



Water, Climate Change, and Adaptive Strategies for Urban Areas in the Arizona-Sonora Region

Results from the 4th Binational Workshop on Water, Climate Change, and Adaptive Strategies held in Hermosillo, Sonora on May 7, 2010

Extensive research has shown that water management agencies in both the United States and Mexico have traditionally not utilized climate information—such as forecasts and projections based on climate modeling—as an integral part of their operational and planning practices. The lack of reliance on climate information is in part due to lack of concern about long-term climate implications for water supply. As well, water management agencies report having insufficient technical and financial resources to institutionalize the use of climatic information into water supply decision making processes. Moreover, water managers frequently identify a lack of fit between the available global or broad-scale climate science products with their inherent uncertainties and managers' need and desire for spatially and temporally specific climate forecasts that are viewed as highly reliable (e.g., Browning-Aiken et al., 2007; Ray et al., 2007; Rayner et al., 2005).

Two important aspects of this situation are changing, as was evident in presentations made by water managers at the May 7, 2010, science-stakeholder workshop attended by 65 participants and held at the Universidad de Sonora in Hermosillo and funded by a National Oceanic and Atmospheric Administration (NOAA) Sectoral Applications Research Program, the Inter-American Institute for Global Change Research, and the NOAA-funded Climate Assessment for the Southwest (CLIMAS) program. The core research team responsible for organizing the workshop includes the Colegio de Sonora, University of Arizona, and the National Center for Atmospheric Research (NCAR) with collaboration from the Comisión Nacional del Agua and Agua de Hermosillo.

First, the exigencies of climate change and compelling projections of likely impacts in vulnerable areas, such as the Southwest U.S. and Northwest Mexico, have encouraged more significant integration of climatic information into water supply planning in some areas and the investment of more state and local resources into monitoring and planning for climate-related changes in the water sector. Second, scientists and climate researchers have become more attuned to the need for an improved fit between climate information products and their adoption and use by water managers and other resource managers and decision makers.

Guest Speakers at 4th Binational Water and Climate Workshop (May 7, 2010)

LOCAL /MUNICIPAL	Title	Agency, Government Level
Ralph Marra	Chief Hydrologist	Tucson Water, City of Tucson
Alfonso Mendoza	Coordinator	Agua de Hermosillo, Municipality of Hermosillo
STATE		
Dr. Sharon Megdal	Elected member and Director	Central Arizona Project Oversight Board (CAWCD) Water Resources Research Center, University of Arizona
Ing. Gilberto Celaya	Official	State Water Commission (CEA)
Ing. Lucas Oroz and Ing. Martín Barrón	Technical Director Chief Meteorologist	Northwest Regional Headquarters, National Water Commission
Ms. Linda Stitzer	Statewide Water Planning	Arizona Dept. of Water Resources

The principal focus of the May 7, 2010 workshop was to bring together state and local water managers from Arizona and Sonora to discuss effective utilization of climate information in their water planning and identify climate-related challenges for long-term water supply, as well as to discuss adaptive management strategies planned or in use. A secondary focus was the presentation of preliminary findings from two (of a total four) urban water vulnerability case studies, for Tucson, Arizona and for Hermosillo, Sonora, and to gather input and feedback on the case studies from workshop participants.

The findings of the workshop are of four types: 1) climate and water situation for growing urban areas in the region; 2) the role of planning to address climate-related uncertainties in future water supply; 3) future climate-related challenges for the transboundary region; and 4) cross-border comparisons in Arizona and Sonora and prospects for future planning and collaboration.

Climate and Water Situation for Growing Urban Areas: AZ-SON

Drought and water supply are concerns for growing urban areas in the transboundary region due to increasing demand and hardening supply.

Based on a 30-year average, the average high temperatures have notably increased in Hermosillo since 1990; both the number of days with temperatures over 35°C and the extent of the extremely high temperature season have increased since 1995. Due to historically low water levels in reservoirs and the critical status of groundwater wells serving public use, Hermosillo has offered only staggered water supply (*tandeo*) to residences on the water network for the last year. In Tucson, groundwater pumping since 1940 resulted in subsidence in the central city, already pronounced by 2000, creating a shift in the management emphasis from groundwater supplies to renewable supplies (Colorado River water, renewable

groundwater, and reclaimed wastewater). While current supplies are reliable, numerous uncertainties may potentially affect future water supplies, including how

Supply-side (augmentation) strategies and demand-side (conservation) strategies are being considered and/or implemented at distinct levels in urban areas within the transboundary region.

