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The Energy-Water Nexus

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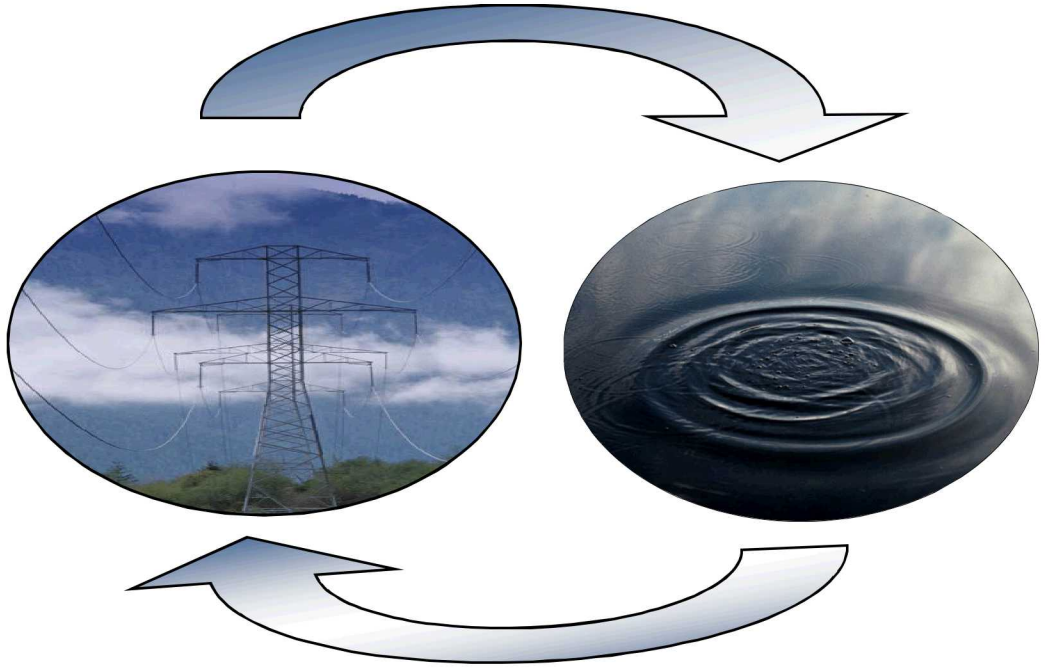
Water for Energy

Energy and power production requires water

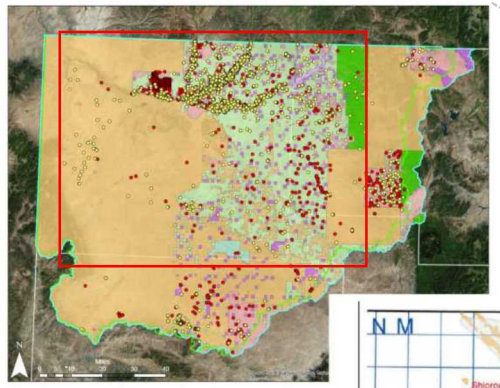
- *Thermoelectric Cooling*
- *Energy Minerals Extraction/Mining*
- *Fuel Processing (fossil fuels, H_2,biofuels)*
- *Emission Control*



