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# Regional Analysis of Energy, Water, Land and Climate Interactions

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# Chapter 10: Energy, Water, and Land Use

<http://nca2014.globalchange.gov/report/sectors/energy-water-and-land>

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Climate Change Impacts in the United States

## CHAPTER 10 ENERGY, WATER, AND LAND USE

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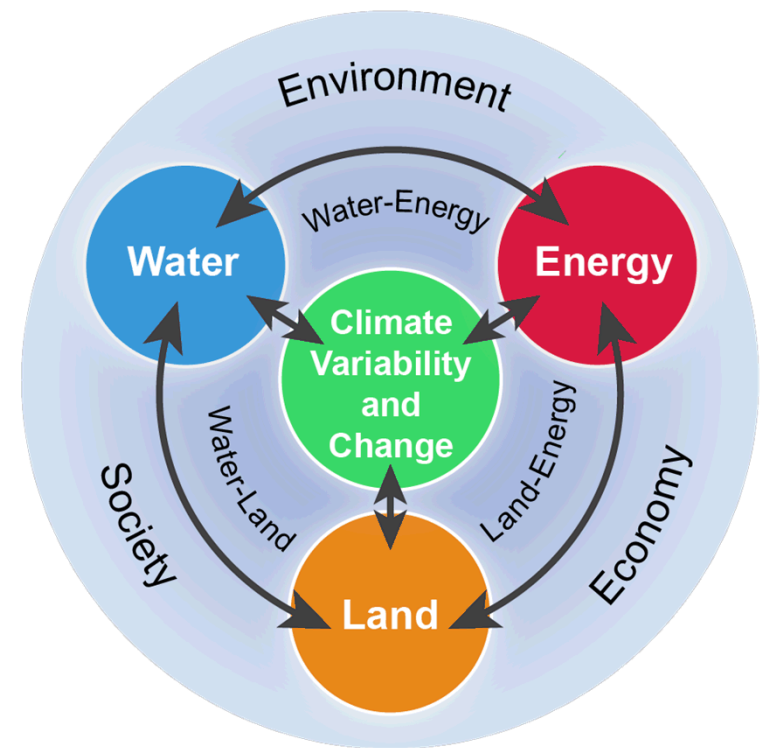
On the Web: <http://nca2014.globalchange.gov/report/sectors/energy-water-and-land>



INFORMATION DRAWN FROM THIS CHAPTER IS INCLUDED IN THE HIGHLIGHTS REPORT AND IS IDENTIFIED BY THIS ICON

# Problem Statement

Energy, water, and land systems interact in many ways. Climate change affects the individual sectors and their interactions; the combination of these factors affects climate change vulnerability as well as adaptation and mitigation options for different regions of the country.



