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Sandia National Laboratories

Where Will the Water Come From? Review of Water Availability in the West

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Sandia National Laboratories

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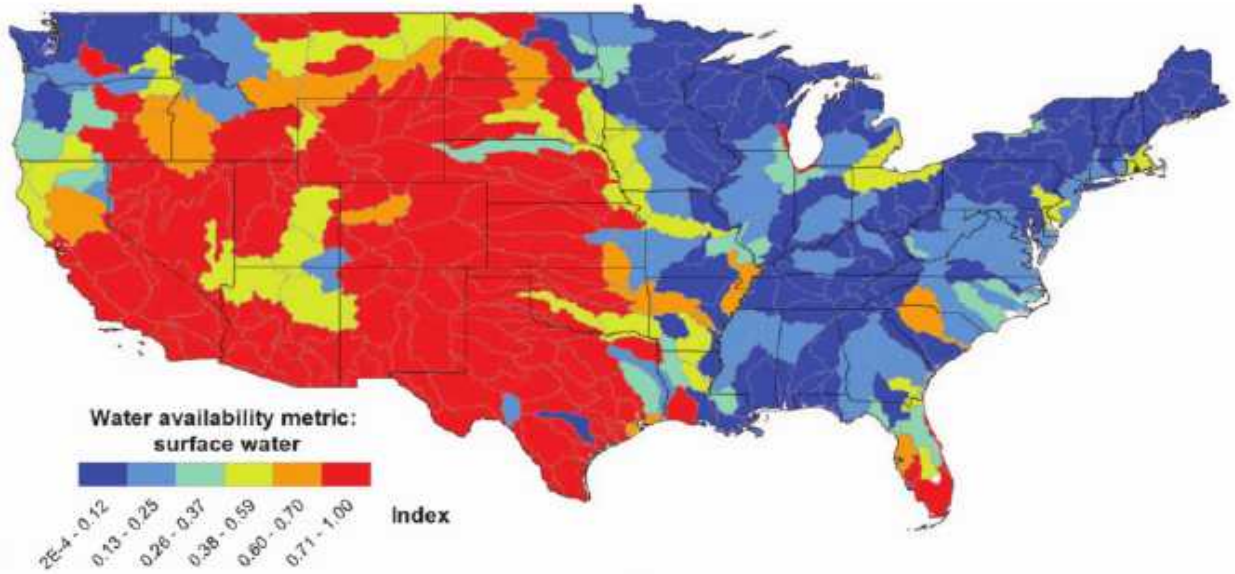
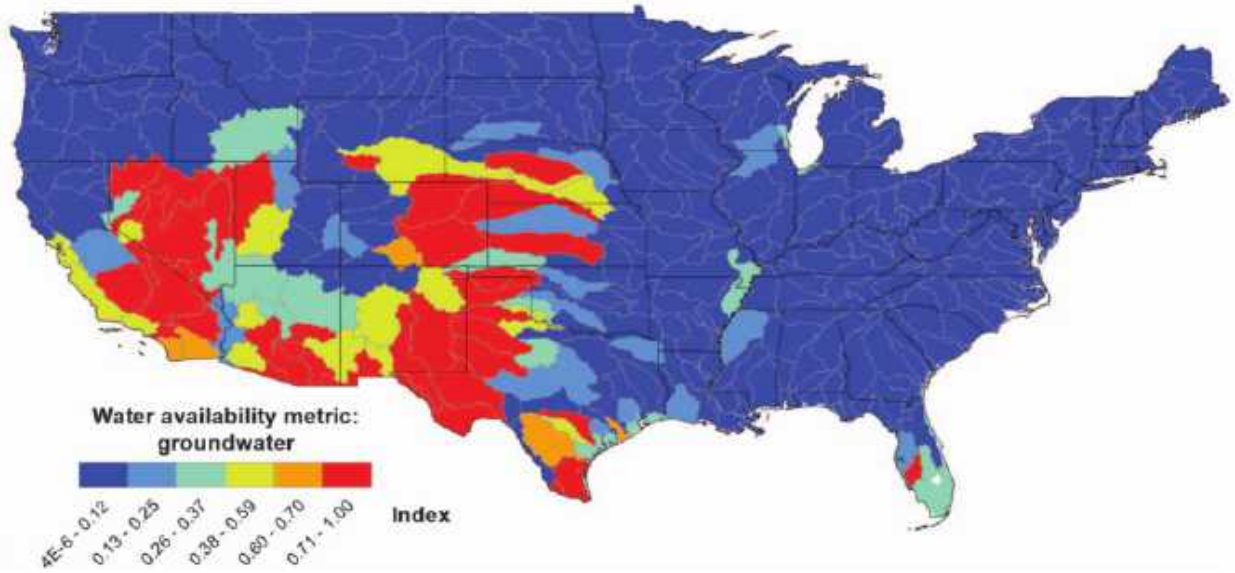
Water Limited Basins

