



# **ADAPTING WATER MANAGEMENT TO A CHANGING CLIMATE IN A DEVELOPING COUNTRY**

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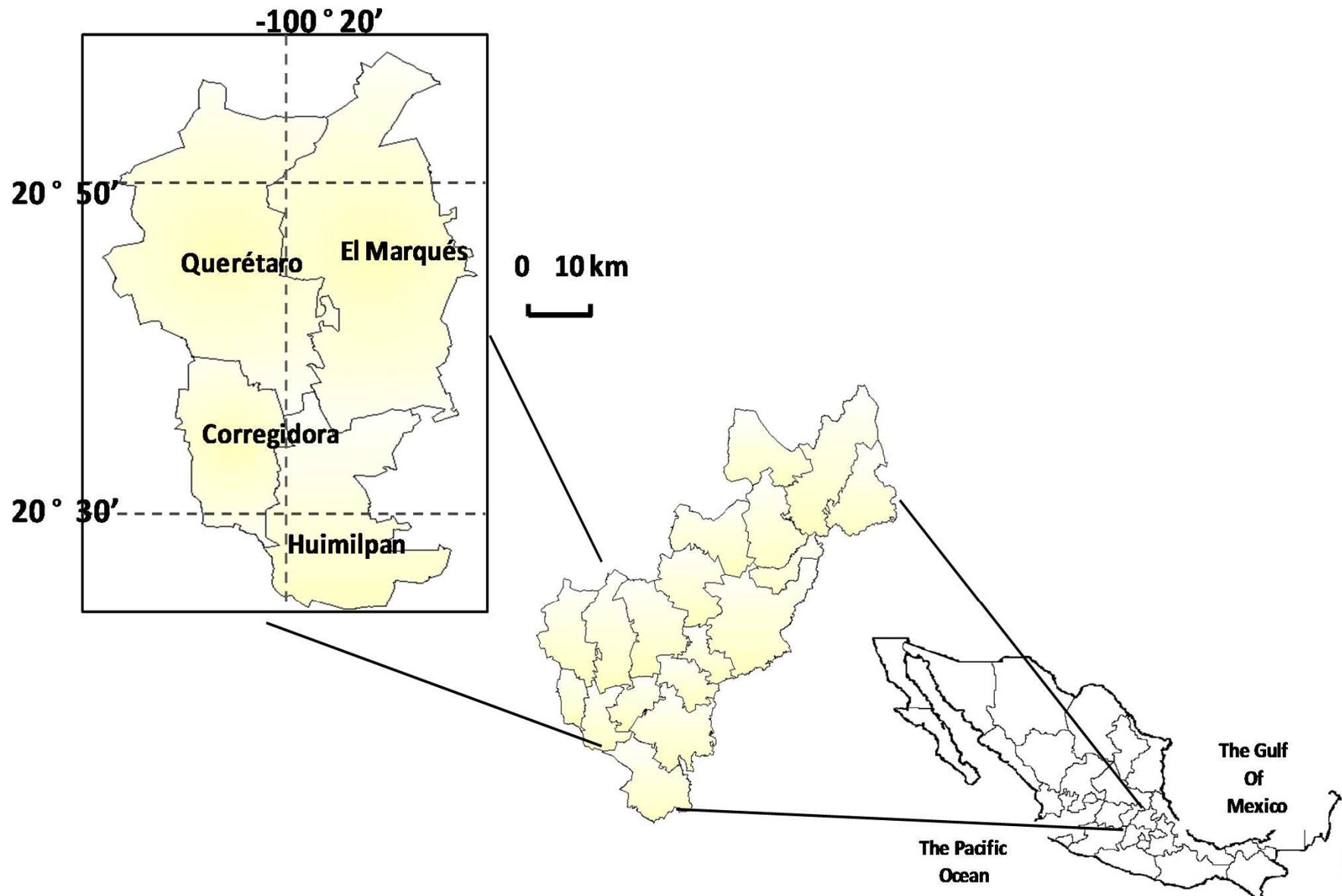
**MAY 2011**