# Objective

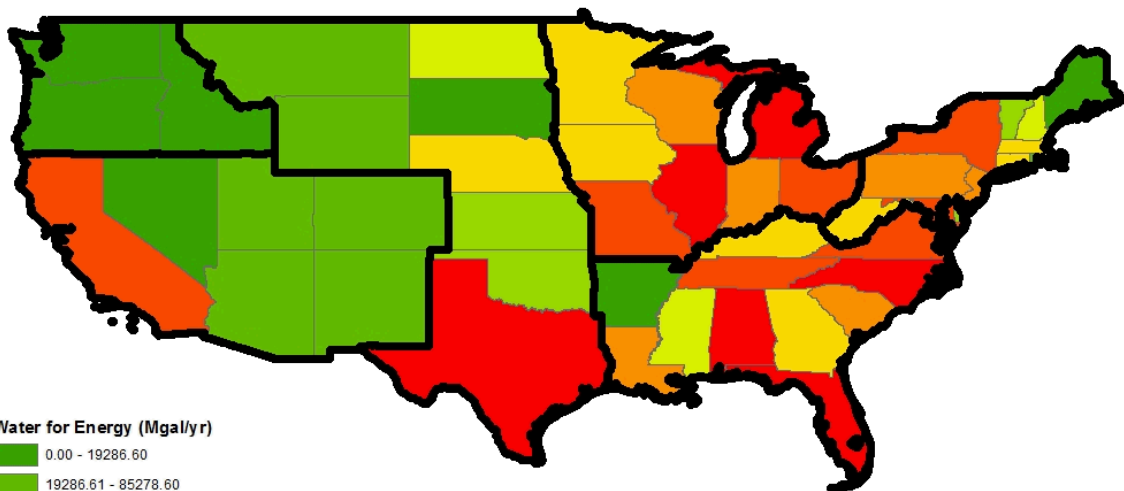


- Explore geospatial differences in energy-water-land interactions:
  - By NCA region, and
  - By state.

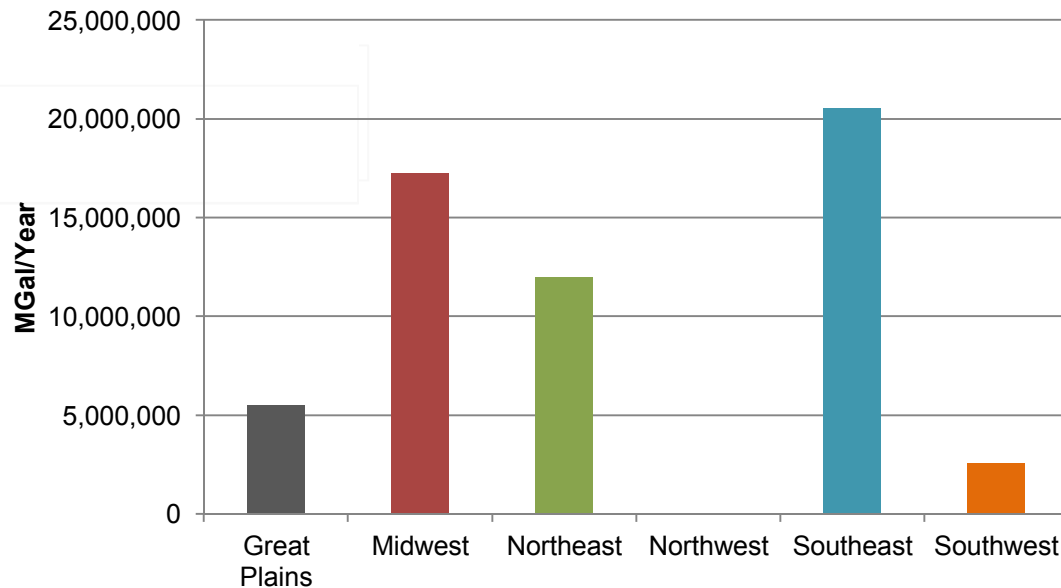
# Bilateral Interactions

- Effect of **ENERGY** on **WATER** use
  - Water used for energy production (power plant cooling, mining, etc.)
- Effect of **WATER** on **ENERGY** use
  - Energy to move, lift and treat water
- Effect of **LAND** on **ENERGY** use
  - Energy consumption associated with land development
- Effect of **ENERGY** on **LAND** use
  - Land used for energy development (power plants, pipelines, etc.)
- Effect of **WATER** on **LAND** use
  - Blue water: irrigated cropland and reservoirs
  - Green water: dry land farming and forests
- Effect of **LAND** on **WATER** use
  - All water use except for energy