Surface Water Availability

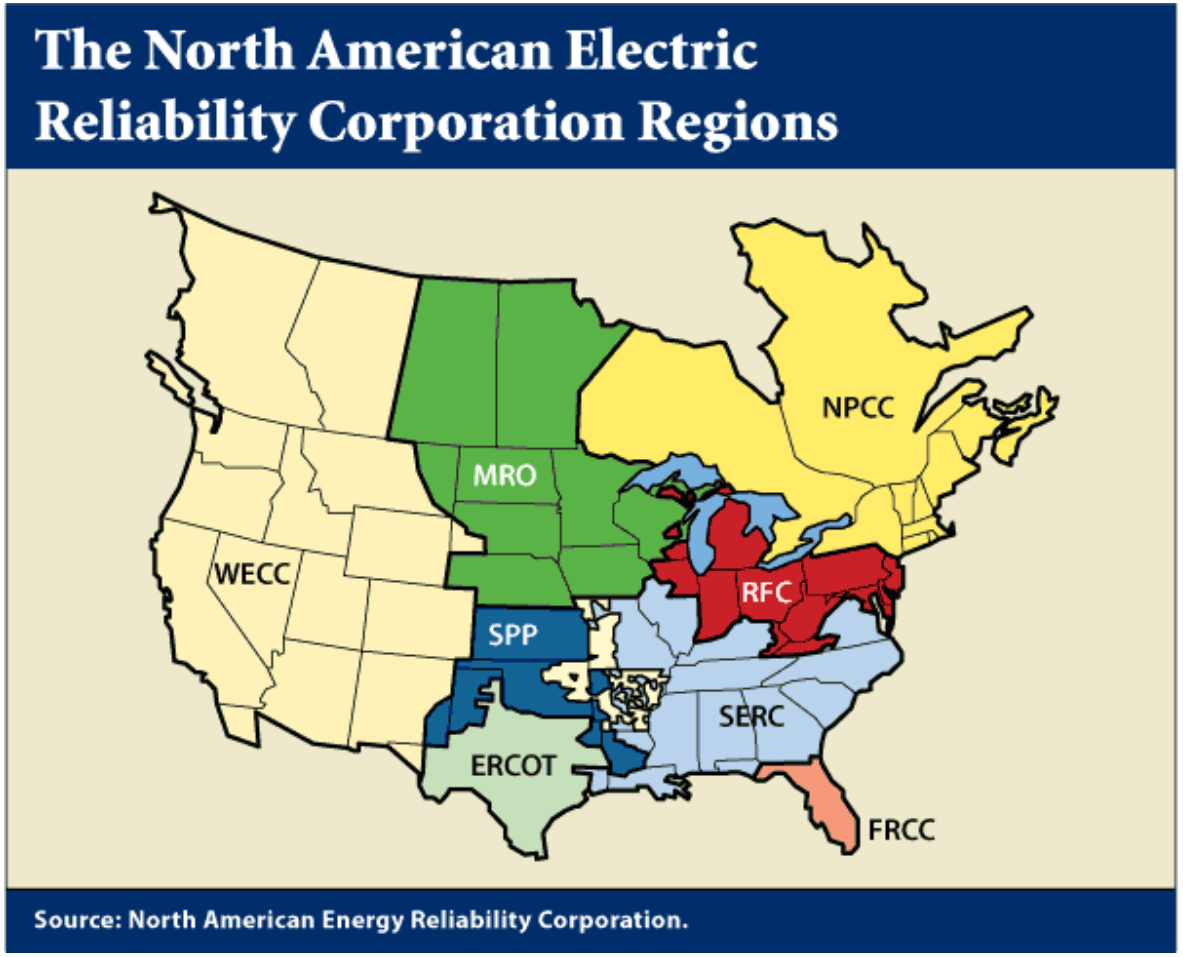


Groundwater Availability

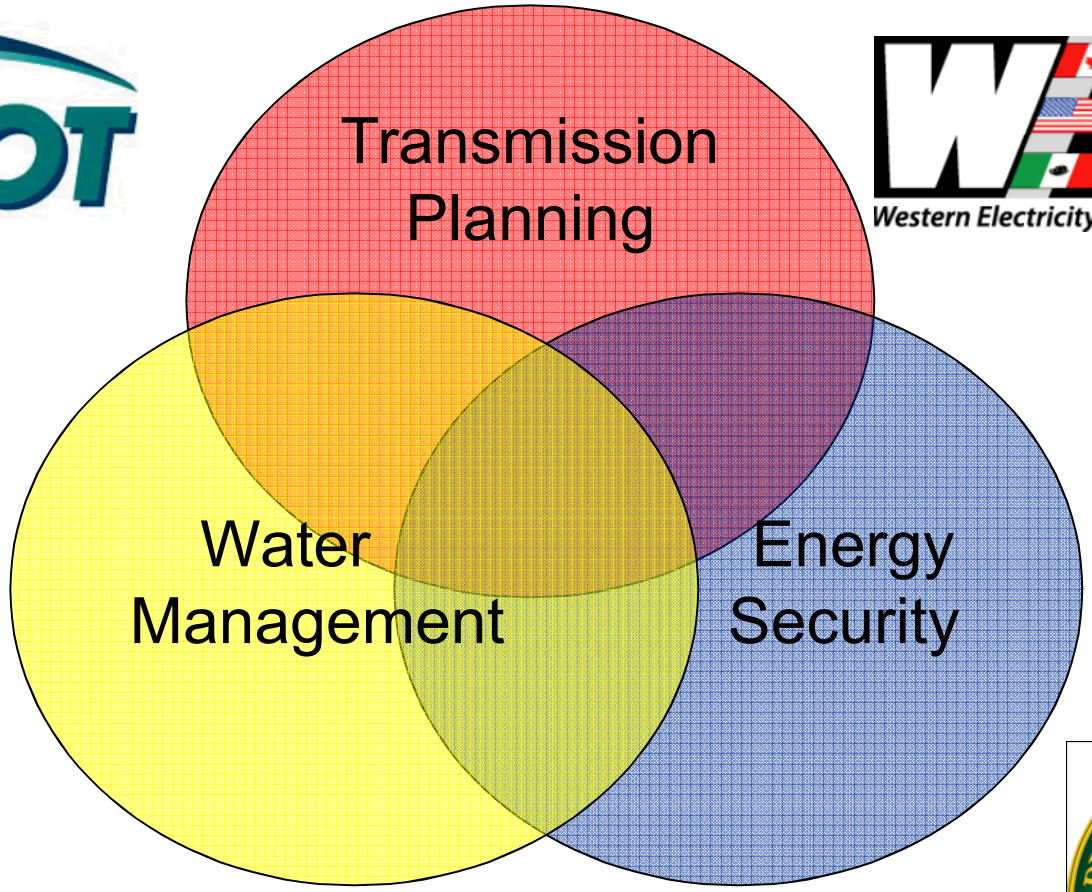


Transmission Planning

- WECC and ERCOT are conducting long-range transmission planning (20 yrs.)
  - Siting of new power plants
  - New transmission capacity



Integrated Planning



ERCOT

WECC
Western Electricity Coordinating Council

Western Governors' Association
Serving the Governors of 19 States and 3 US-Flag Pacific Islands

WSWC
Western States Water Council

Department of Energy · United States of America

Technical Support Team

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  - Eugene Yan
  - Chris Harto
- Electric Power Research Institute
  - Robert Goldstein
- National Renewable Energy Laboratory
  - Jordan Macknick
  - Kathleen Hallett
- Idaho National Laboratory
  - Gerald Sehlke
  - Dan Jensen
  - Chris Forsgren
- Pacific Northwest National Laboratory
  - Mark Wigmosta
  - Ruby Leung
- University of Texas
  - Michael Webber
  - Carey King

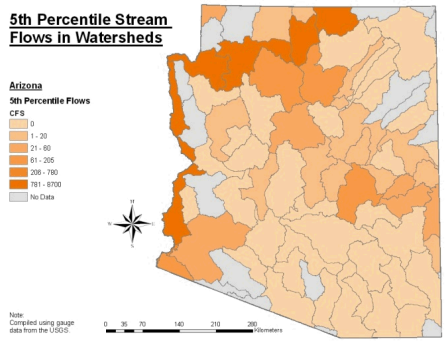
Key Water Sources

- **Potable Water**
  - **Unappropriated surface water**
  - **Unappropriated groundwater**
  - **Appropriated water (rights transfers)**
- **Non-Potable Water**
  - **Municipal/Industrial wastewater**
  - **Shallow brackish water**