Water production, processing, distribution, and end-use requires energy

- *Pumping*
- *Conveyance*
- *Treatment*
- *Distribution*
- *Use Conditioning*

Water for Oil and Gas



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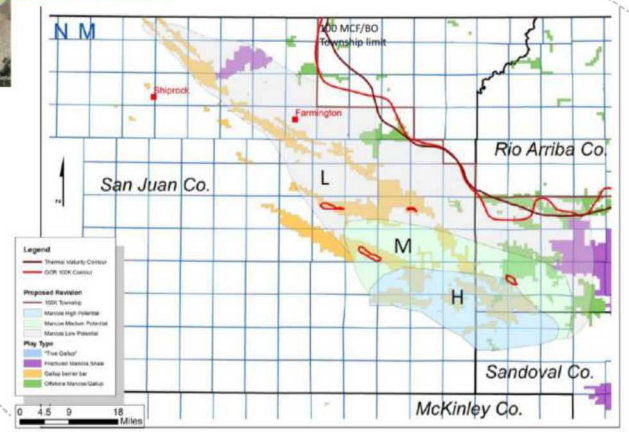
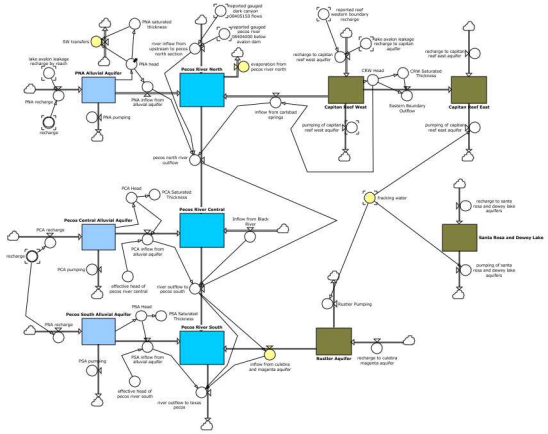
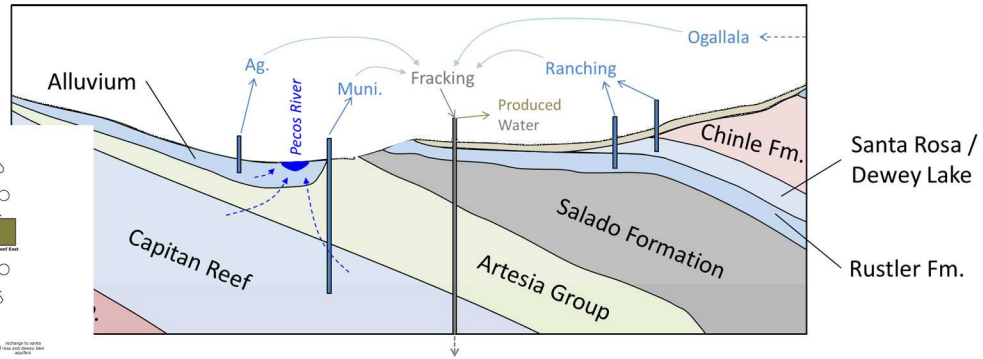


System Dynamics Modeling – Develop a system dynamics (SD) simulation tool to simulate water availability over a range of different future scenarios.

- Table-top player
- Simulate the increase in drilling activity and water demand relative to each formation and water source to identify the areas/users/formations that are most vulnerable and to estimate the risk to water quantity and quality.
- Provide decision makers with a tool to assess localized, cumulative impacts.