# OBJECTIVES

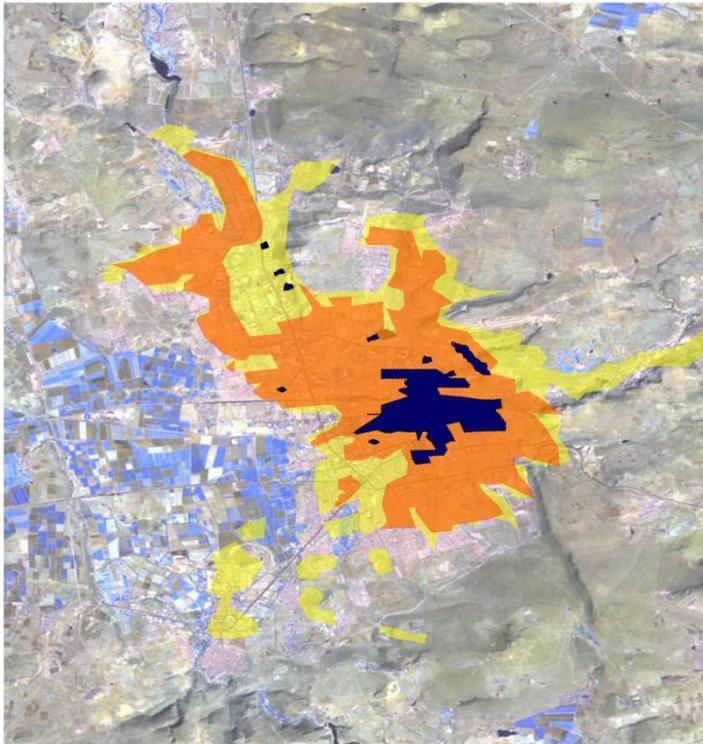


- To estimate the impact of climate change on water resources under different climatic scenarios in a semiarid area
- To investigate the role of institutions in building resilient countermeasures to cope with the effects of climate change on water availability through sustainable water management

