Rodney T. Smith, President

On Markets and Water Security

Water Resources Research Center, University of Arizona
Conference "Water Security from the Ground Up," March 5, 2013

What is Water Security and What is it not?

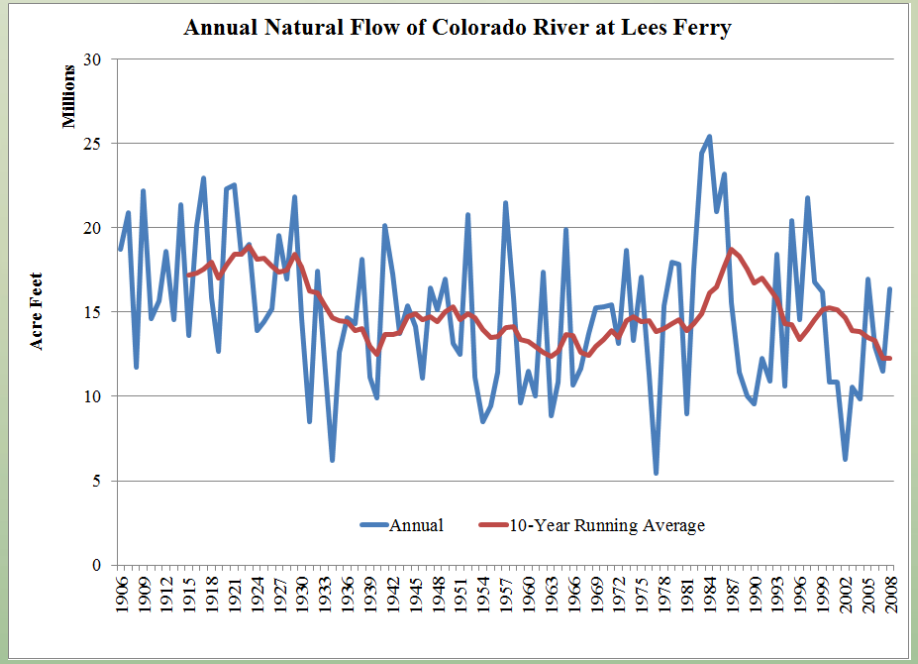
- "Water security constitutes the sustainable availability of adequate quantities and qualities of water for resilient societies and ecosystems in the face of uncertain global change" (*Varday and Scott, emphasis added*)
- A missing link: resource risk management (humans and institutions)
  - ✓ Sustainable: longevity and survivability
  - ✓ Availability: reliability (robustness to realization of risk factors)
  - ✓ Uncertain: risks even in the absence of global change

Water Security is an Elusive Goal

- How is risk currently allocated?
- How may risk be reallocated?
- How may we mitigate (reduce) risk?
- How do we quantify risk and measure how it changes to improve water security?
- Explore these questions using the hydrologic risk of the Colorado River

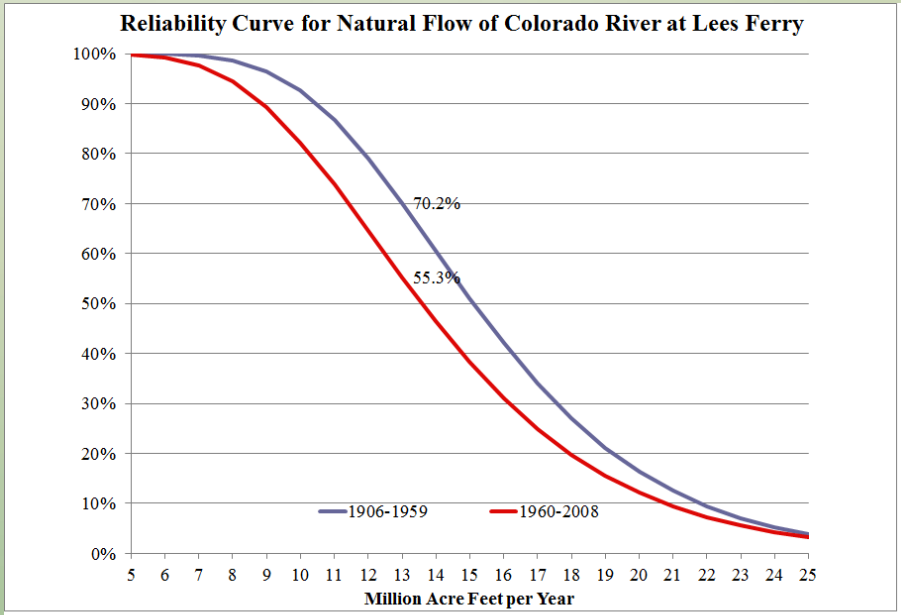
Hydrologic Risk on the Colorado River

Earlier Part of 20th Century Unusually Wet Period



- Until 1930s, annual flow averaged 18 million acre feet
- 1922 Compact allocated 15 million acre feet/year
- 1944 Treaty allocated 1.5 million acre feet/year to Mexico
- Tree ring studies suggest long-term average flow 13.5 million acre feet

Probability that Annual Natural Flow Exceed 13 Million Acre Feet has declined from 70% to 55% during 20th Century



- Decline in reliability of annual flows means less likely that there are sufficient supplies to meet all rights
- Storage helps firm up supplies, but need excess supplies in high-flow years to store water for use during low flow years (more below)

How is Risk of Low Supplies Allocated Today?