Augmentation:

Develop multi-state (and Mexico?) strategies to mitigate future Colorado River supply shortages

Acquire additional water resources to reinforce vulnerable supplies and for growth
Plan for desalination plants on Gulf of California coast (e.g., Puerto Peñasco and Guaymas) for municipal and statewide use

Plan for binational desalination plant(s) to serve Arizona, other Lower Basin states, and Sonora

Conservation:

Reduce groundwater use to sustainable rate

Utilize all available renewable resources

Increase the level of per capita conservation

Replace aging infrastructure

Increase revenue to pay for all the above

Role of Planning for Climate-Related Uncertainties in Future Water Supply

Identified uncertainties that affect future water supply planning include:

How to find highly-reliable supplies to meet future water demand

Willingness of public to accept indirect potable reuse of effluent

Emerging regulations of currently-unregulated contaminants and impacts on water supply

Ability of consumers to conserve more than currently

Not only what supplies will be available in future, but when will they be available

Willingness of customers to pay for these new supplies and technologies

How large will Colorado River shortages be, and will they be permanent or temporary? Will the Lower Basin states (and Mexico) engage in conflict or cooperation?

Mitigation of climate change and impacts on costs of energy, and therefore, of water

Due to heightened awareness of the potential impacts of climate change on future water supply, water management agencies increasingly see the role of planning as an adaptive strategy to cope with the uncertainties as climate conditions change and intersect with demographic change over time.

Water supply planning is a key component of building adaptive capacity to meet the future challenges associated with climate change in urban areas of the transboundary region.

Plan Sonora SI

In Sonora, the Sonora Integrated System Plan (Plan Sonora SI) has been introduced as a means of resolving water supply problems currently and into the future. Plan Sonora SI centrally has three central components: 1) improved utilization of current water sources via infrastructure repair, replacement, and improvement and improved conservation by the public; 2) construction of new dams and system to transport water from large reservoirs serving southern Sonora to major cities such as Hermosillo; 3) construction of a desalination plant in Guaymas on the Gulf of California coast to serve coastal cities and, in future, Hermosillo. Other plan components include: flood control, wastewater treatment, hydroelectricity generation, recharge of reclaimed water, improvements to residential water service (for those on network) to 24/7. Total cost (with large share to be private capital): \$11.8 million pesos (approximately one billion dollars). <http://www.sonora.gob.mx>

Arizona Dept. of Water Resources Plans

Groundwater Management Plan

In 1980, Arizona adopted a statewide Groundwater Management Act to stem overdrafting of groundwater aquifers and establish safe-yield as a goal within specific Active Management Areas (currently five AMAs, including Phoenix, Tucson, Pinal, Prescott, and Santa Cruz). Groundwater management plans call for increasingly stringent conservation requirements for agricultural, municipal and industrial water users and long-range water demand and supply projection scenarios to assess and predict goal progress. Climate variability was only recently incorporated in long-range water supply and demand projections.

Due to concerns about uncertainties in predictive models, for example, the 4th Management Plan includes a water budget projection scenario that incorporates Colorado River water shortage.

Arizona Drought Plan

The Arizona Drought Plan was developed by the Governor's Drought Task Force established in March 2003, with the goal of preparing for and mitigating the impacts of drought, based on 1) an active monitoring program and 2) a series of drought "triggers" that would result in coordinated multi-agency responses depending upon the trigger.

Arizona Water Atlas

The Arizona Water Atlas is an online database compilation of statewide water resource data for water planning and public information, with data organized by seven planning area and 15 groundwater basins, including information on: surface & groundwater hydrology; water demand and supply; water quality; and climate and meteorological data.

Central Arizona Project (CAP) Planning and Enhanced Climate Information

The CAP incorporates climate change considerations via various planning processes, including: planning for potential shortages and other impacts; participating in the modeling of river runoff scenarios; evaluating alternative options – Adaptive management, river augmentation, conservation (Yuma Desalting Plant and Drop 2 Reservoir); and storing excess water underground today for use during shortages. For example, the Arizona Water Banking Authority has built up significant storage in Central Arizona to use during times of shortage to CAP municipal and industrial customers. In addition, to improve scientific information relating to climate and Colorado River flows, the CAP is participating in regional and national research to improve the accuracy of climate models; downscaling global models to improve their utility for the Colorado River basin; developing new methods to use climate models to generate stream runoff projections for use in Colorado River system models; and using tree-ring data to develop a stream flow record for the past 1,240 years to capture a wider range of runoff variability.