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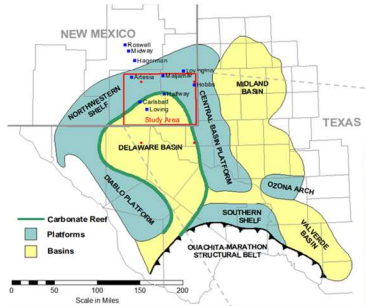
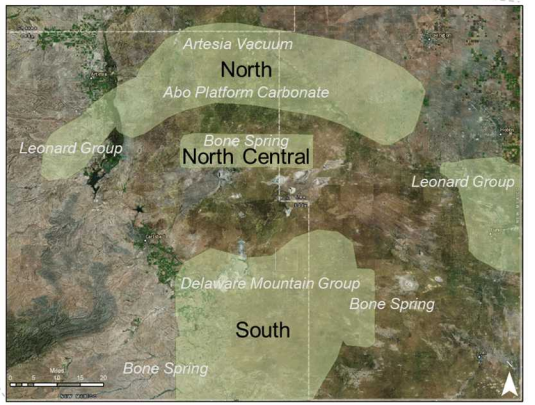
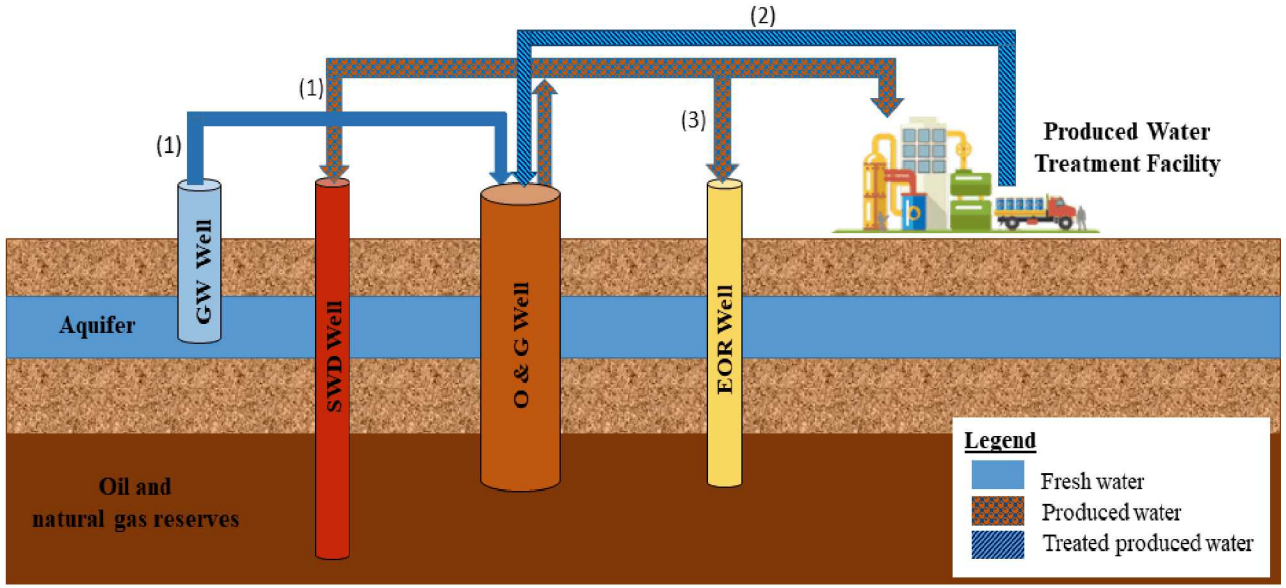




