

# Groundwater Overdraft in Mexico

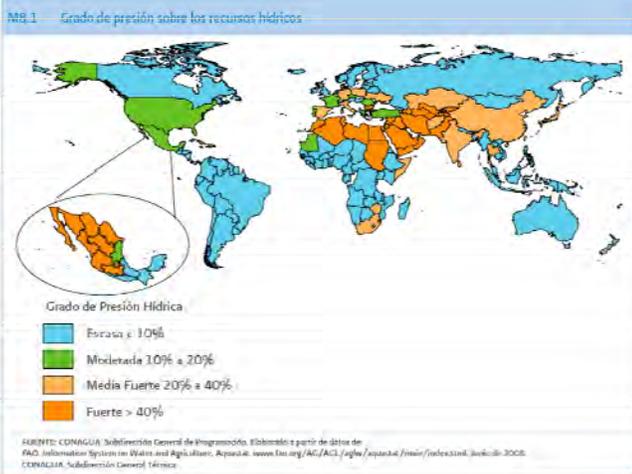
## Climate, Energy, and Population Drivers

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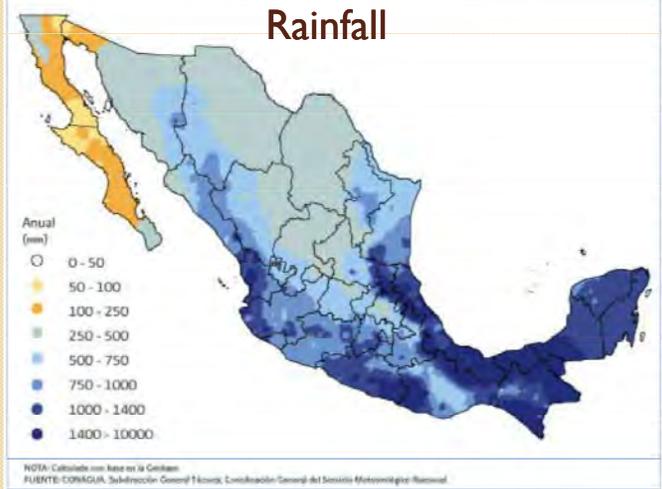
### Outline

- Mexico's GW dependence is emblematic
- Sustained groundwater use challenged by:
  - Climate change – currently in bulls-eye
  - Energy and water based economy
  - Population urbanized for decades
  - Centralized management, water rights revenues
- Progressive policy futures
  - Groundwater as strategic resource/ reserve
  - Consensual, planned depletion

### Water scarcity = resource pressure



M2.3 Distribución de la precipitación pluvial anual en México (1971-2000)



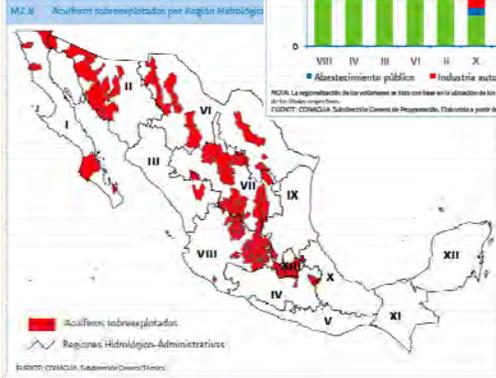
M1.2 Índice de rezago social municipal 2005



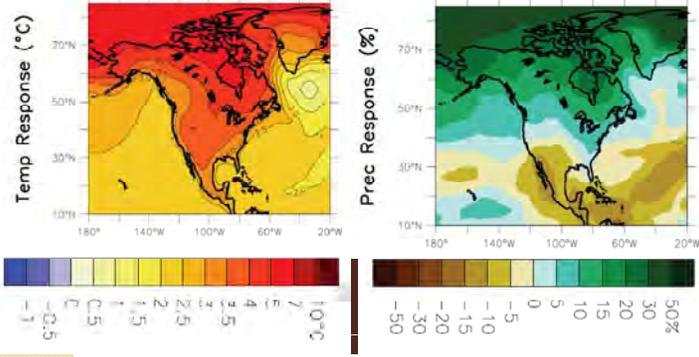
M3.1 Intensidad de los usos consuntivos del agua por municipio, 2007