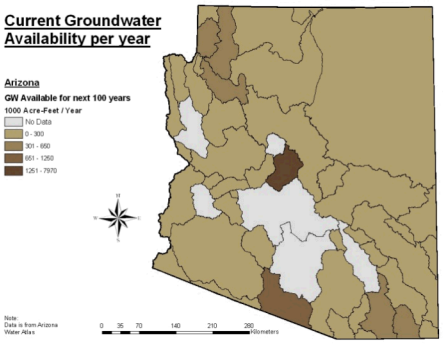
Relative Availability and Cost

Utilized State Water Data

Water Supply

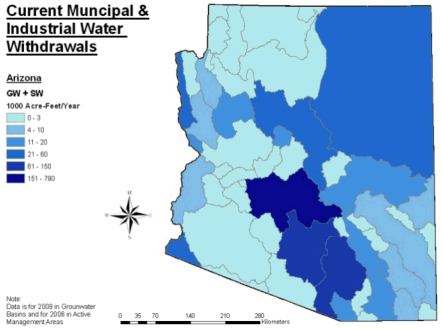


Mean Gauged Streamflow

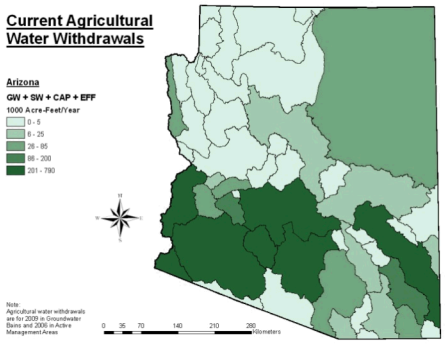


Groundwater Depletion

Water Demand

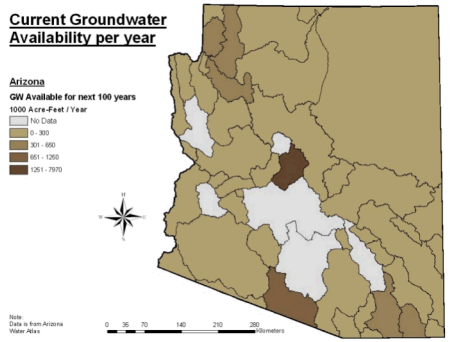


Municipal Demand

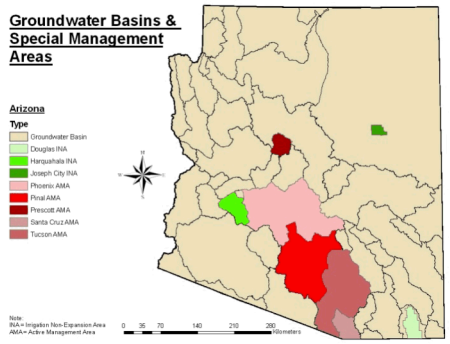


Irrigation Demand

Water Institutions



Unappropriated Water



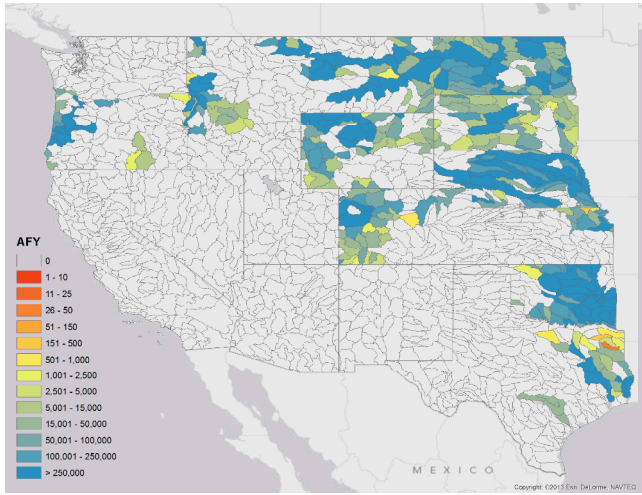
Administrative Control Areas

Metric Development

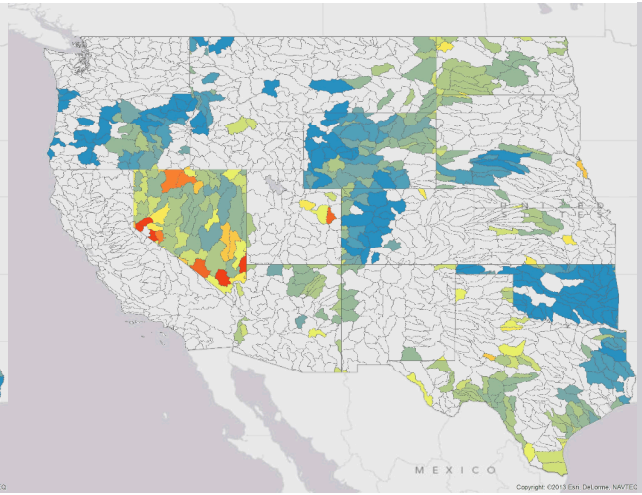
- **Data on "available water" are rare**
- **As such, metrics were estimated from available information**
- **Assisted by volunteer team from WSWC**
  - **Bret Bruce (USGS)**
  - **Dan Hardin (TX)**
  - **Sara Larsen (WSWC)**
  - **Dave Mitamura (TX)**
  - **Andy Moore (CO)**
  - **Ken Stahr (OR)**
  - **Todd Stonely (UT)**
  - **Steve Wolff (WY)**
  - **Dwane Young (WSWC)**