# STUDY AREA



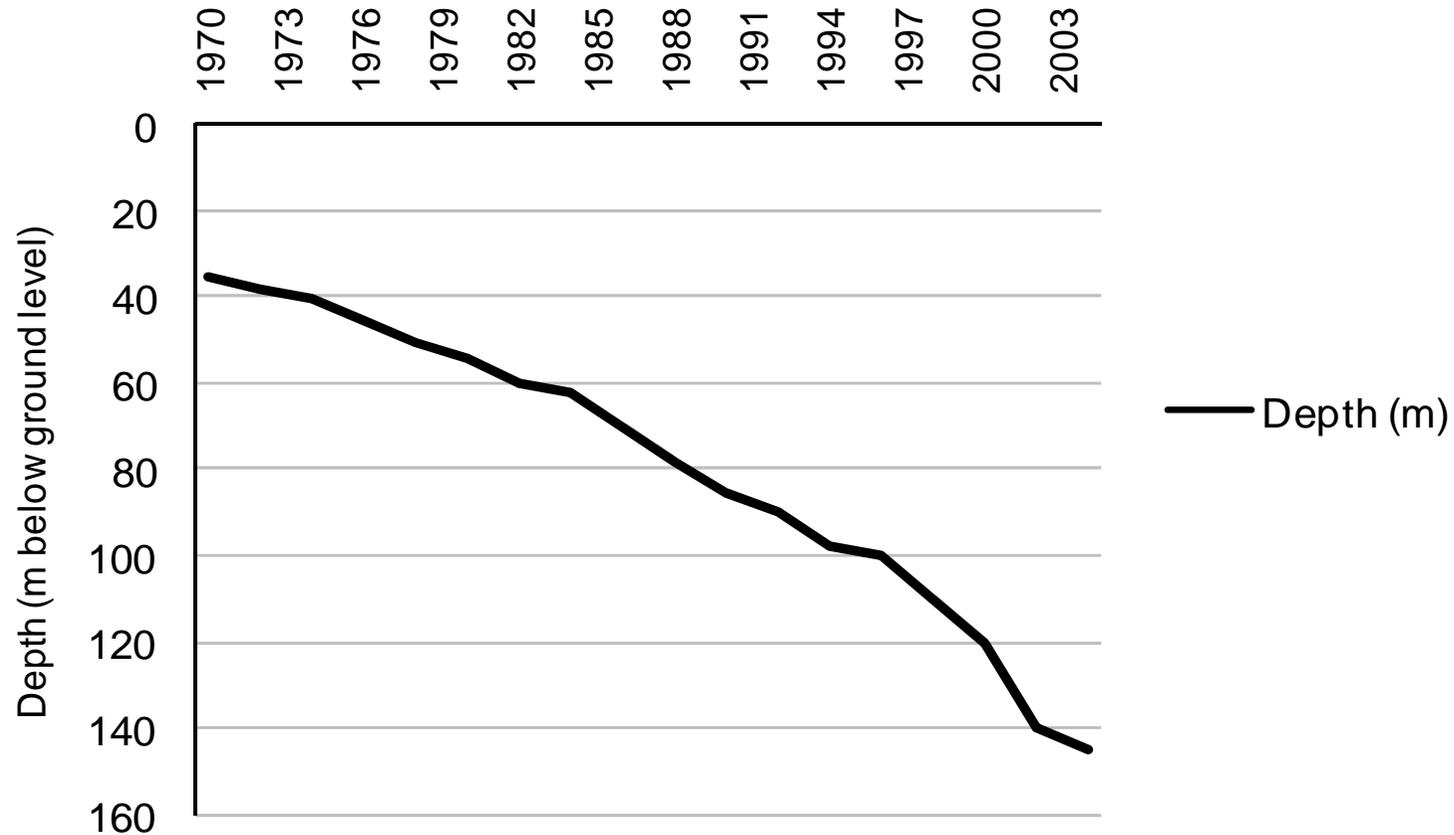
## VULNERABILITY



Change in urban area

- **Queretaro is one of the driest states in Mexico**
- **Urban booming and industrial developments with an increasing demand for water**
- **High population growth rate**
- **It depends mainly on groundwater, which during the last 20 years, has been dramatically overexploited.**
- **Deforestation**
- **Land use change**

# GROUNDWATER TRENDS



**The intense over extraction of groundwater has caused an average decrease in groundwater levels of 3.5 m a<sup>-1</sup> and a compaction of the alluvial volcanic lacustrine valley causing land subsidence.**