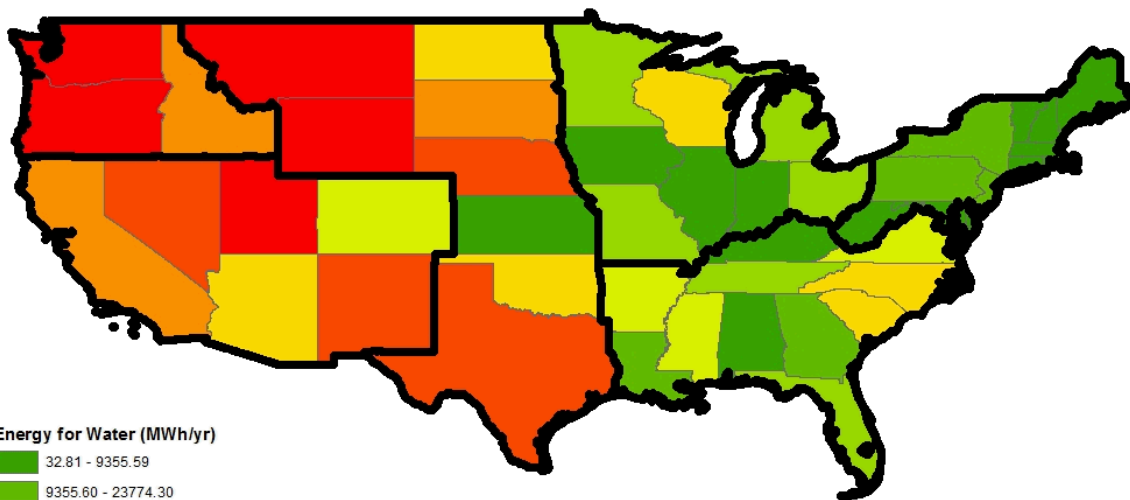
# Effect of Energy on Water Use



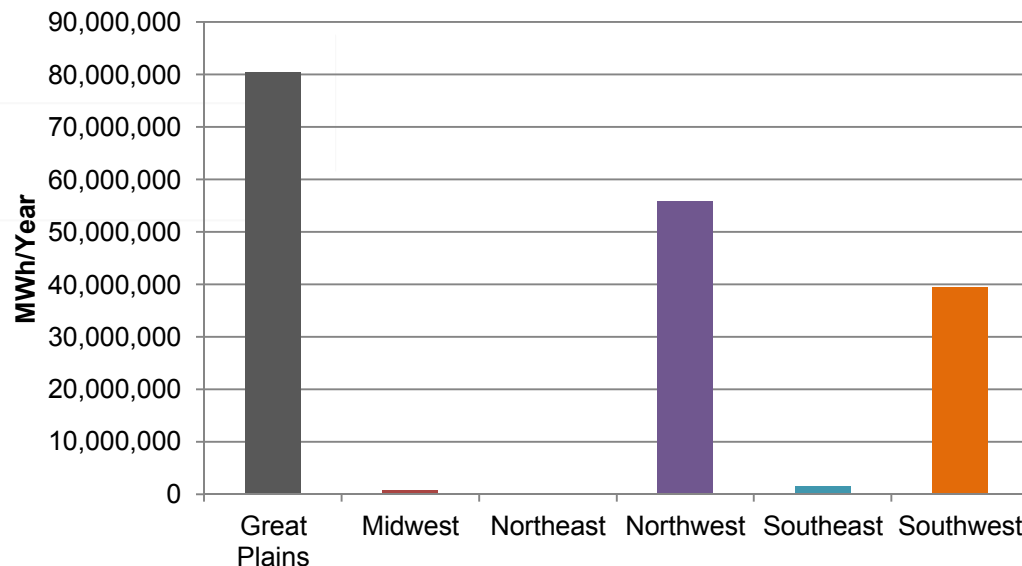
- Thermoelectric water use
- Water for fuel extraction
- Water for biofuel production