Water Availability

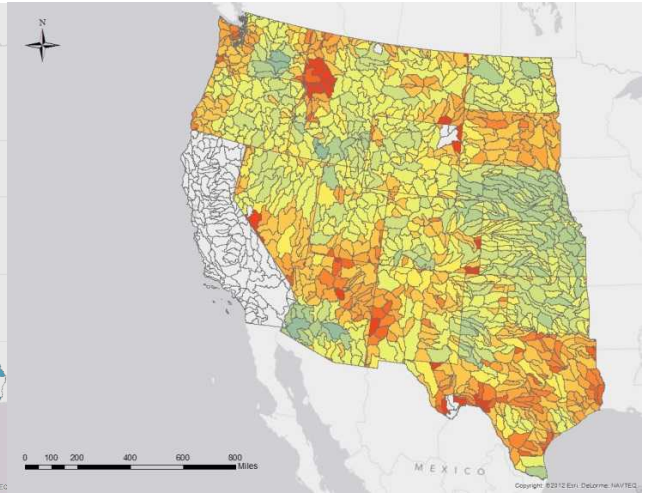
Unappropriated Surface Water



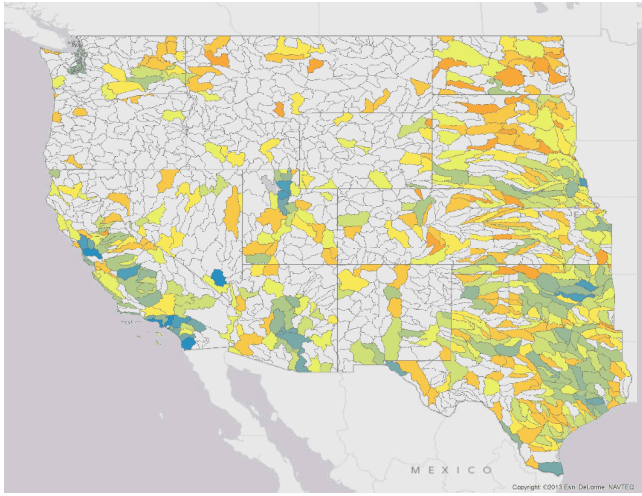
Unappropriated Groundwater



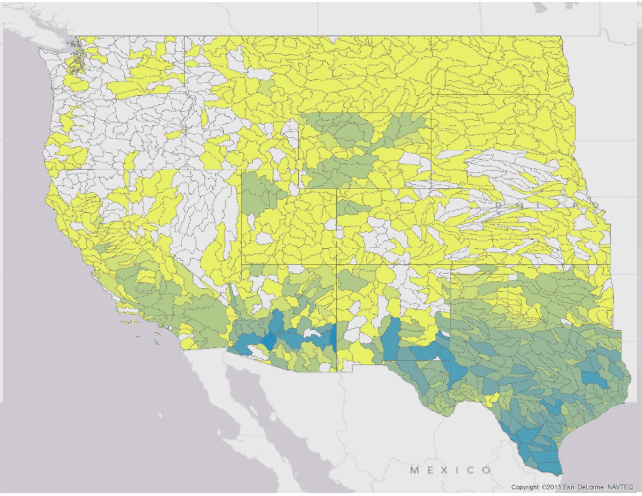
Appropriated Water



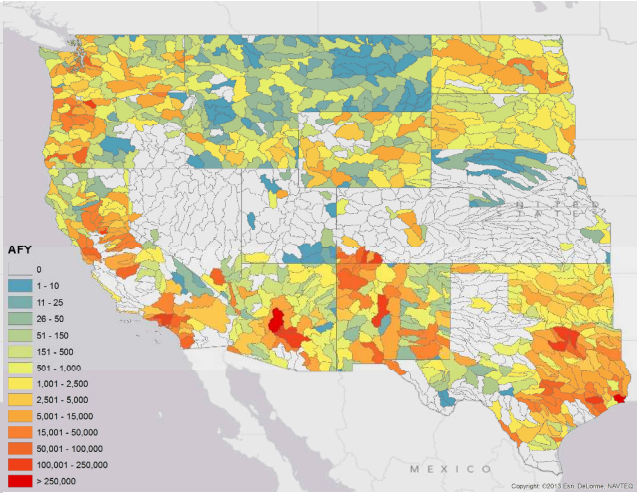
Municipal Wastewater



Brackish Groundwater

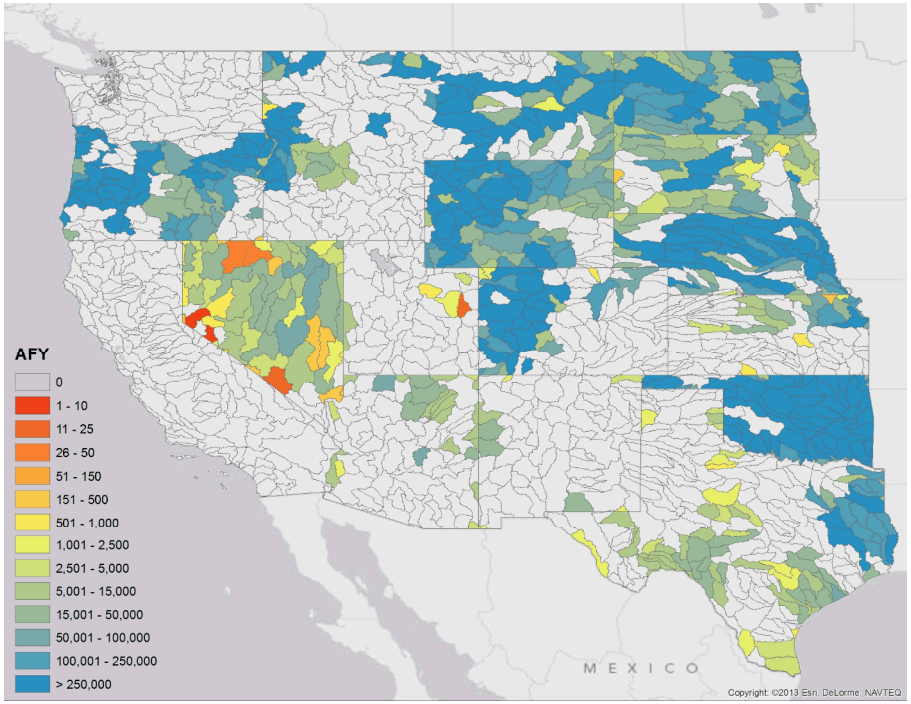


Consumptive Demand 2010-2030

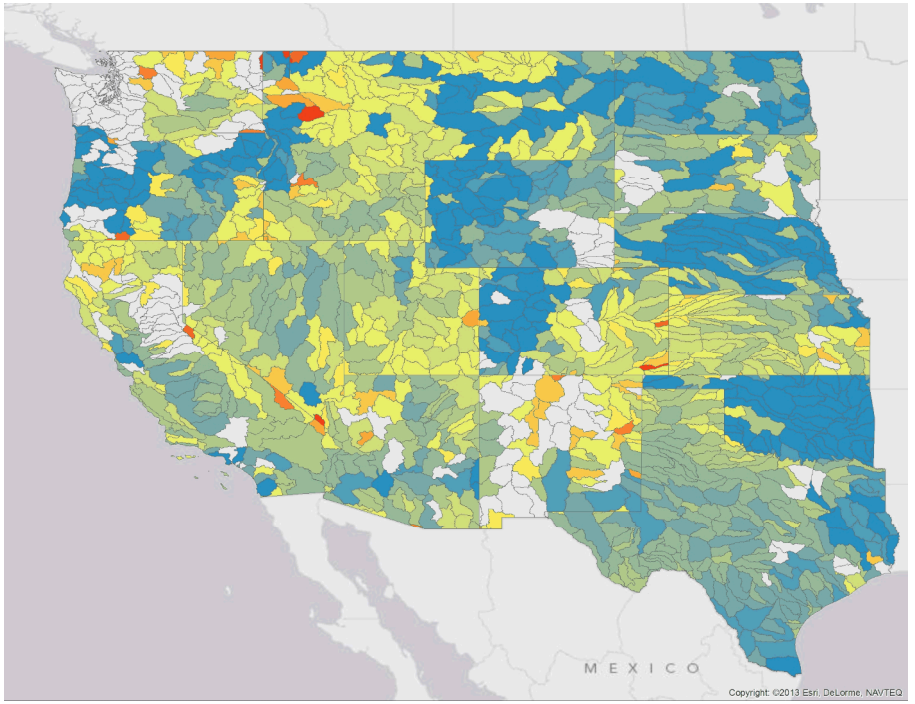


Water for Development

Unappropriated Water Sources – Change in Demand 2030