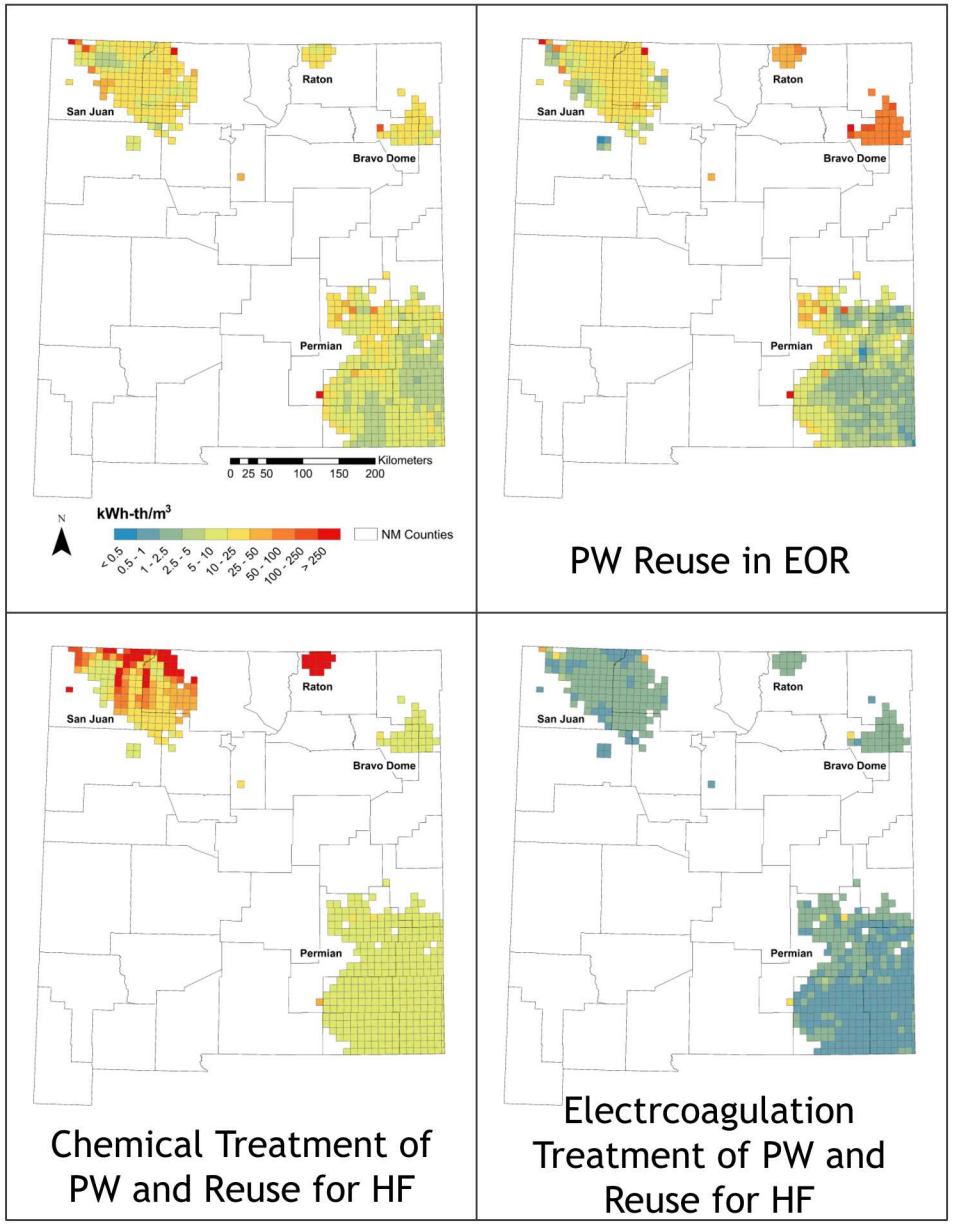
Energy for Produced Water

Energy tradeoffs in disposition of produced water



Source: Zemlick et al. 2018

Produced Water Energy Use



Water for Energy in San Juan Basin

Framework that links natural and engineered systems to evaluate climate vulnerabilities and adaptive measures:

- Multiple interacting sectors, and
- Multiple forcings.