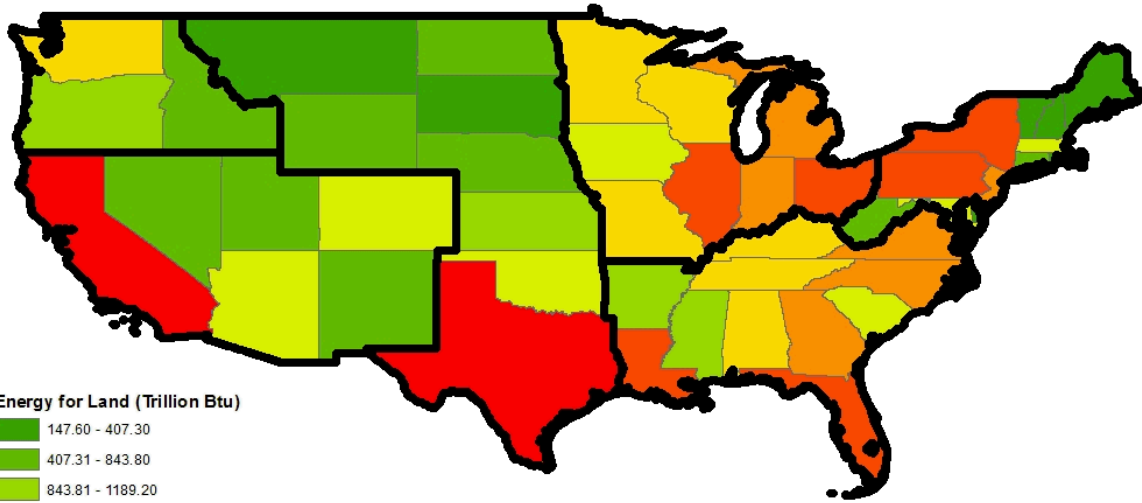
# Effect of Water on Energy Use



- Energy to pump groundwater
- Energy to move and treat:
  - Drinking water
  - Wastewater

