Draft Policy Directives for Sustainable Groundwater Management

Toward Sustainable Groundwater in Agriculture: An International Conference Linking Science and Policy
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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 km²
- 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%

Mexico – Renewable Water Resources
Total 447,260 hm³ in 2014
Renewable Water Resources Per Capita 2014

Precipitation Distribution (mm) Occurs June–October
1981-2010 Average Annual – 740 mm
2014 Total 831 mm

National Average
3,736 m³/person/year

1.604 m³/person/year

10,853 m³/person/year
Mexico – Proportional Water Demand

Agriculture 76.72%
Energy Generation 4.89%
(Excludes Hydropower)
Industry 4.21%
(Self-Supplied)
Public Supply 14.19%

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
- 145 seawater intrusion
- 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 9 m
- Supply for 40 years

Mexico – Degree of Water Stress

Overdraft
Availability
Regulation

Mexico – Aquifer Status
### 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

Next steps

- Policy Directives
  - Additional editing by a small group
  - Provide to IAH for further consideration and finalizing
  - Discuss in Montpellier, 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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