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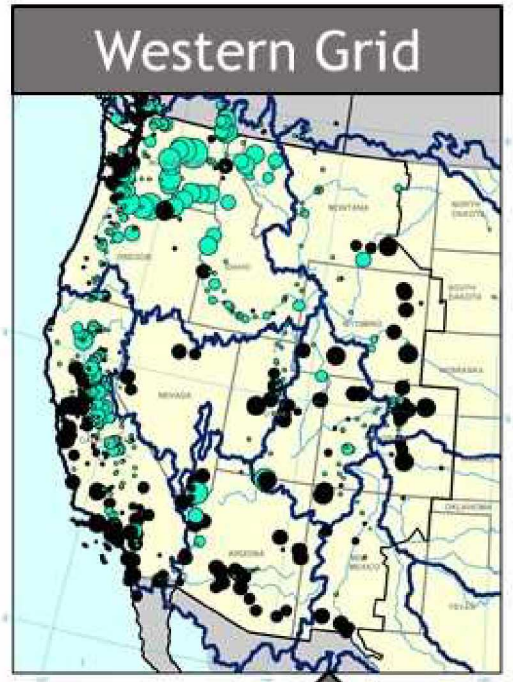
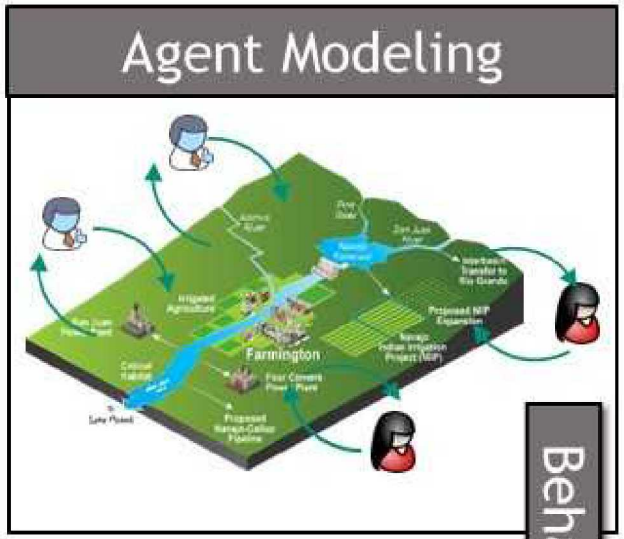
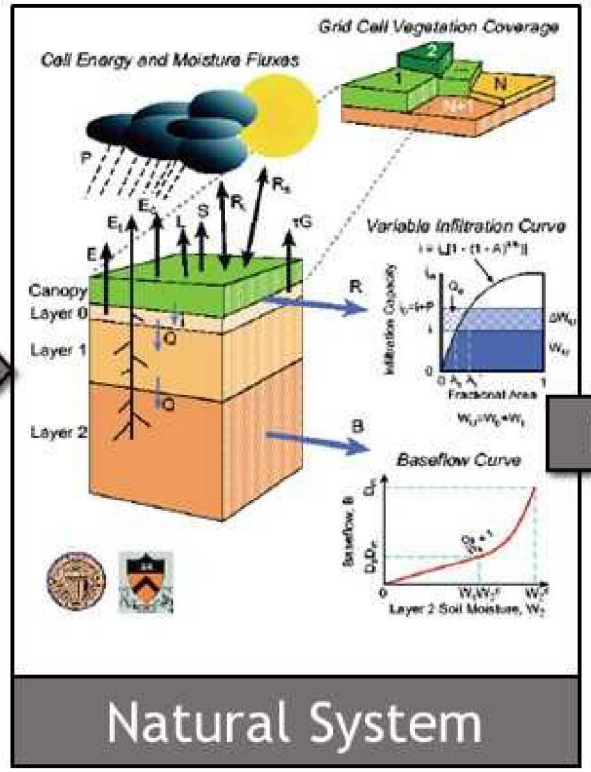