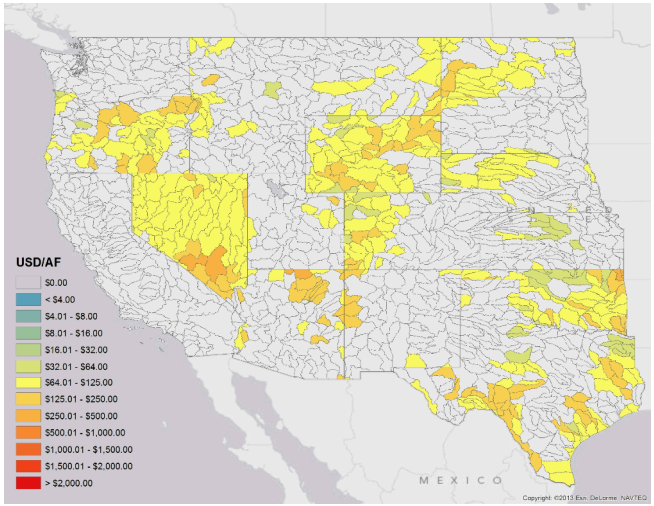


All Water Sources – Change in Demand 2030

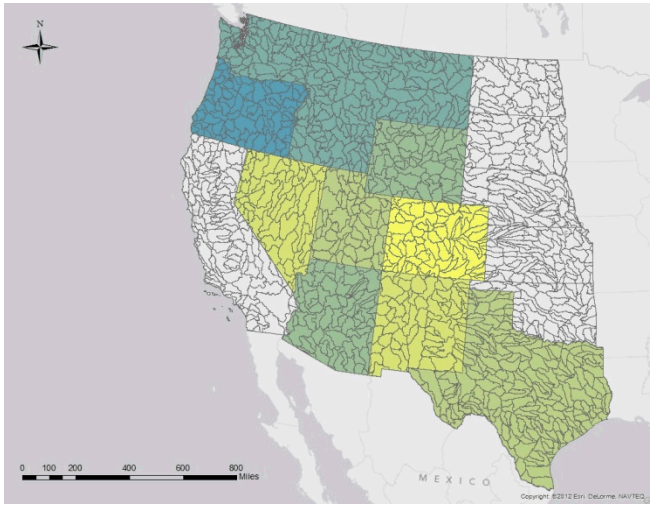


Relative Cost of Water

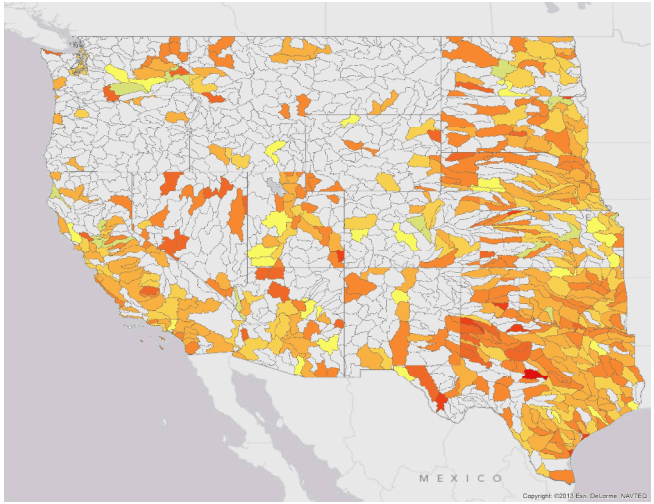
Unappropriated Groundwater



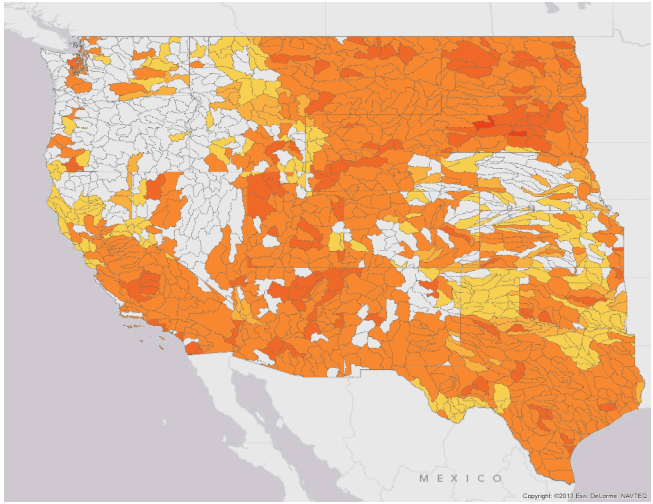
Appropriated Water



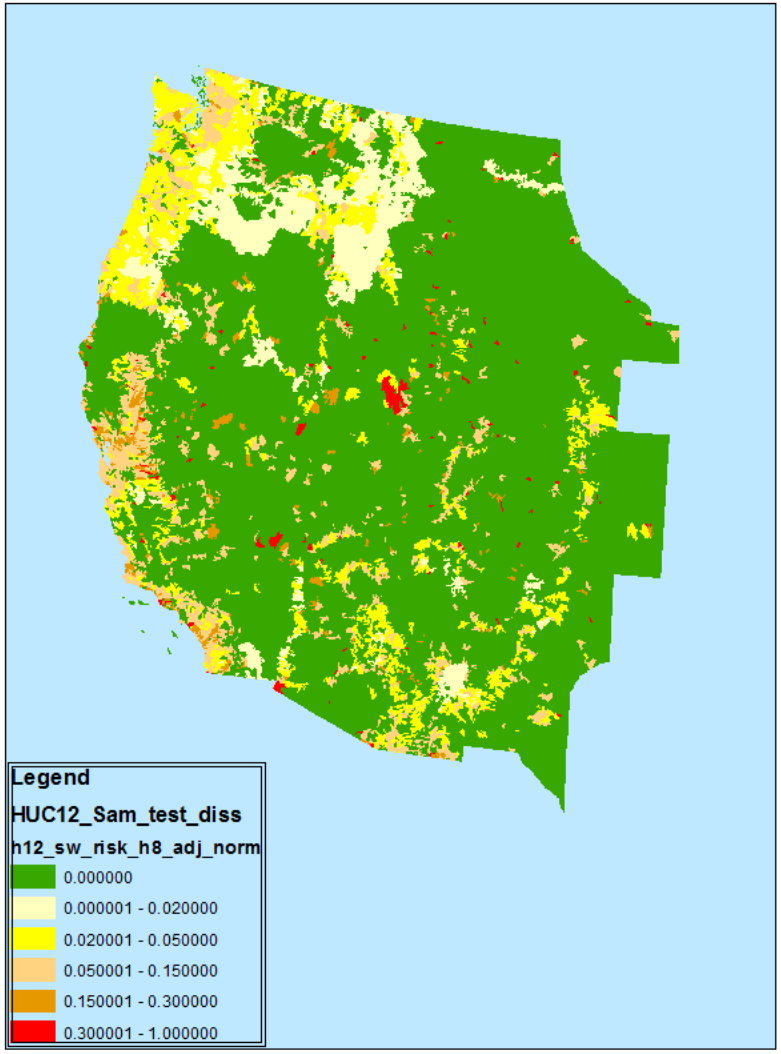
Municipal Wastewater



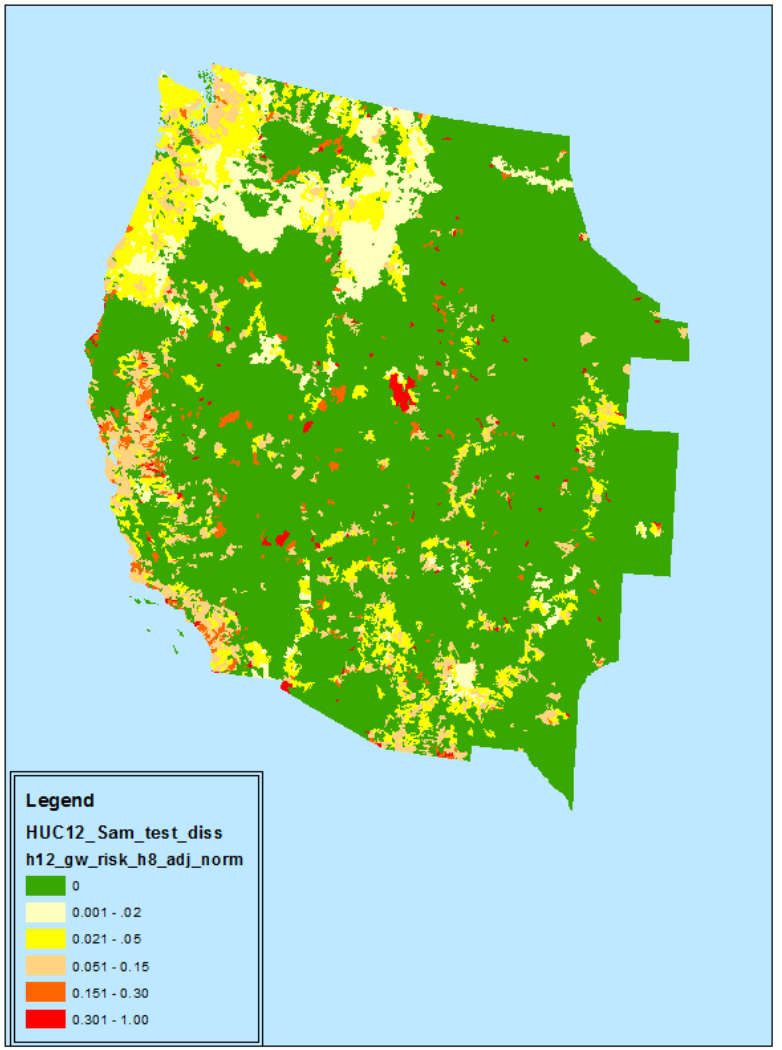
Brackish Groundwater



HUC-12 Risk Map (From Surface Withdrawals)



