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Water, People, and the Future: Water Availability for Agriculture in the United States

Presented by:

Sharon B. Megdal, Ph.D.
The University of Arizona

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The University of Arizona

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Issue Paper Authors

• Sharon B. Megdal (Chair)
  – Water Resources Research Center
  – University of Arizona, Tucson

• Richard Hamann
  – Levin College of Law
  – University of Florida, Gainesville

• Thomas Harter
  – Department of Land, Air, and Water Resources
  – University of California, Davis

• James W. Jawitz
  – Soil and Water Science Department
  – University of Florida, Gainesville

• J. Michael Jess
  – Conservation and Survey Division of the School of Natural Resources
  – University of Nebraska, Lincoln
Issue Paper Reviewers

• Pierce Jones
  – Program for Resource Efficient Communities
  – University of Florida, Gainesville

• Don R. Parrish
  – American Farm Bureau Federation
  – Washington, D.C.

• Rita Schmidt Sudman
  – Water Education Foundation
  – Sacramento, California
Technical Advisor and CAST Liaisons

Technical Advisor

• Joanna Bate, Research Assistant
  – Water Resources Research Center
  – University of Arizona, Tucson

CAST Board Liaisons

• Ed Hanlon
  – Department of Soil and Water Science
  – University of Florida, Immokalee

• John Havlin
  – Department of Soil Science
  – North Carolina State University, Raleigh
Presentation Outline

• Introduction and overview
• Four case studies
• Conclusions and recommendations
• Questions and discussion
Factors Affecting Water Availability

- **Competition:** Multiple, often growing demands of multiple sectors, including water for energy production
- **Water quality regulations and concerns**
- **Water rights and legal/institutional structure**
  - Varies significantly by state and sub-state region
- **Environmental considerations**
- **Natural conditions**
  - Drought
  - Climate Change
- **Technological advances**
Types of water

- Surface water
- Groundwater
- Recycled water
- Desalinated seawater
Four case studies

- **California**
  - Large state with large and growing population
  - Large agricultural sector
- **Arizona**
  - Rapidly growing urban population
  - Large agricultural sector
  - Water-scarce state
- **Florida**
  - State with significant water supplies and agriculture
  - Water supply challenges exist
- **High Plains Aquifer Region**
  - Sizable High Plains aquifer is being depleted
  - Population growth not the factor it is in the other three regions
Federal nexus throughout Case Studies

- Federally funded/constructed projects
- Endangered Species Act
- Clean Water Act and
- Safe Drinking Water Act
  - New constituents
  - Changing standards for naturally occurring constituents, e.g. arsenic
- Shared borders
California Snapshot

- Population expected to increase from approximately 35 to 59 million by 2050
- The additional demand will be met largely by conservation, reuse, and retirement of agricultural water uses (land conversion)
- The water landscape is driven by the temporal and spatial disconnect between the major source of water and the water users
  - Insufficient storage for long-term droughts
- Major agricultural activity, including dairies (15% of nation’s milk and cheese supply)
  - Approximately 1/3 of applied agricultural water percolates back to groundwater or returns to streams as tailwater
Recently, state funding for water projects requires Integrated Water Resources Management Plans:
- Water quality across jurisdictional boundaries
- Surface water and groundwater rights
- State and federal laws

Another recent factor driving regional water management: Water supply assessments for new subdivisions of 500 or more units prior to getting land development permit from local land use agencies. Complete basin analysis is required.
Meeting water demands in CA will require

• Expansion of groundwater banking, possibly combined with expansion of surface water storage
• Improved conveyance through or around the Bay-Delta region
• Decrease in consumptive use of water, particularly by urban sector, which will continue to expand into CA ag lands
• Water conservation and reuse
• Desalination
• Continued improvement to irrigation efficiency and agricultural productivity
Arizona

• Two major Reclamation Projects
  - Salt River Project (SRP)
  - Central Arizona Project (CAP)
• Since 1980, Groundwater management in the Active Management Areas
• Agriculture expansion limited in AMAs and Irrigation Nonexpansion Areas
Arizona Snapshot

- Population of 6.5 million people expected to almost double by 2050. Typically at or near the top of the list for population growth

- Water use estimated to be between 7 and 8 Million Acre Feet (MAF)
  - Approx. 40% of total use is groundwater
  - Approx. 3% is recycled or reclaimed water
  - Of the remaining use, which is surface water, 2.8 MAF is from the Colorado River
    - 1.5 MAF of that is delivered through the CAP

- Approx. 70% diverted or extracted by agriculture
• Non-Indian agricultural water use is diminishing as lands are urbanized in central Arizona

• Agricultural activity is increasing on non-AMA areas of the state
  – Southwestern part of Arizona has seen increase in vegetable production and processing
  – Indian agriculture increasing in parts of Arizona, in part due to settlement of Indian Water Rights claims
AZ Water Management Policy