Agent Modeling



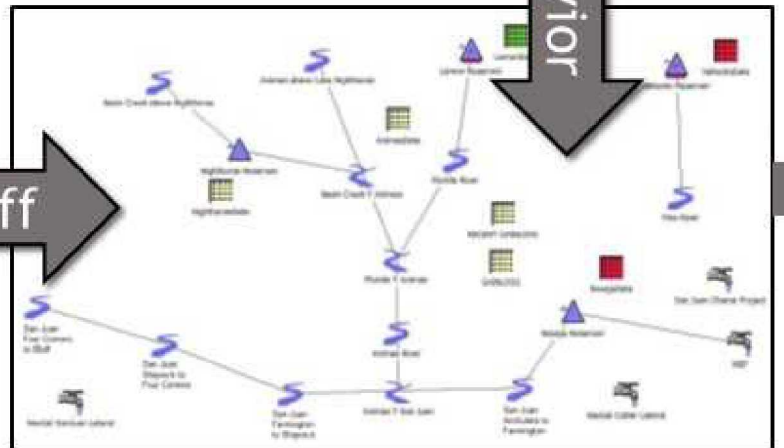
Behavior

Climate



Natural System

Runoff



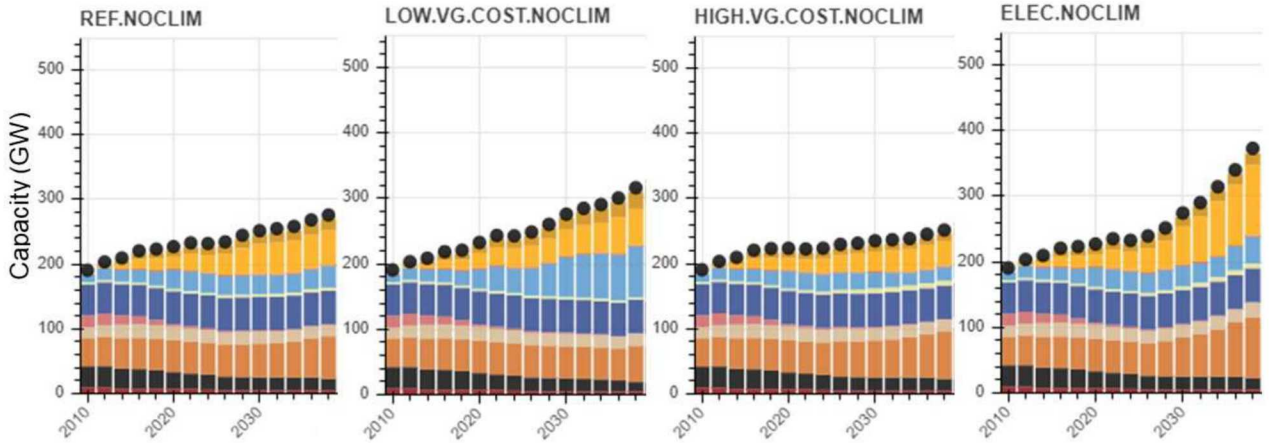
Engineered System

Deliveries

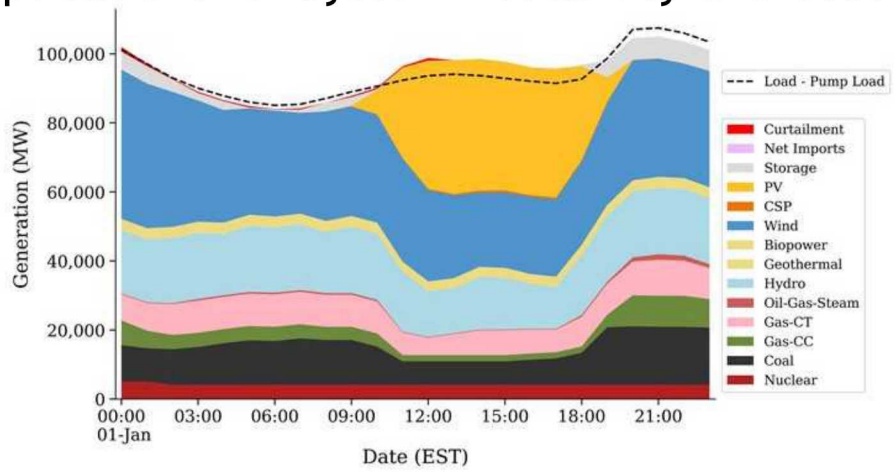
- Electric Power
- Irrigation
- Instream Flows
- Compact Native American

Water in Transmission Planning (WECC)