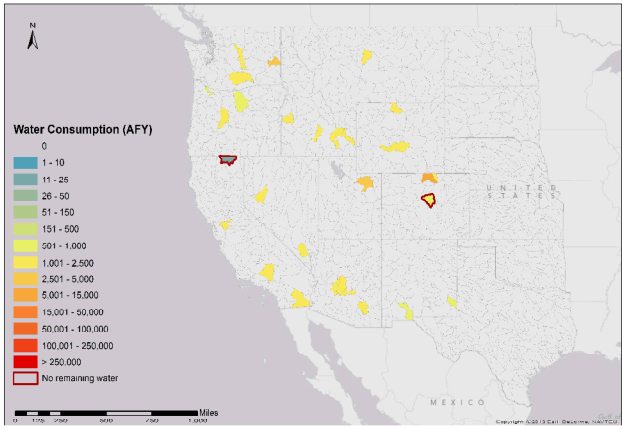
HUC-12 Risk Map (From Underground Withdrawals)



Long Range Planning Results

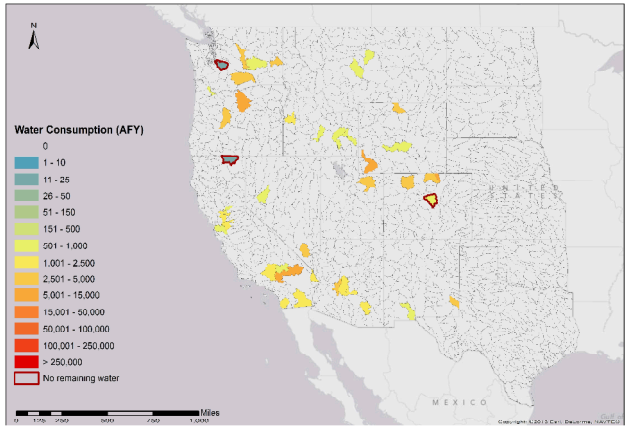
Reference Case

Total water demand (AFY) and areas where demand exceeds availability (red)



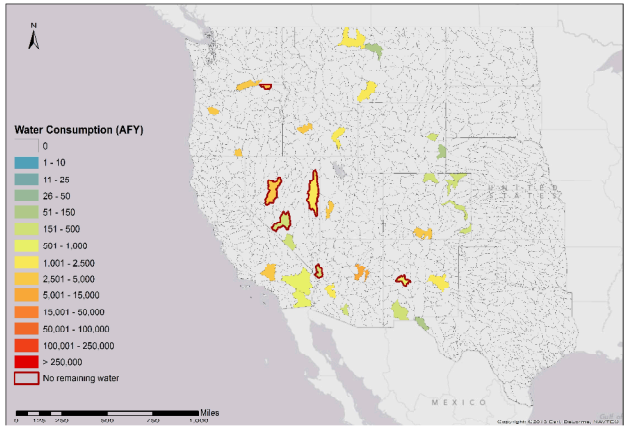
Scenario 1: Focus on Economic Recovery

Total water demand (AFY) and areas where demand exceeds availability (red)



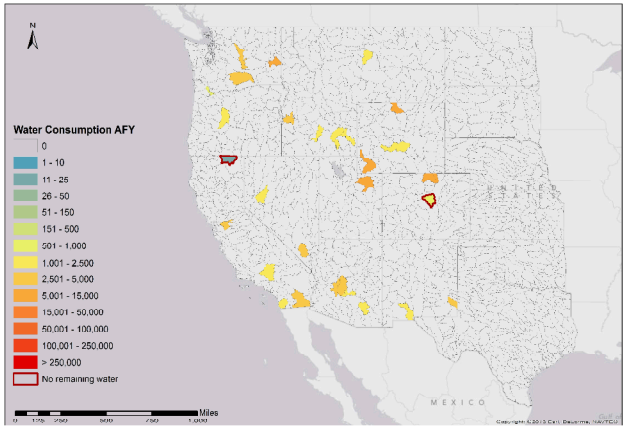
Scenario 2: Focus on Clean Energy

Total water demand (AFY) and areas where demand exceeds availability (red)



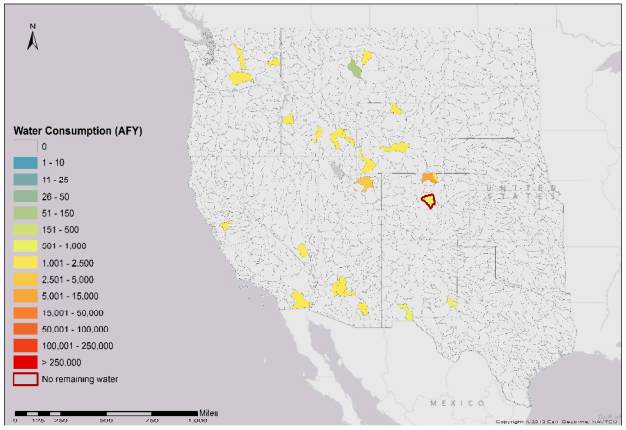
Scenario 3: Focus on Short-Term Consumer Costs

Total water demand (AFY) and areas where demand exceeds availability (red)



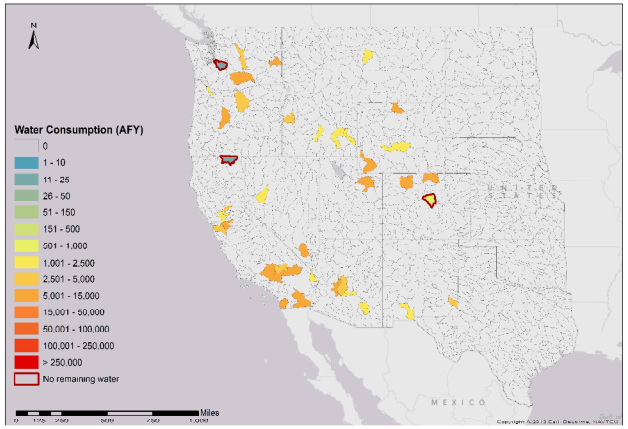
Scenario 4: Focus on Long-Term Societal Costs

Total water demand (AFY) and areas where demand exceeds availability (red)



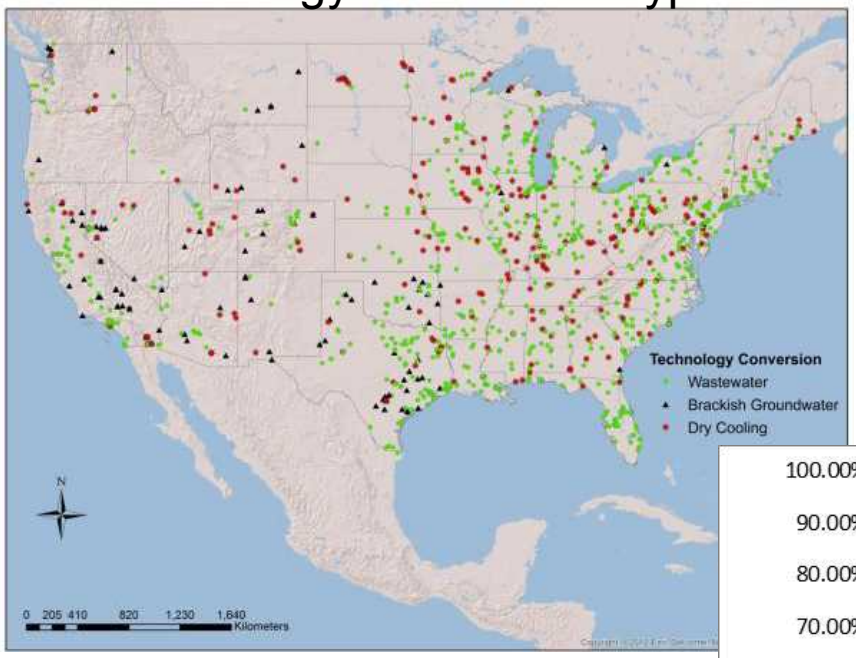
Sensitivity Analysis: $2/MMbtu Natural Gas Price