• AMA Assured water supply program requires demonstration of 100 years of legally, physically, and continually available water for new residential development
• Conservation regulations in the AMAs for all large water users
  – Best Management Practices
• Drought planning requirements
• No statewide water plan required
• Environmental water use recognized in state reports in very limited way
• Groundwater overdraft continues in many areas
“...in addition to remaining challenges within the AMAs, there is a need to understand the growing – and often competing – demands for water....Rapid population growth, continuing drought, and impacts of climate change are additional factors making water management in Arizona challenging and careful water planning imperative.” (p. 12)

Update: State budget problems are affecting significantly Arizona Department of Water Resources personnel and programs
Florida’s Water Management Districts
Florida Snapshot

- Population of approx. 18 million is largely urban and expected to increase to 26.5 mil by 2030
- Agriculture uses more than half of freshwater
  - About half of this is groundwater
- Agribusiness in FL is 9th largest in U.S. ($7.8 billion in 2005)
- Abundant groundwater
- More than 7,800 lakes
Florida Water Management

- 1972 Water Resources Act delegated water management to five regional districts covering entire state
- District boundaries follow surface hydrologic boundaries and cut political boundaries, including cities
- Districts permit consumptive use for a maximum of 20 years but usually much less
- Effect of water withdrawals on natural systems is a consideration
“Criteria for the limit of acceptable environmental impacts caused by water withdrawals are established based on minimum flows and levels in surface waters and aquifers…

...the effects of pollutants from nonpoint sources on Florida ecosystems are increasingly of concern.” (p.13)
Moving toward sustainability in FL

- Having enough for future generations
- Economic, social, and environmental considerations
- Major constraint on water withdrawals for human use is regulatory protection of water for ecosystems
- Expansion of use of reclaimed water for urban, household turf irrigation in lieu of good quality water
High Plains Aquifer Region
High Plains Snapshot

- Area is predominantly rural
- As a whole, aquifer is not polluted
- Complex aquifer
- No one has undertaken the task of counting water wells
- Most water consumption is for crop irrigation
- Groundwater overdraft in a variety of locations
- Estimates indicate since 1950s 6-11% of the aquifer’s water has been extracted
“Lying in a semiarid environment and geologically cut off from replenishment by sources outside the region, natural recharge of the High Plains Aquifer is meager.” (p. 14)

“Beneath the eight-state region, the volume of water...is nine times the volume of Lake Erie.” (p.15)
Conclusions related to High Plains overdraft

- It is expected that overdraft will continue in many parts of the High Plains Aquifer.
- High Plains section of the paper concludes that in most High Plains locations “…no utility would be gained from leaving water in the ground. Pumping the ground water has and will continue to create wealth...” (p.17)
Differences and similarities abound

- There is wide diversity in availability, distribution, consumption, and regulation of surface and groundwater resources.
- Each state or region increasingly is concerned with the ability to meet future demand of diverse users.
- Although the proportion of available freshwater used in agriculture varies widely among the case studies, it is a major proportion of total water use in every area.
Changing agricultural water use

- Increasingly, regulatory considerations related to water quality and the environment are affecting agricultural water use.
- Agricultural lands are being urbanized, resulting in decreased water use by ag.
- Other voluntary transactions are likely to decrease ag water use, such as dry-year options to address drought or other, longer-term transactions, such as those in California.
Analysis of impacts of changes and water management actions needed

• Reversible or not
• U.S. trade balance
• Food security
• Irrigation and urban water use efficiency
• Water reuse practices
• Expansion of surface water or groundwater storage
• Identification and analysis of tradeoffs needed
“Water management reflects a complex, ever-changing legal and institutional framework. As the case studies illustrate, it is important to the economic vitality of the United States – including agriculture – that policymakers, water managers, and water users work collaboratively to achieve sustainable water resource management.” (p.3)
“Because of the relationship among water quality, the quantity of water that can be put to alternative uses, and the interstate reach of many natural and constructed water supply systems, federal involvement in the resolution of long-range water supply issues will be critically important.” (p.18)
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ABSTRACT

With projected 5% and 50% increases in U.S. and world populations, respectively, by the year 2050, substantial increases in freshwater use for food, fiber, and fuel production, as well as municipal and industrial consumption, are inevitable. This increased water use will not come without consequences.

Already, the United States has experienced a rising demand for groundwater, resulting in declining water tables, increased costs of water withdrawal, and the deterioration of water quality. Long-term drought conditions have greatly decreased surface water flows. Climate change projections include higher temperatures, decreases in snowpack, shifts in precipitation patterns, increases in extreme events, and more frequent droughts. Not surprisingly, conflicts over water use are continually emerging.

As one of the largest users of water in the United States, agriculture will be impacted significantly by changes in water availability and cost. Approximately 80% of the water withdrawn is used for irrigation. Although the allocation of available freshwater and agricultural water use varies among geographical areas, it is a major proportion of total water use in every area.

Increasing populations are being placed on agricultural water use at a time when available water resources are declining. Additionally, increasing industrial and municipal water use may continue to limit the water available to agriculture. Given agriculture's future role in feed, fibers, and fuel, efforts will be necessary to ensure that agriculture has access to sufficient water supplies.

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