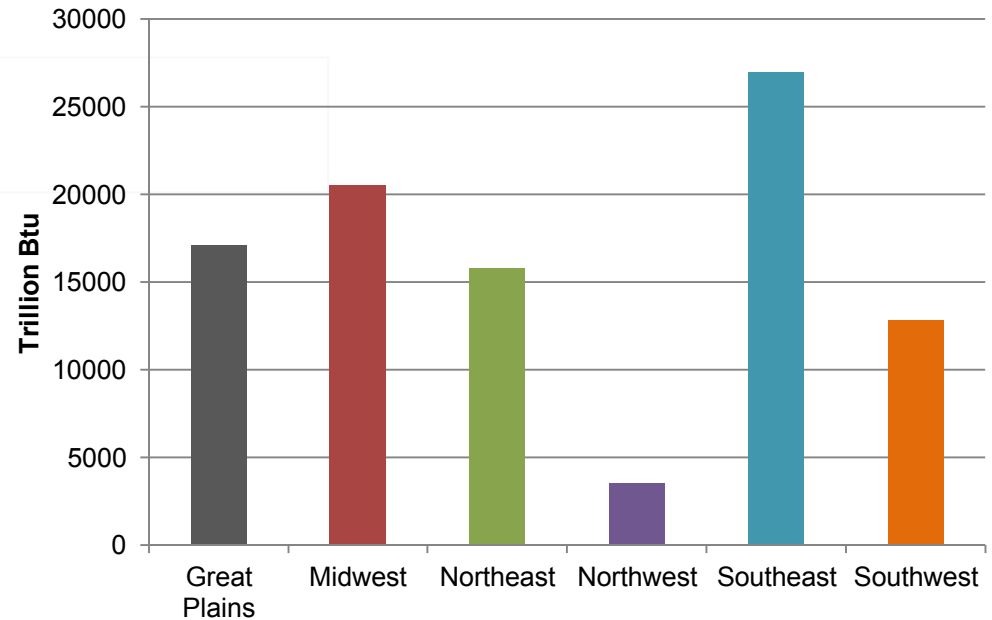


# Effect of Land on Energy Use



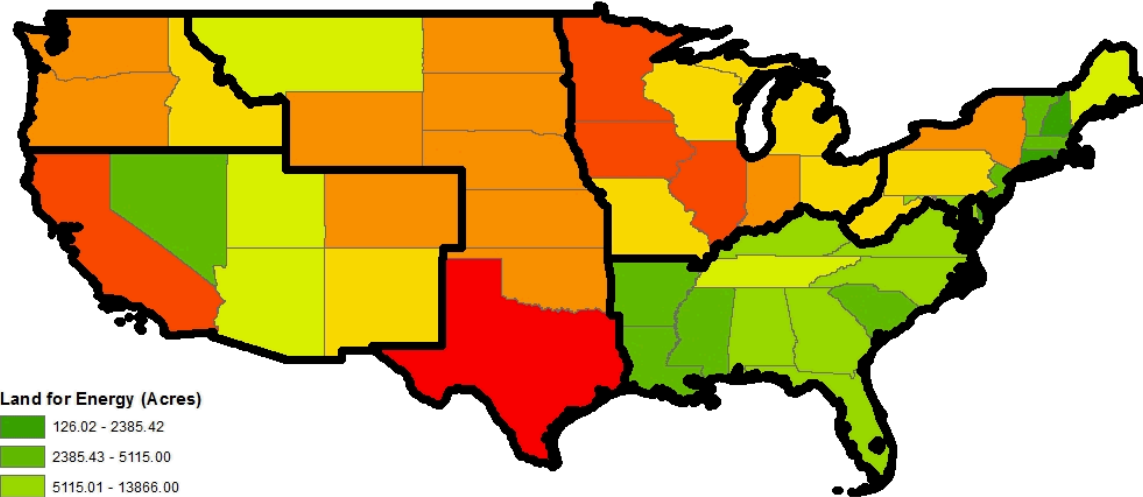
■ Primary energy consumption

Energy for Land (Trillion Btu)

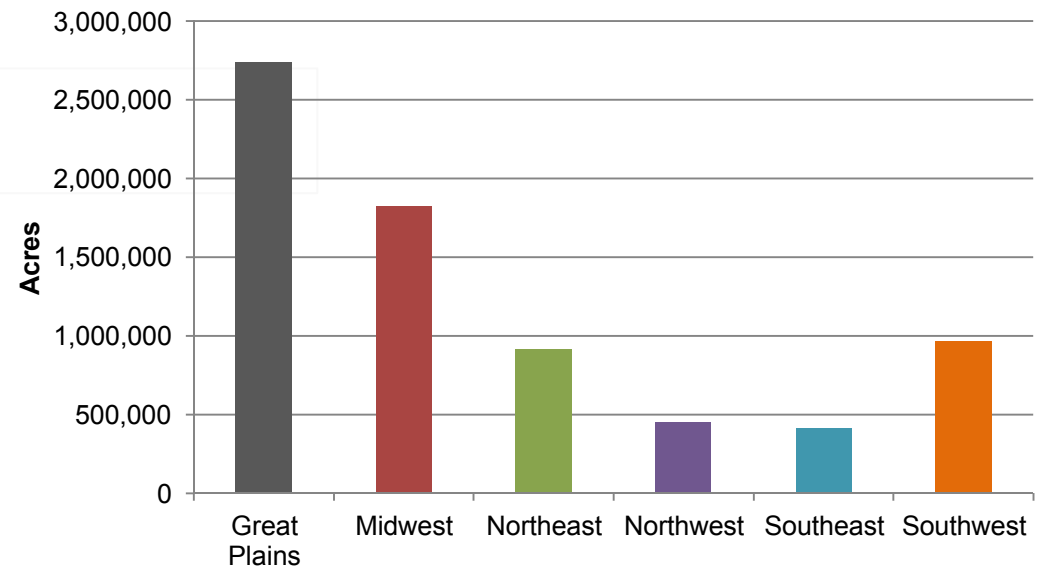
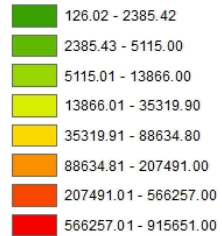