Tucson Water Plans

Among its extensive water supply and quality planning activities, Tucson Water engages in scenario planning as part of its frequently-updated 50-year water plan—including Tucson Water professionals and members of advisory boards and the public—to develop flexible future plans based on distinct scenarios that could develop based on identified uncertainties within a range of feasible possibilities.

<http://www.ci.tucson.az.us/water/waterplan-2008.htm>

Climate-Related Challenges for the Transboundary Region

Limited resources and constrained policy choices limit the effective implementation of strategies to address a broad range of climate-water challenges in the transboundary region. Uncertainty associated with climate change makes it difficult to factor climate into existing operational and planning models. Following are some of the major challenges identified by Workshop speakers:

- Drought, Climate Change
- Impacts of climate change on seasonal water demand
- Distinct vulnerabilities exist in different socioeconomic sectors, geographic areas due to topography, economic livelihood and the transboundary region
- Growth and the need for additional supplies

- Access 24 hours a day to water for those on residential network
- Water and Energy
- Water management outside the Active Management Areas (AMAs), including water quantity assessments
- Water Quality
- Use of effluent for potable and other water needs – the next major new water source
- Access to and utilization of renewable supplies
- Transboundary water issues
- The surface water/groundwater interface
- Riparian areas and other environmental considerations related to water
- Conservation Programs
- Recovery of Stored Water
- Approaches to replenishment
- Water cost/pricing
- Water Planning

Cross-Border Comparisons in Arizona and Sonora

The transboundary Arizona-Sonora region shares a common climate regime with the North American monsoon, yet due to differences on the U.S. and Mexico sides of the border, identified vulnerabilities, policy priorities, and strategies for response may differ.

	ARIZONA	SONORA
Similarities MONSOON	North American monsoon climate regime	North American monsoon climate regime
GROWTH	Rapid demographic growth (higher than U.S. average)	Rapid demographic growth (higher than Mexico average)
ECONOMY	Economic structure linked to growth, tourism, and agriculture	Economic structure linked to growth, tourism, and agriculture
PROJECTED IMPACTS	Higher temperatures, less precipitation, longer, more severe droughts	Higher temperatures, less precipitation, longer, more severe droughts
Differences COASTAL EXPOSURE	No coastal exposure	Gulf of California coast subject to hurricanes, extreme storms
ACCESS TO WATER	100% residential access to water and sanitation networks; 24/7 access in Tucson	[check 85%] residential access to water and [70+%] sanitation networks; limited access daily and rationed supply (<i>tandeo</i>) in Hermosillo
PLANNING FOR CLIMATE CHANGE	Drought monitoring and statewide plan; Colorado River shortage sharing plan; 50-year water supply plan and Scenario planning (Tucson); BUT, multiple uncertainties, and	Beginning Sonora State Climate Action Plan (PEAC) process; and new integrated statewide water plan (Sonora SI) has been introduced; BUT, long-range plans at municipal and state

	plans do not translate necessarily into effective implementation and policy; resources to plan and mitigate are lacking	levels are lacking and resources to plan, implement, and mitigate are lacking
Overall AUGMENTATION strategies being planned with ADAPTATION AND CONSERVATION	CAP; Reliance on Colorado River supplies and banking mechanisms; heavy emphasis on tightening conservation beyond current levels; and new sources via desalination, water reuse and reclamation	Planning new dams and water transport system in-state to serve multiple needs; emphasis on “new culture of water” (developing personal conservation ethos)

The May 7 workshop was fourth in a series of science-stakeholder interactive workshops focused on improving the fit between climate science and decision maker needs; understanding the common vulnerabilities in the urban water sectors of the transboundary region; identifying appropriate adaptive management strategies for long-term resilience of water supply; and testing and refining a Binational Climate Summary (published in English and Spanish) available to water and resource managers to inform regional knowledge on climate information, forecasts, or models of particular significance for the transboundary Arizona-Sonora region.

Website: <http://udallcenter...>

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