# GW depletion



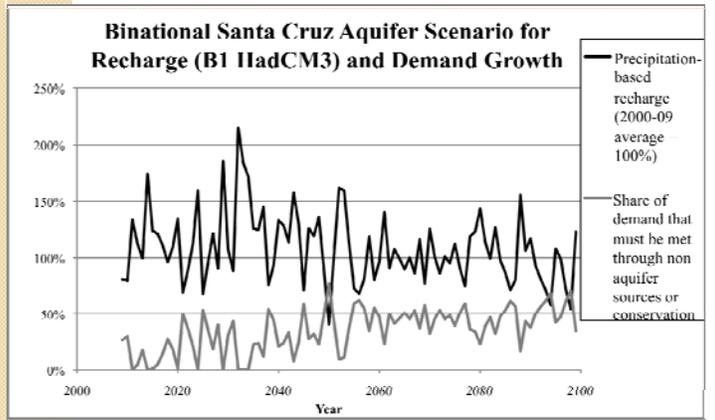
# GW available for titling



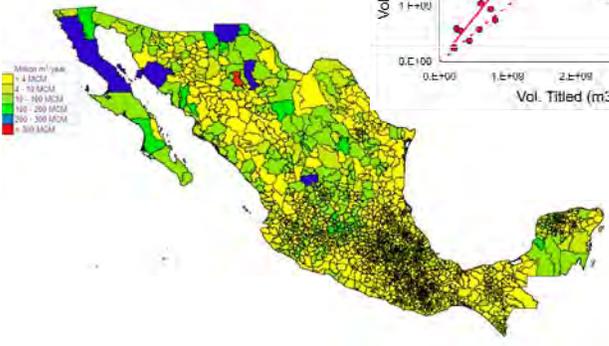
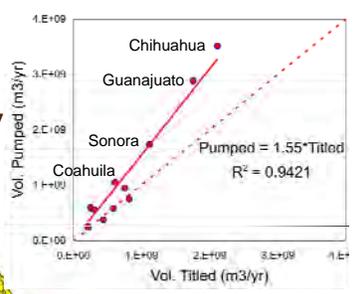
Annual Temperature and Precipitation Change End of 21<sup>st</sup> Century — Scenario: A1b

IPCC 4<sup>th</sup> Assessment: Working Group I, Chapter 11, Regional Projections