# Effect of Energy on Land Use

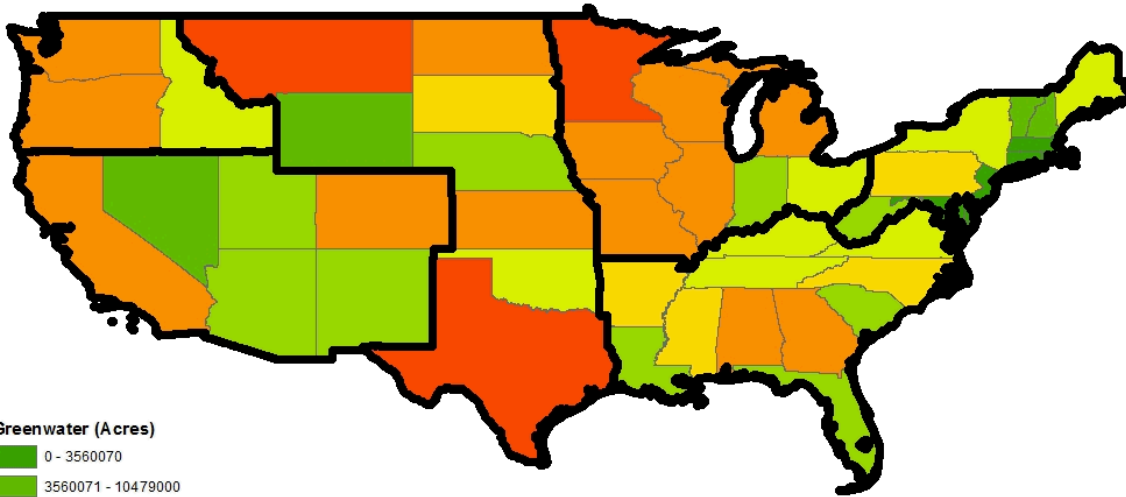
- Land for power plants
- Land for energy extraction
- Land for biofuel cultivation



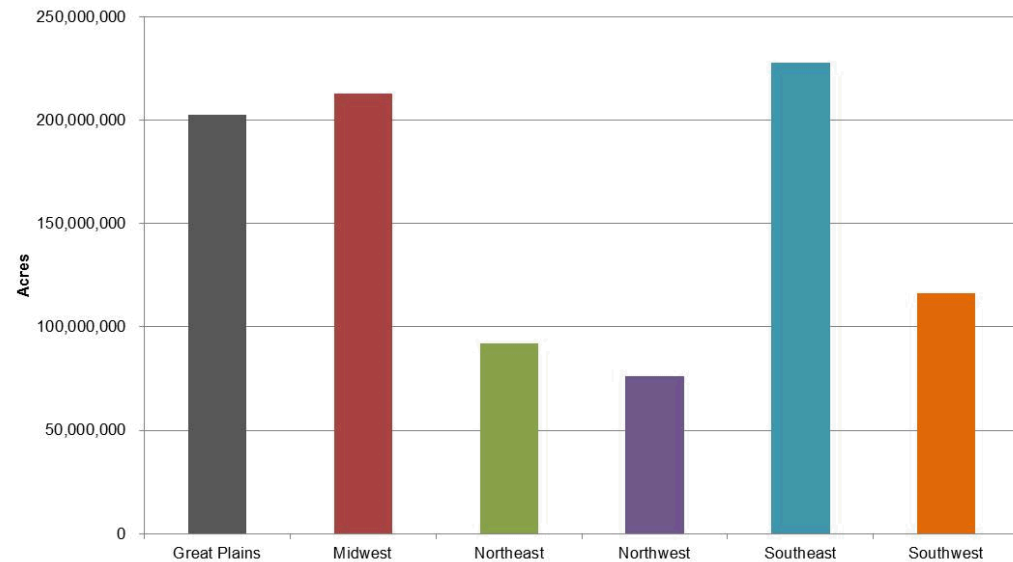
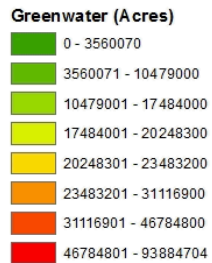
Land for Energy (Acres)