Prior Appropriation Doctrine

- First in time, first in right
- With agricultural uses developed earlier in time than municipal uses, agriculture generally has “senior right” and municipal uses “junior rights”
- Risk of declining availability and reliability of water supplies borne by municipal water users

How System Works for Colorado River in Arizona

- Arizona sustains the first 1.5 million acre feet per year cutbacks in the Lower Basin
- Within Arizona, Central Arizona Project takes first shortages
- Agricultural water users on Colorado River have 782,900 acre feet of water rights senior to Central Arizona Project

How to Improve Water Security for Arizona Municipal Water Users?

Tools of Risk Management: Risk Allocation

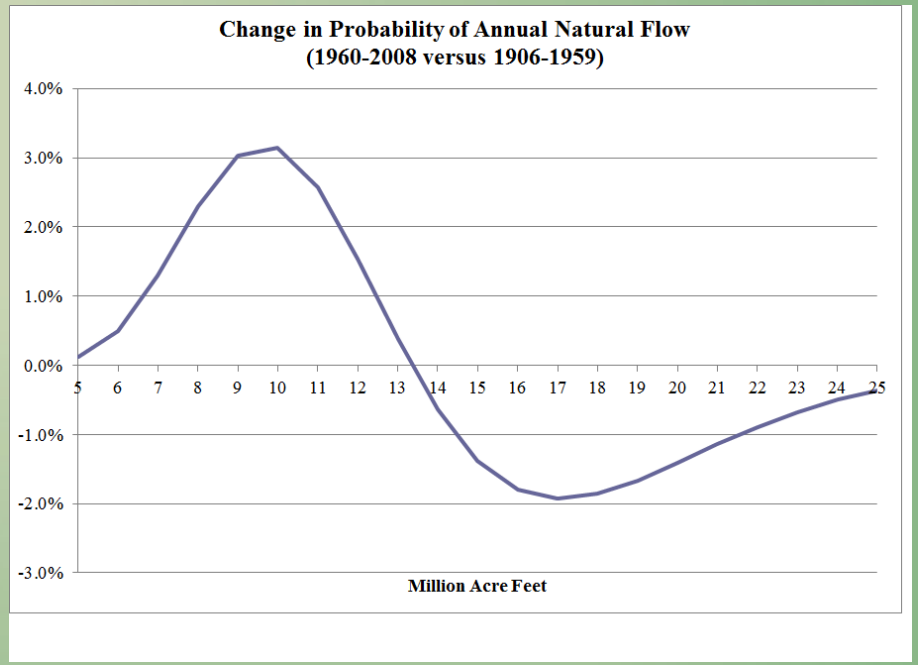
- Involuntary (litigation/legislation)
  - Delay, transaction costs, uncertain outcome
  - Add litigation lottery/political risk to resource risk
- Voluntary (water transfers)
  - Palo Verde Irrigation District/Metropolitan Water District fallowing program reallocates supply reductions from junior to senior priorities when needed—money for water

Tools of Risk Management: Risk Reduction by Conservation

- Imperial Irrigation District/San Diego County Water Authority agreement based on long-term water conservation to allow more uses of water available from senior water right—money for water
- Water conservation by junior right holders: "move up" the supply reliability curve of the underlying resource
  - ✓ Reducing the bet on higher flow years/storage needed to meet higher demands—money to reduce need for water

Tools of Risk Management: Risk Reduction by Storage

- Colorado River System has storage to improve supply reliability
- Active storage capacity about 3x 16.5 million acre feet
- Water in storage 2x 16.5 million acre feet today
- Changing hydrologic risk on Colorado River means more frequent demand for stored water and less frequent opportunities for storage



Quantifying and Understanding Risks

Current Approaches: Wisdom of Experts

- Looking into the Rearview Mirror: hydrologic history
- Using Black Boxes: computer resource models (see "Blind Men, Elephants and Zen: Approaching Basin Evaluation Like a Cup of Tea", Larry Fanning, *Water Strategist Community Blog (www.wscommunityblog.com)*, posted January 23, 2013)
- While these tools continue to evolve in meaningful and useful ways, run risk of lack of buy-in of policy and broader community (witness the climate change debate)

“Market of Ideas” Solution: Wisdom of Crowds

- What are prediction markets and what do they do?
  - ✓ trade contracts about defined future outcomes
  - ✓ thousands of public and private sector markets successfully predict the frequency of traded events actually occurring
  - ✓ aggregate information, analysis and beliefs of participants
- What can prediction markets do for water security?
  - ✓ inform choices by assessing risks and magnitude of consequences of future events (policy outcomes, hydrology, projects, agreements, litigation)

Conclusion

- We don’t live in a riskless world nor can we create one
- We can improve water security through prudent risk management
- Risk management is forward-looking and based on objective factors, but is also subjective
- Decision making will improve from broadening the dialogue with alternative views about risks and future outcome with a way to balance them
- Prediction markets can harness the wisdom of the industry crowd’s well-known diverse set of (often conflicting) interests, knowledge and information
- By improving understanding of future risks, prediction markets can help us secure a better water future

For More Information

- "Increasing Hydrologic Risk on the Colorado River Basin", Rodney T. Smith *Water Strategist Community Blog* (www.wscommunityblog.com), posted January 28, 2013
- For ongoing commentary on western water policy, www.wscommunityblog.com. Join the dialogue as a blogger, commentator, or reader
- For emergence of water policy prediction markets, keep your eye out for www.waterpolicymarkets.com (under development). Use "contact us" on the *Water Strategist Community Blog* to let us know if you want to receive information about roll out and how to participate once we go live