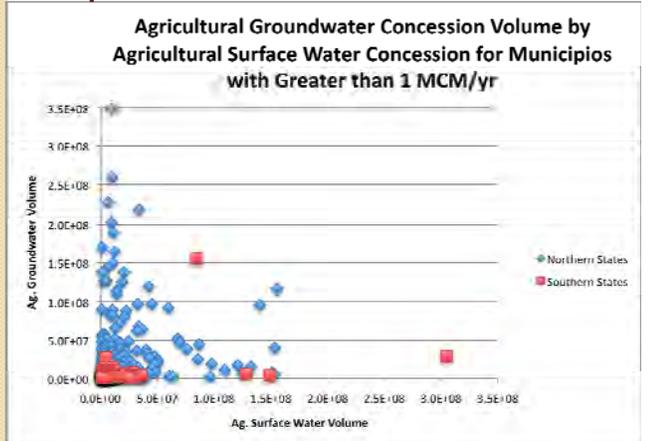
# Climate impacts on groundwater



# Regulation unsuccessful: pumped GW exceeds titled GW



# Groundwater substitutes for -- not complements -- surface water



## User self-regulation COTAS

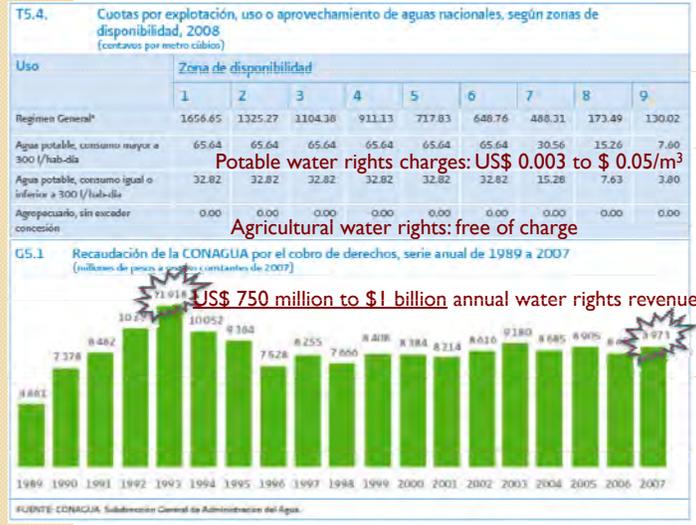
- Groundwater technical committees
- CONAGUA model
  - coordination platform centered on federal authority
- Guanajuato state model
  - IWRM but without legal mandate
  - Lack incentive mechanisms

## Water law and rights

- Law of the Nation's Waters (Ley de Aguas Nacionales), 1992 & 2004
- Public Register of Water Rights (Registro Público de Derechos de Agua, REPDA)
  - volumetric rights granted as concessions, usually 10-years for groundwater
  - administered by National Water Commission (Comision Nacional del Agua, CONAGUA)
  - 97% of water rights titling completed by 2006

## REPDA – Water Rights Registry

- Concessions granted for
  - Aquaculture
  - Agriculture
  - Agroindustrial
  - Domestic
  - Power generation
  - Industrial
  - Multiple use
  - Livestock
  - Public / urban
  - Services
- 423,179 rights on record (all uses, nationally) – available over the Internet
- Payment for concessions by public/urban and industrial users is an increasingly **important revenue source** for CONAGUA