Total water demand (AFY) and areas where demand exceeds availability (red)



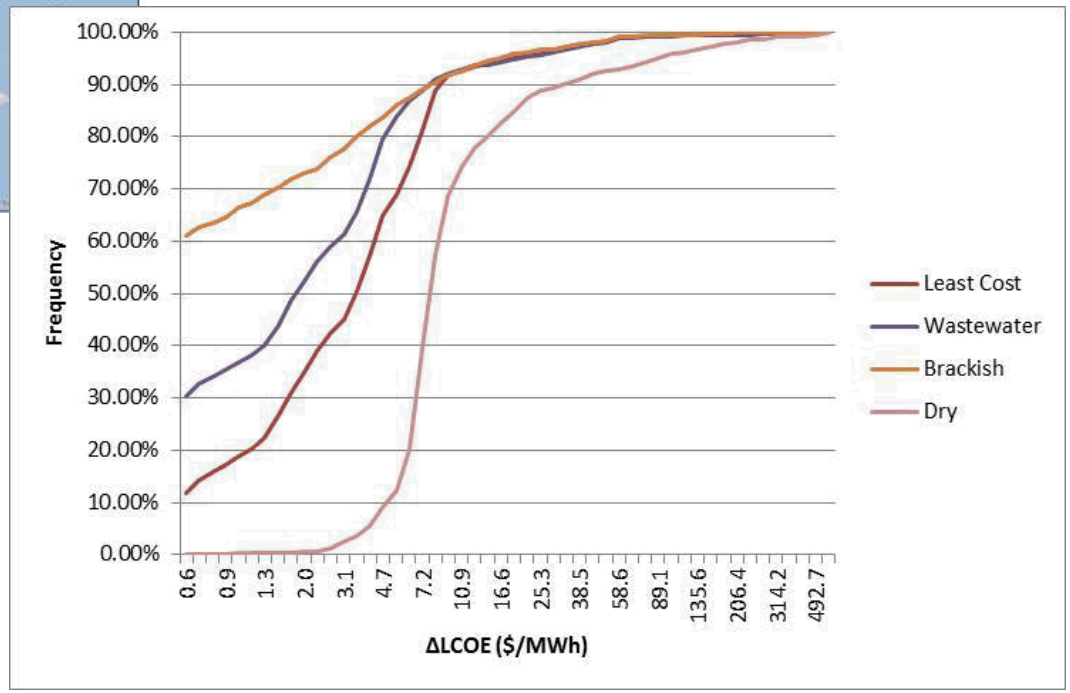
Cost to Retrofit

Technology Conversion Type



With wholesale cost of electricity about $40/MWh, many retrofits could be accomplished at levels that would add less than 10% to current power plant generation expenses.*

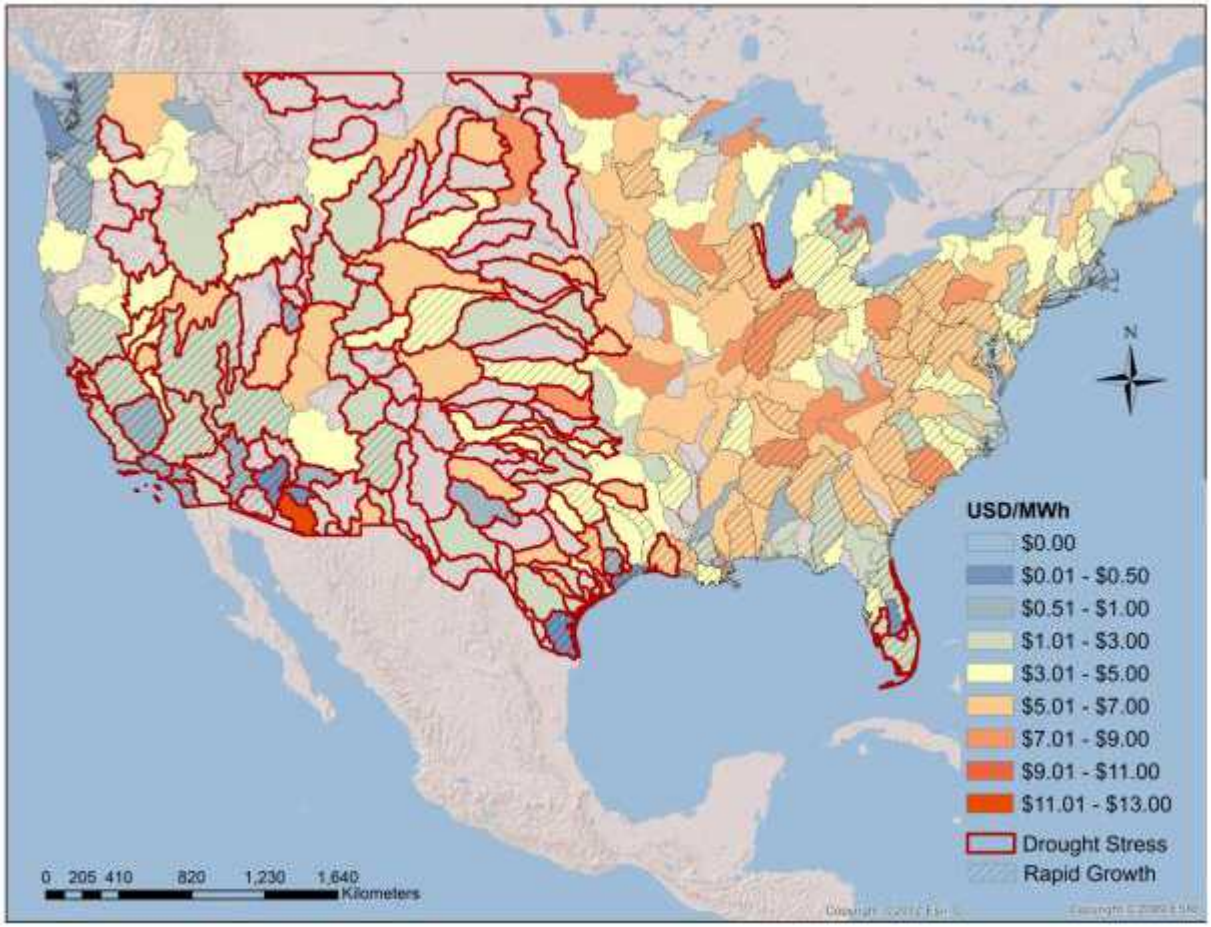
Cumulative Frequency Plot of Retrofit Costs