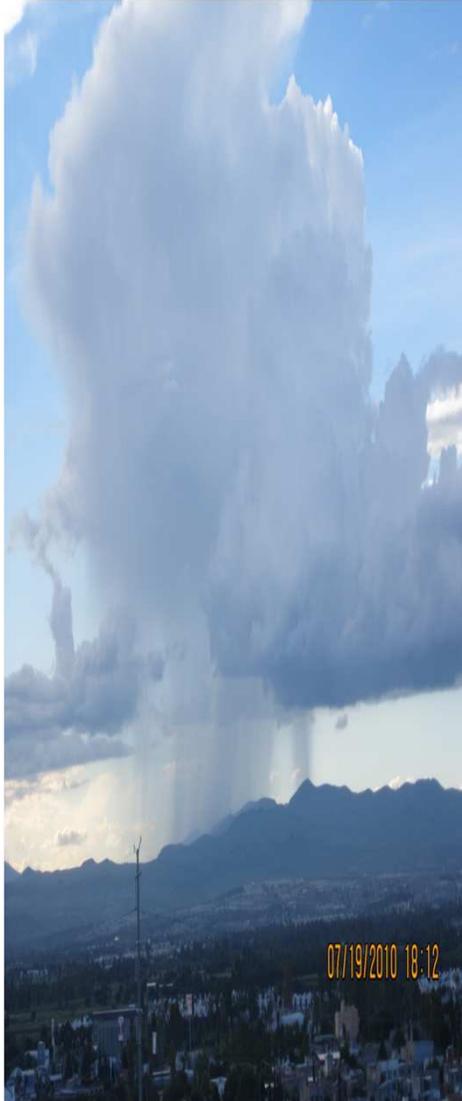
## METHODOLOGY

- **Baseline** 1973-1991
- **Future gas emission scenarios:** Coupled GCMs from the WCRP CMIP3 multi-model dataset . Program for Climate Model Diagnosis and Intercomparison (PCMDI) . B1 and AB1 scenarios

Model	Model Sponsor	Resolution
Inmcm3_0	Institute for Numerical Mathematics,	4 x 5
Giss_aom	NASA/Goddard Institute for Space Studies,	3 x 4
Bccr_bcm2_0	BCCR (Bjerknes Centre for Climate Research) BCM2	2.8 x 2.8
Miroc3_2_medres	Center for Climate System Research, Medium resolution	2.8 x 2.8
Csiro_mk3_0	CSIRO Atmospheric Research, MK 3.0	1.9 x 1.9
Ncar_ccsm3_0	for Atmospheric Research, Boulder, CO, CCSM 3	1.4 x 1.4
Miroc3_2_hires	Center for Climate System Research, High resolution	1.1 x 1.1



## FUTURE SCENARIOS

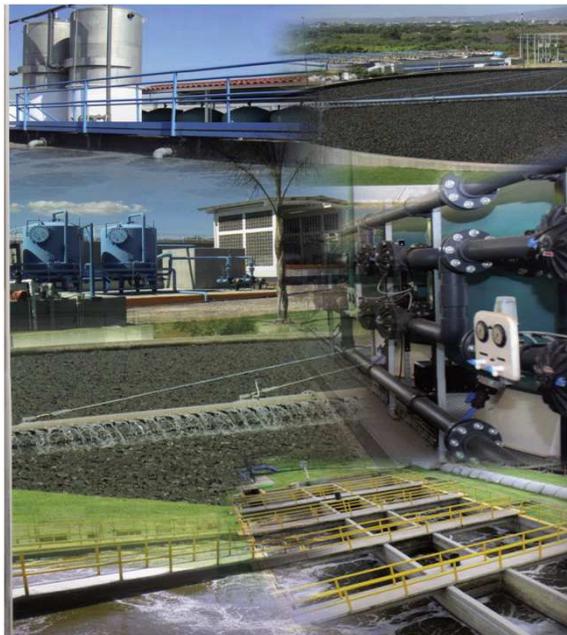


- Under the low emissions and high emissions scenarios all the models predicted increases in mean annual temperatures. Increases could range from 0.8 °C to 4.4 °C.
- Total annual mean precipitation is predicted to decrease under both scenarios by all the models. Decreases could vary from 3.7 % to almost 20%
- On the whole, for Queretaro future scenarios suggest that an increase in temperature and a decrease in precipitation may result in a decrease in the available water for groundwater recharge or runoff by the end of the century

