other Actions for Adaptation to Climate Change

- Physical water infrastructure: dams, levees, groundwater recharge, reservoirs and drainage systems managing the flow and distribution of water;
- A knowledge system to make decisions in long term preventive actions and short term operation.
- Climate information sharing may be extremely valuable when it serves for decision making.

Summary and Conclusions

The effects of climate variability and change are just beginning to be considered as part of the problem in water availability

Extreme climatic conditions have serious impacts in various socioeconomic sectors of Mexico (drought and flooding)

Some initiatives to examine potential adaptation options to face climate change are in process.

Trends in water management policies could favor the implementation of adaptation to climate change