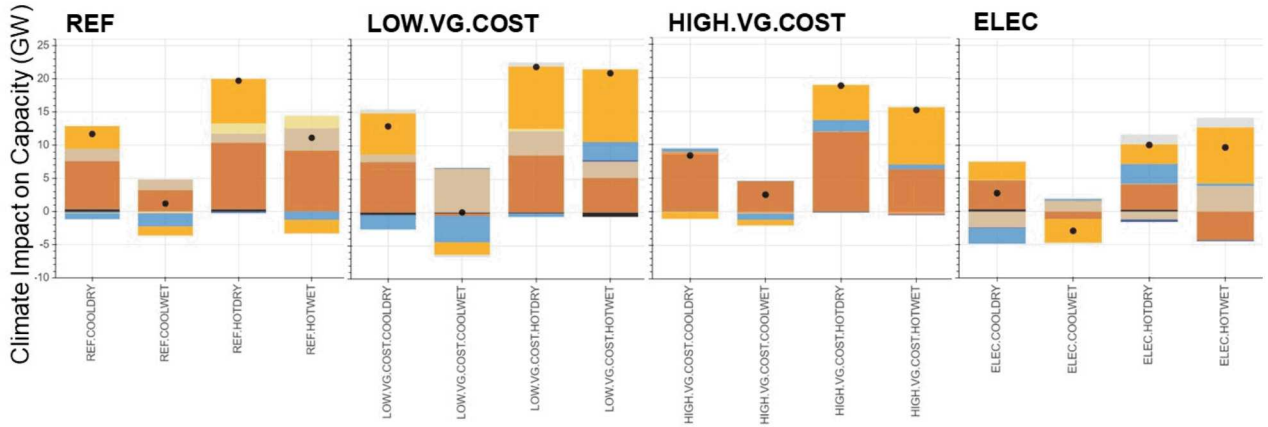
Generation Expansion Profiles



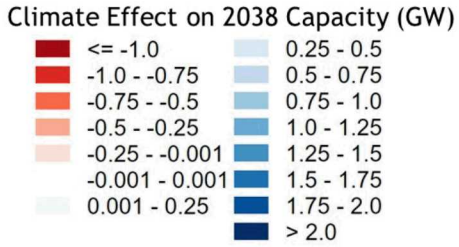
Implications for System Reliability and Cost