Cost to Retrofit

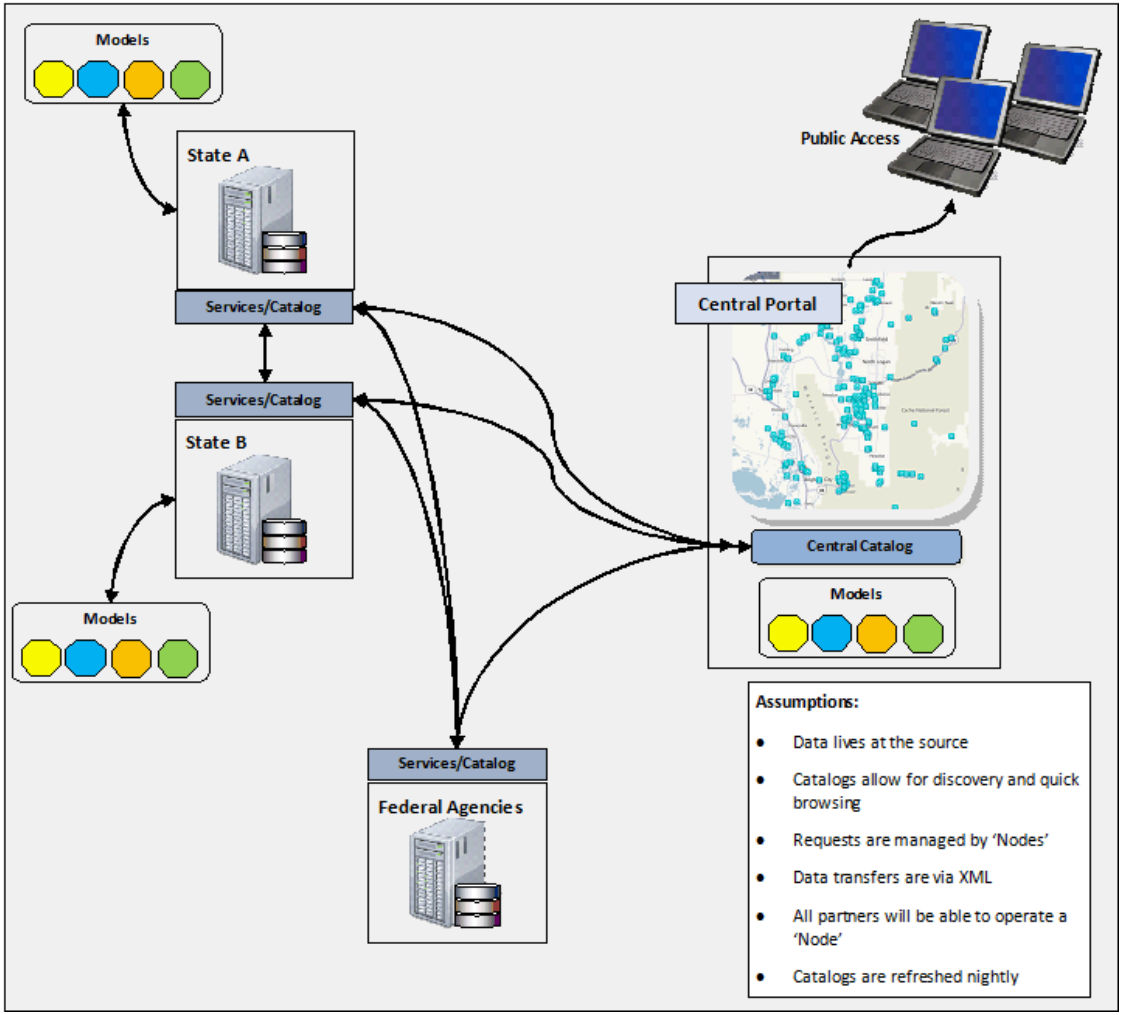
- **Many of the lowest cost retrofits are located in:**
  - **Drought stress basins (outlined in red)**
  - **High growth (cross hatched)**

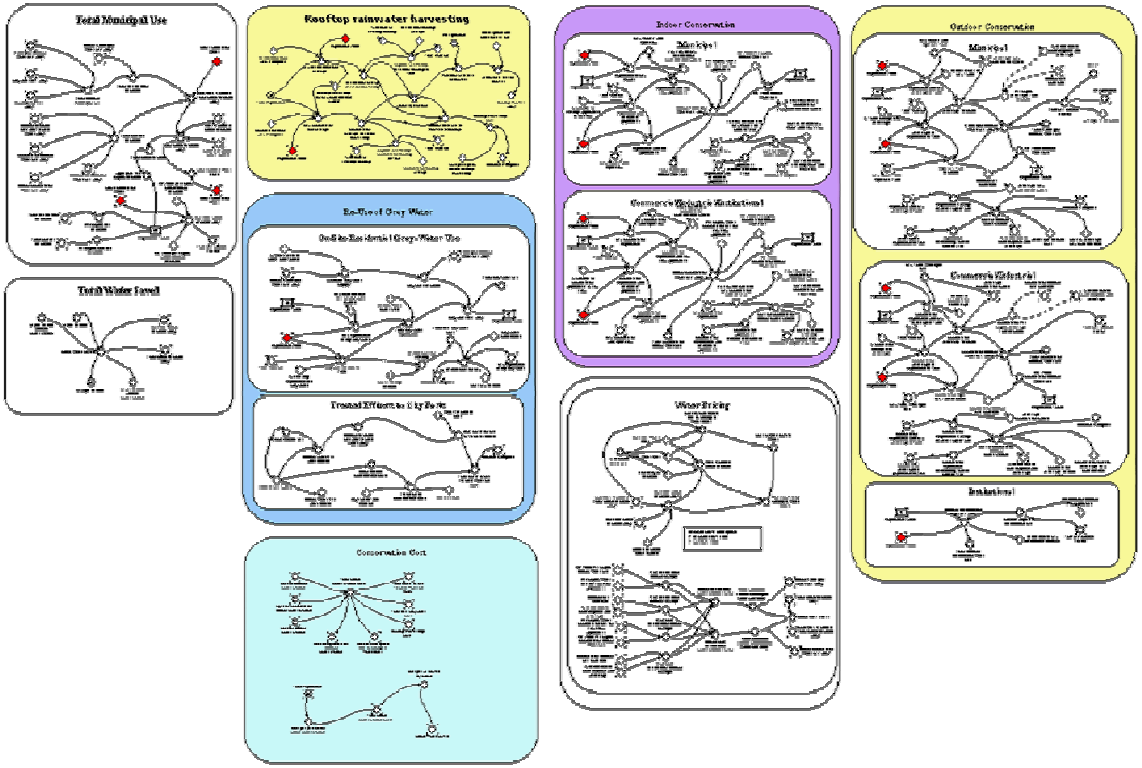
Cost to Retrofit Aggregated at 8-Digit Watershed Level

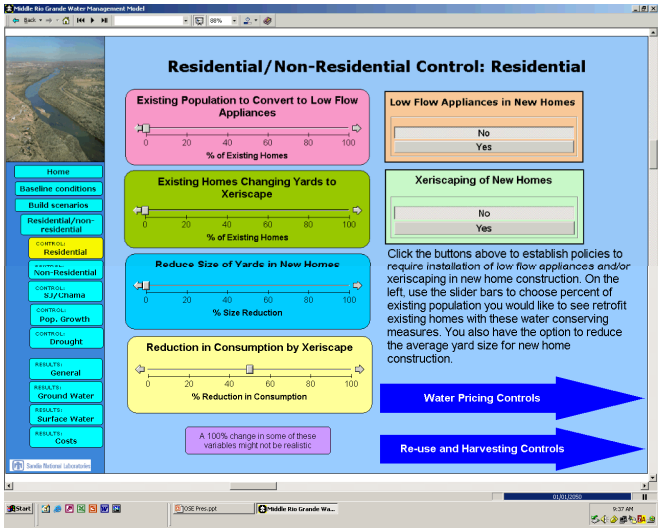


Water Use Data Exchange (WaDE)

- Use Web Services to transfer data
- Data Stay at the Source (i.e. the states)
- Provide transparent link between state data and integrated water metrics
  - Link to metadata
  - Changes in state data are automatically reflected in metrics







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