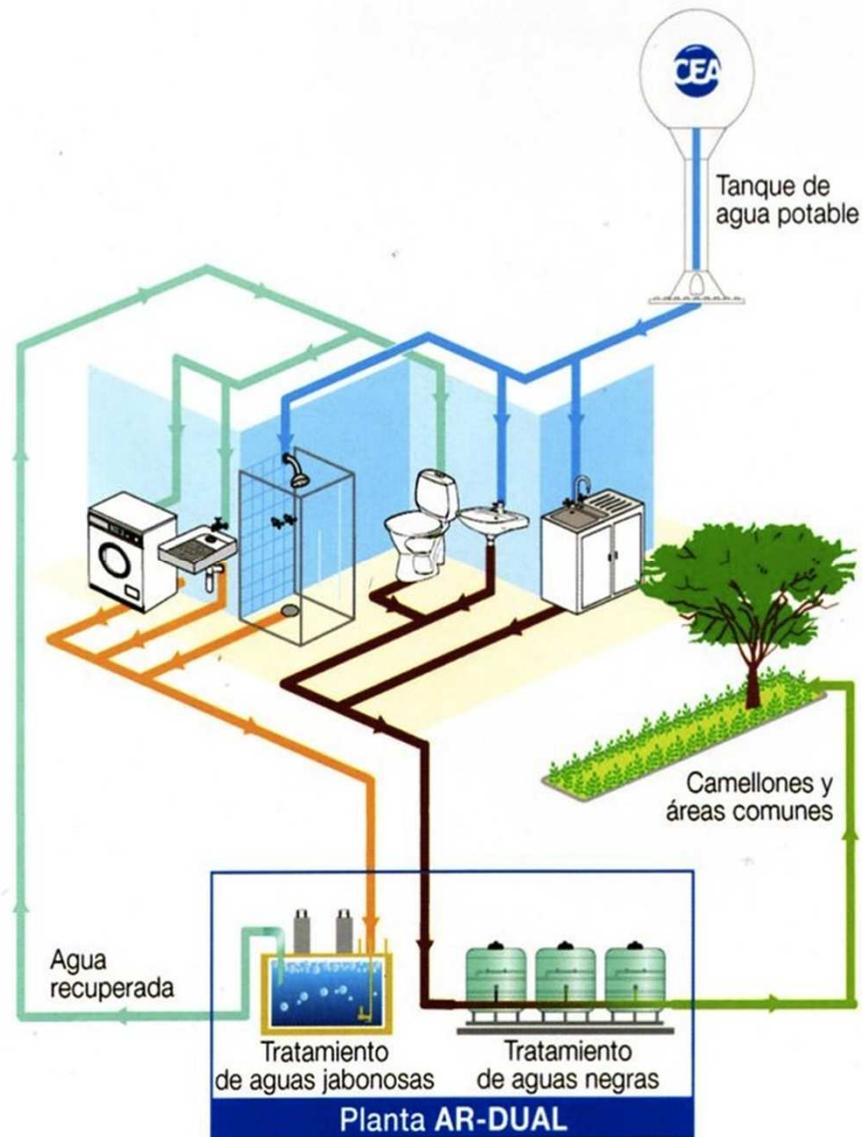
# STRATEGIES



- To promote an efficient use of water through increased metering and water reuse.
- The number of treatment plants in operation in Queretaro State has increased from 2 in 2001 to 28 in 2009 and the percentage of water treated by the end of 2011 is expected to reach 90%.



# STRATEGIES



- An innovative recycling system named 'Ar-Dual' has been implemented in 2 neighborhoods.
- The 'Ar-Dual' recycling system results in a saving of  $6 \text{ l s}^{-1}$  of clean water.

## STRATEGIES



- To ensure a constant water supply to Queretaro City and recovery of the aquifer, 'Acueducto II', a new hydraulic system has been built with a capacity to import more than 1500 l/s from the Panuco basin sources located 122 km away (CEA, 2009).
- In addition, Queretaro Water Commission has also invested in technology for the monitoring of hydrometeorological conditions .





## CONCLUSIONS

- **The actions taken by the Queretaro Water Commission in 2001 started a sustainable water management programme.**
- **On the whole, for Queretaro future scenarios suggest that an increase in temperature and a decrease in precipitation may result in a decrease in the available water for groundwater recharge or runoff by the end of the century.**
- **These steps are leading to reduce the predicted impacts of climate change and ensuring the water requirement of the growing population through improved performance.**
- **However, without urban planning and land use zoning many of these efforts will be diminish.**
- **It is concluded that local institutions, by promoting principles of sustainable development proactively promote opportunities to adapt to a changed climate.**



**Thank you**

