Draft Policy Directives for Sustainable Groundwater Management

Toward Sustainable Groundwater in Agriculture:
An International Conference Linking Science and Policy
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Acknowledgements/References

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- Sharon Megdal, University of Arizona Water Resources Research Center

Metrics and graphics from "*Statistics on Water in Mexico*," 2015 Edition, CONAGUA

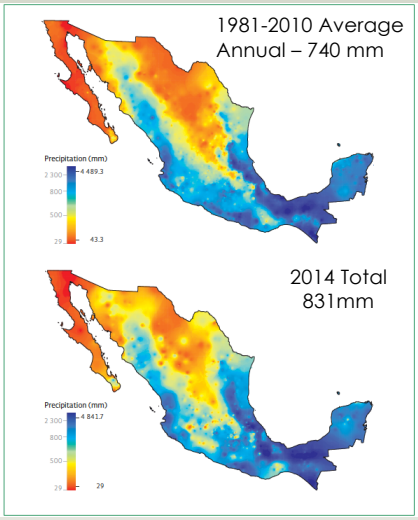
Process to Draft Policy Directives

- Desired ISMAR 9 outcome for Mexico's National Water Commission (CONAGUA)
- English and Spanish versions drafted separately
- Two Special Sessions at ISMAR9 to present and discuss
- Condensed into one Word version and PowerPoint
- Drafts under revision and will be taken up by IAH

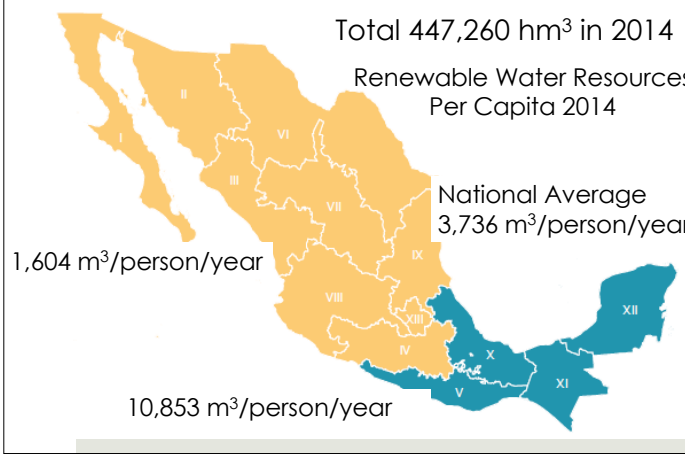
Mexico – Some Basic Metrics

- Area – 1.964 million km^2
- 32 States
- 2,457 Municipalities responsible for water supply and waste management through water agencies
- 59 Metropolitan areas
  - Contain 56.9 % people
- 120 million people
- 11.4 million people disadvantaged
- 731 Watersheds
- 51 Main Rivers
- 653 Aquifers
- Offstream Demands
  - 61.3 % surface water
  - 38.7% groundwater
- 2014 GDP $13,760,184 million pesos
  - Services – 62.4%
  - Industry – 34.4%
  - Agriculture – 3.1%

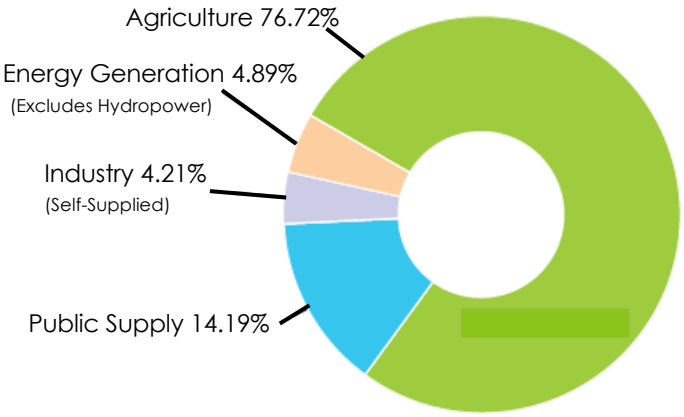
Precipitation Distribution (mm)
Occurs June-October