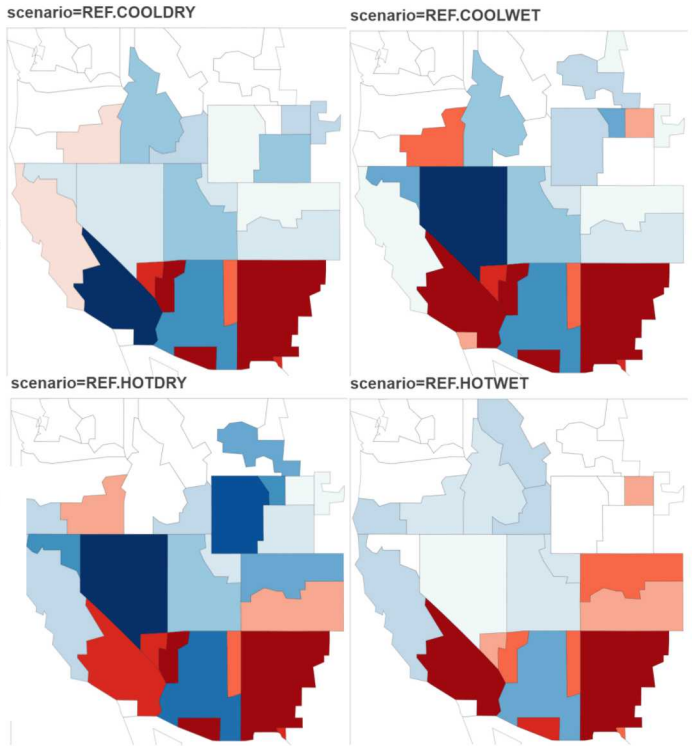


Difference with and without Water Constraint



Water Impact on PV Generation Additions

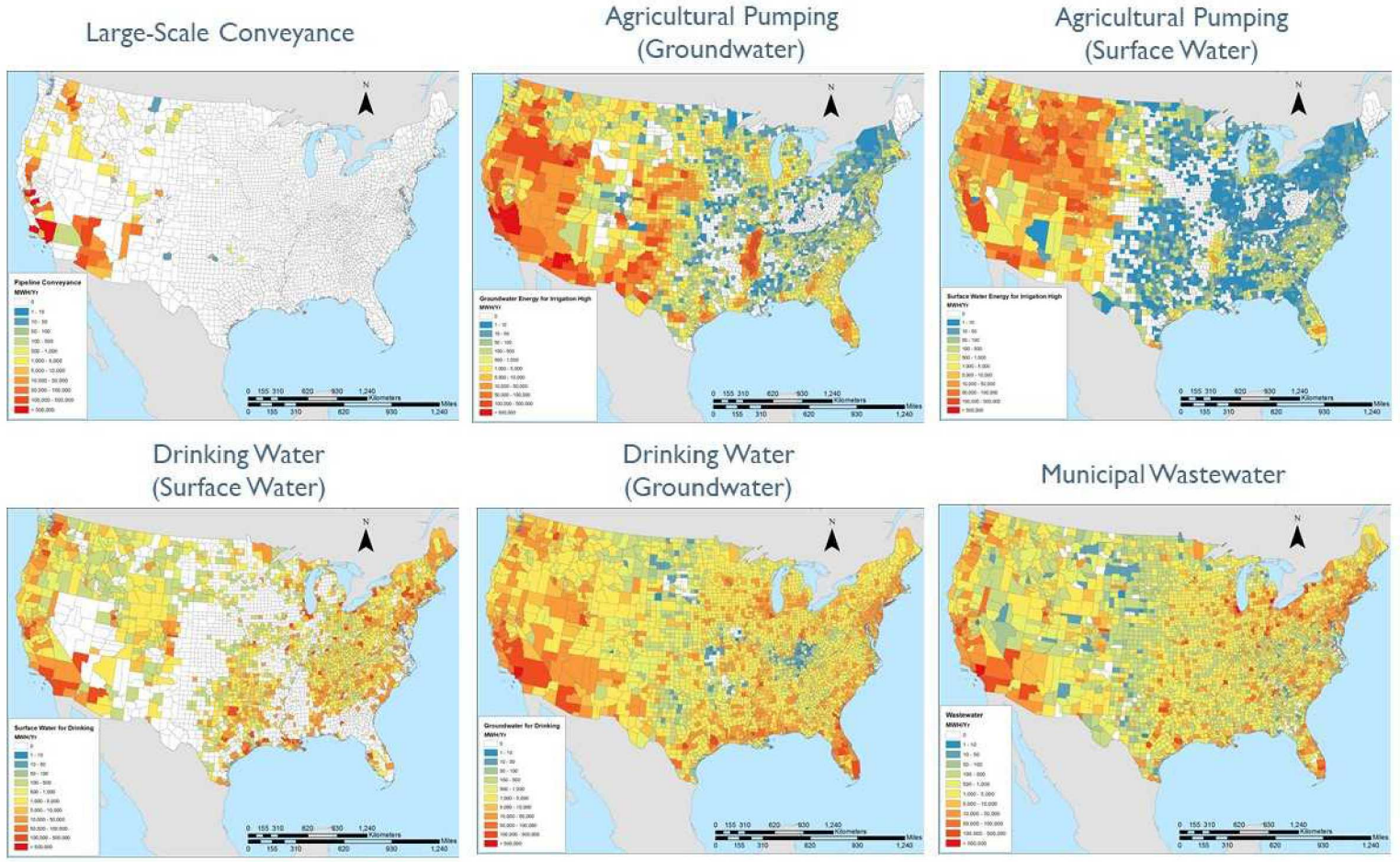




Energy for Water Services

Map electricity use for water services at the county level, distinguishing between four sectors:

- Large-scale conveyance,
- Irrigation,
- Drinking water, and
- Wastewater.



Source: Tidwell et al. 2014