## All future population growth will be urban

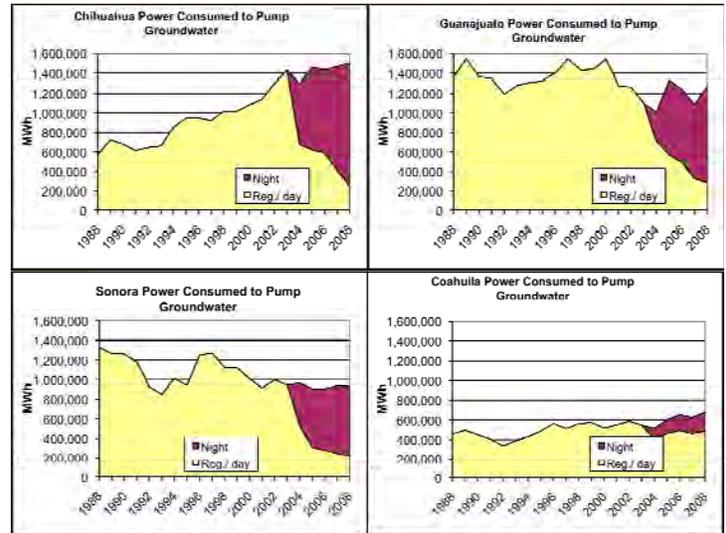


## Annual growth of urban population (localities of greater than 2,500 inhabitants)



## CONAGUA (Nat'l Water Commission) & CFE (Federal Electricity Commission)

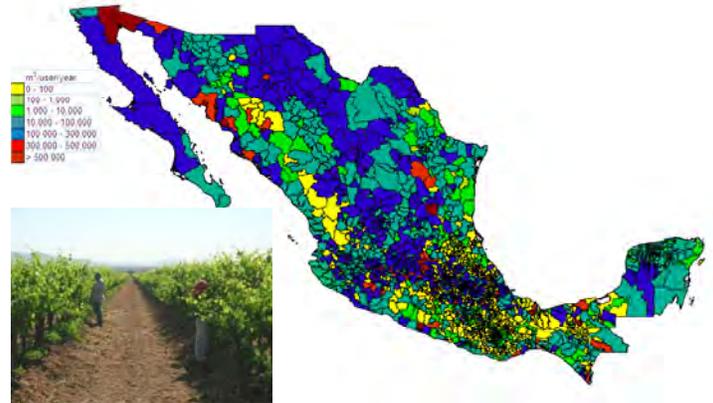
- Contentious relationship, rival ministries
- CONAGUA policy focuses on hydropower
- Rural energy law (with groundwater provision) remains unenforced
- Water – energy nexus opportunity lost
- Instead, concessional night-time power off-loading to ag may increase pumping



## Agricultural Groundwater

- Intensification of groundwater-irrigated ag
- Virtual water exports of strategic gw needed for future population growth, climate adaptation
- Poor high labor absorption in agriculture
- High energy reliance
- Low water productivity basic grains (wheat, maize) competing with high productivity horticulture

## Ag. groundwater high per-user volumes (titled)



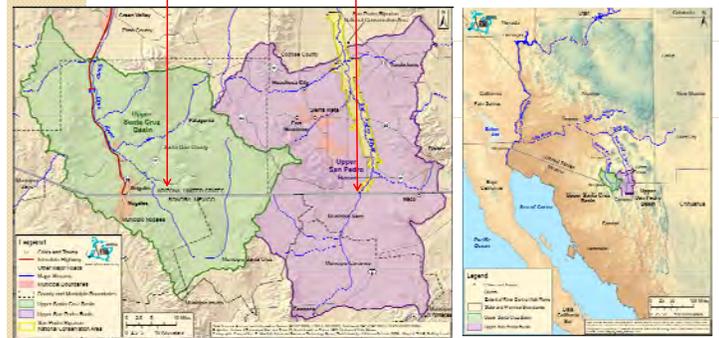
## Conclusions

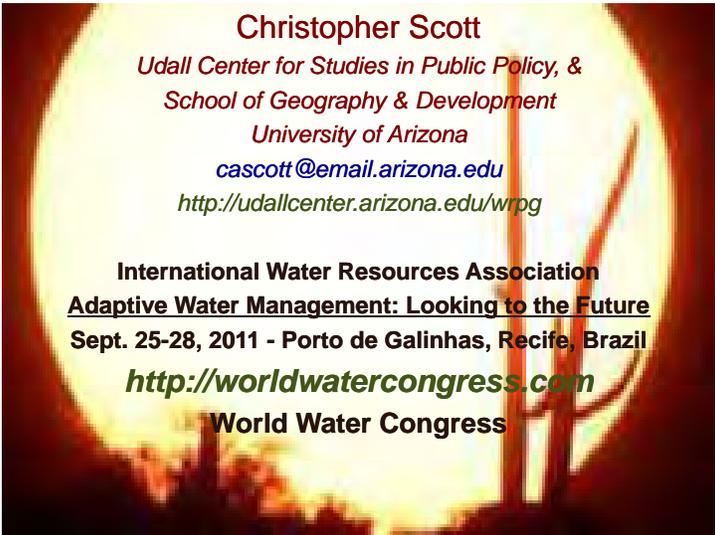
- Groundwater is a strategic resource
- Intergenerational equity rises above sectoral, spatial, or transboundary equity
- Virtual water arguments fall flat when based on overdrafted groundwater
- Compounded effect of climate, energy, and population drivers
- Consensual, managed depletion

## U.S. - Mexico Transboundary Aquifer Assessment Program (TAAP)

([www.cals.arizona.edu/azwater/taap](http://www.cals.arizona.edu/azwater/taap))

### Santa Cruz and San Pedro Aquifers





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**International Water Resources Association**

**Adaptive Water Management: Looking to the Future**

**Sept. 25-28, 2011 - Porto de Galinhas, Recife, Brazil**

**<http://worldwatercongress.com>**

**World Water Congress**