Mexico – Renewable Water Resources



Mexico – Proportional Water Demand



Mexico – Three Stages of Sustainable Water Policy Development

- First Stage - 20th Century
  - Supply side focused
  - Construction of large number of surface storage reservoirs, aqueducts and other systems
  - Creation of irrigation districts
- Second Stage – 1980s – 1990s
  - More demand-oriented water policy with decentralization
  - Responsibility for drinking water supply, sewerage and sanitation services transferred to municipalities
  - CONAGUA created to manage water resources at national level
  - Creation of Public Registry of Water Duties to track water allocation
- Third Stage – Dawn of 21st Century
  - Increasing water reuse
  - More emphasis placed on demand management through
    - Extraction accounting and verification,
    - Aquifer and watershed regulation
    - Updating of fee schedules and collections for water use

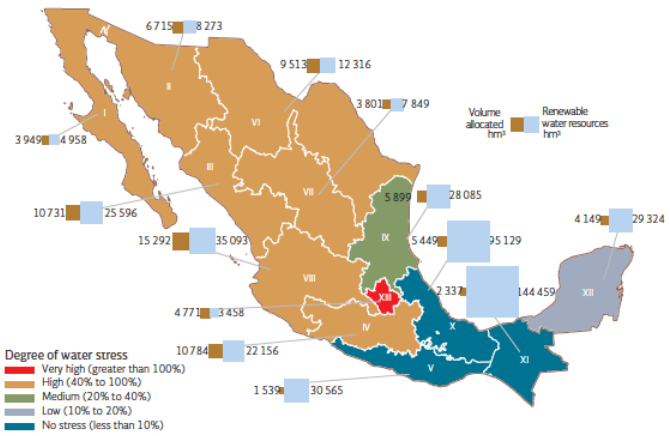
Mexico – Legal, Policy and Institutional Framework

- All water property of the federal government
- 1989 **National Water Commission (CONUAGUA)** established
  - Administrative, regulatory, technical, consultative and decentralized agency of the Ministry of the Environment and Natural Resources
  - "Water Pays for Water" principle - $47.35 million pesos in 2014
  - Water law has been updated a few times since 1989
- **State Water Commissions** – water management, irrigation and wastewater
- **Basin Authorities** – formulate and implement policy and programs
- **River Basin Councils**
  - Multi-stakeholder collegiate bodies
  - Provide support, consultation, and advice to CONAGUA and coordination amongst local, state, federal and NGO entities
- **Auxiliary Bodies** – localized constituent groups
  - 35 Watershed commissions
  - 47 Micro-watershed commissions
  - 87 Technical committees
  - 39 Clean beach committees

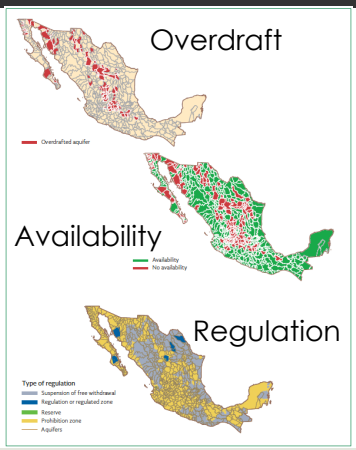
Mexico – Current Groundwater Conditions and Challenges

- 653 Aquifer conditions
  - 106 overdraft
  - 31 salinity issues
  - 15 seawater intrusion
  - 145 prohibition zones
  - 7 regulated zones
  - 333 suspended free withdrawal
- Water Supply
  - Up to 35 % leakage
  - Issues with purification plants and conveyance networks
- Mexico City
  - Groundwater dropping 1 meter per year
  - Land subsidence of 0.3 m per year – over 9m
  - Supply for 40 years

Mexico – Degree of Water Stress



Mexico – Aquifer Status



Draft Policy Directives for Sustainable Groundwater Management

Developed for decision-makers and the public to inform, engage and educate stakeholders on the critical need for addressing our shrinking groundwater resources now, before it is too late

Introduction to Key Principles

- Groundwater is essential for water and food security, public health and socio-economic well-being, and maintaining the environment and ecosystems
- Groundwater is a common pool resource subject to the classic tragedy of the commons: overexploitation
- Emerging challenges exist to maintaining and improving groundwater quantity and quality:
  - Climate change
  - Rising pressures from increasing demands from population, urbanization, industry and agriculture
- Groundwater should be sustainably managed

