Decision-making about water in Phoenix

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- Urban water decision-making under uncertainty
- Regional stakeholders engaged from start to finish
- US NSF’s largest social science grant ($14M)
- Decision Theater helps explore alternative futures
- Could also apply to air pollution, energy, traffic, food
Phoenix has three water sources: Aquifers, Colorado River, Salt-Verde Rivers
Sources of Phoenix’s water uncertainty

- Global climate change
- Annual rainfall variability
- Urban heat island
- Population growth
“WaterSim” framework connects models for hydrology, law, economics, climate, land use.

Lake Mead, Lake Powell, and the Seven States Plan
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Lake Mead, Lake Powell and the Seven States Plan
Using “WaterSim” tool in Decision Theater

*WaterSim has* many user-adjustable variables
Slider bars on graphs allow alternate futures to be assessed in real time

WaterSim also available online at http://watersim.asu.edu
Watershed Simulation

Watershed Flow Simulation

- Historic Colorado River Flow Through Lee's Ferry
  - Million acre-feet
  - Years 1900 to 2020

- Historic Salt and Verde Rivers Flows
  - Million acre-feet
  - Years 1900 to 2020

Reservoir Storage

- Colorado River Reservoirs
  - Million acre-feet
  - Years 2010 to 2030

- Salt & Verde Rivers Reservoirs
  - Million acre-feet
  - Years 2010 to 2030
Climate Change

Implications of Climate on Watershed

2007 IPCC Fourth Assessment Report Results Applied to the Colorado Basin

Change in Colorado Runoff Under Model/Scenario Combinations

Change in Salt/Verde Runoff Under Model/Scenario Combinations

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Land Use and Population

Population & Retirement of Agriculture

Historic Maricopa County Population

- People (in millions)
- Year

Phoenix Water Sources

From Central Arizona Project
- Water source

From Salt River Project
- Water source

From Groundwater Sources
- Water source
Policy Tradeoffs

Total estimated gallons used per person per day under policy: 224

Indoors: 78
- toilet
- clothes washing: 0.4 loads
- showers: 1.5 min
- baths: 10 min
- faucet: 6.7 min
- leaks: 0
- other domestic: 1.5 gal/day
- dish washing: 0.1 loads

Outdoors: 146
- Density of urban expansion
- Non-desert landscaping: 13%
- Pools: 13%

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Groundwater Sustainability

Total change, 2006-2030

Net recharge: +50 maf
Net withdrawal: -50 maf
-12.83 million acre-feet

Average change per year, 2026-2030

Net recharge: +2 maf/year
Net withdrawal: -2 maf/year
-0.53 million acre-feet/year

Scenario summary:
Colorado: 1970-1994 historical period; 100% of average 2006-2030; 100% of historical runoff
Salt/Verde: 1970-1994 historical period; 100% of average 2006-2030; 100% of historical runoff
Population: 100% of DES
Agriculture: buildout by 2069
Policy: starting in 2020; indoors usage of 78 gpcd; outdoors usage of 146 gpcd
Lessons learned

- Stakeholder engagement an ongoing process
- DCDC helps managers communicate with their bosses
- Using WaterSim identifies critical gaps in observations
- Important to emphasize we don’t predict the future
- Neutral convening role as important as modeling role