I. Recognize aquifers as critically important, finite, valuable, and vulnerable resources

- Supply 50% of global water demand
- Resiliency for drought management
- Limited and vulnerable resource, part of the hydrologic cycle, and connected to surface water
- Widely thought to be endless

II. Halt chronic aquifer depletion on global basis

- Many of world's aquifers being overexploited and depleted at increasing rates
- Groundwater sustainability indicator evidence includes:
  - Declining groundwater levels and loss of storage
  - Water quality degradation
  - Land subsidence
  - Sea water intrusion
  - Loss of springs, ecosystems, and base flow
- Essential to invest new efforts and resources to establish regulations and management as needed to reach sustainability in this century

III. Aquifer systems are unique, need to be well understood, and groundwater should be invisible no more

- All aquifer systems are unique and diverse
- It is essential to know:
  - Nature of the aquifer geometry, chemical and physical characteristics
  - Hydrology, trends and interconnectedness relationship of overlying local and regional surface water systems
  - Water balance and availability
  - Current and future demands
  - Climate change assessment and projections
- Increase the knowledge on aquifers to improve tools and innovative technologies for less costly and higher value information
- Knowledge and data on aquifer systems need to be shared, users should be educated and groundwater should be invisible no more

IV. Aquifers need to be sustainably managed

- Sustainable groundwater management requires:
  - Increasing and sustained adequate investment, with costs equitably shared amongst users
  - Appropriate policy, legal and regulatory framework
  - Institutions covering aquifer systems in entirety, with authority and accountability
  - Integration of planning and coordination of actions amongst users and management institutions involved with shared and transboundary aquifer systems
  - Intervention and enforcement mechanisms in place adequate to provide incentives to achieve sustainability
  - Knowing the amount of available supply in order to balance that with the short- and long-term demand

IV. Aquifers need to be sustainably managed

- Sustainable groundwater management plans should be developed for important aquifers and include:
  - Sustainability goal, measureable objectives, not to exceed thresholds and milestones to achieve sustainability
  - Detailed description of physical system, hydrology, and environment
  - Water balance
  - Monitoring program and protocols
  - Planning horizon of not less than 50 years considering climate change
  - Public outreach and engagement program
  - Management components, projects and actions including:
    - Increasing conservation
    - Considering wastewater a resource and increasing treatment and reuse
    - Considering stormwater a resource and increasing capture, treatment and its recharge and use
    - Managed aquifer recharge (MAR)
    - Allocation and demand reduction
    - Water markets, water trades and transfers
  - Data management system
  - Schedule, budget and review program

V. Managed Aquifer Recharge (MAR) needs to be greatly increased globally

- MAR's objective is to increase groundwater recharge over natural infiltration processes
- MAR is a key demonstrated groundwater management component for achieving long-term sustainability and incentives should be provided to increase application
- MAR may:
  - Increase storage and augment supply
  - Improve water quality through natural subsurface treatment
  - Provide resiliency during dry cycles or droughts
- MAR should be implemented where:
  - Project is economically viable
  - Suitable aquifer that can accept sufficient quantity and quality of water at an adequate recharge rate
  - Within areas being actively managed

IV. Effective groundwater management requires collaboration and robust stakeholder participation

- Groundwater as a shared resource requires
  - Collaboration amongst its users
  - Consideration of the environment and ecosystems
- Robust stakeholder participation
  - Provides an invaluable pathway toward collective action
  - Is an essential tool for acceptance, trust and buy-in on the knowledge, decisions, program, funding, and equitable sharing in costs and actions to achieve groundwater sustainability
- Stakeholder engagement is an ongoing and never ending process

Next steps

- Policy Directives
  - Additional editing by a small group
  - Provide to IAH for further consideration and finalizing
  - Discuss in Montpelier, France at annual IAH Commission
  - Discuss policy directives with other organizations (UNESCO, NGWA, AWWA, AWRA, Energy Agency, etc.)
- Mexico
  - Desire to address groundwater management and depletion
  - Recognition that may require new legislation and /or policy changes
  - May accomplish through legislative and/or regulatory actions and mandates

QUESTIONS?

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