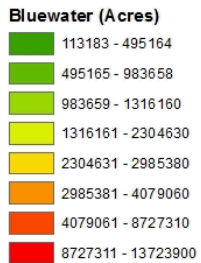
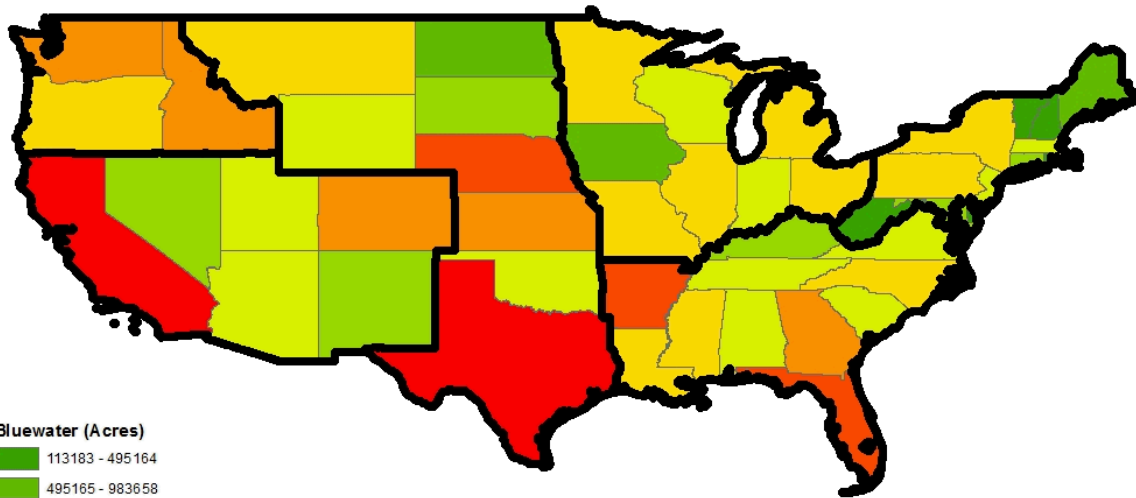
# Effect of Water on Land Use



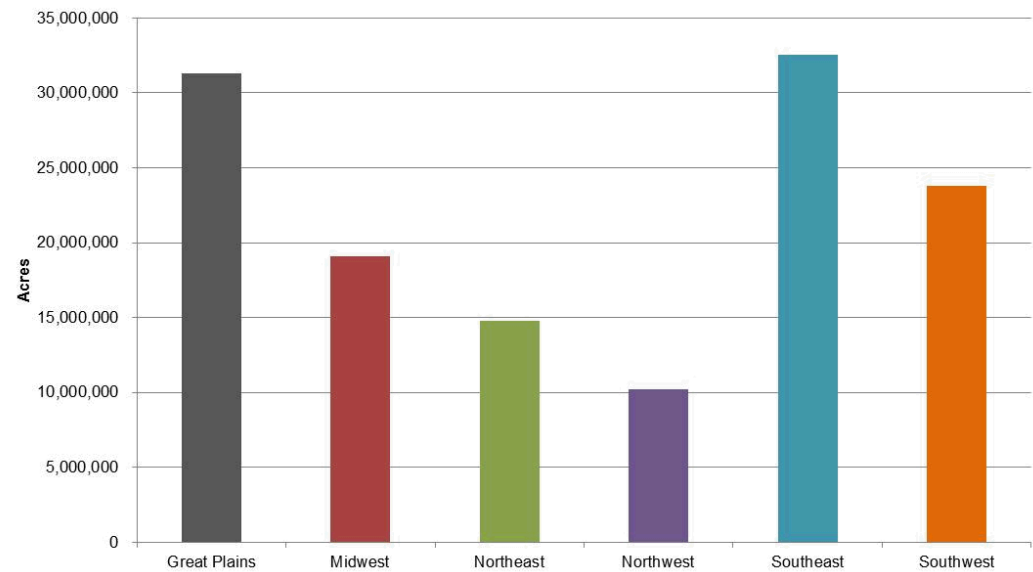
- Green Water:
  - Dry Land Farming
  - Forest



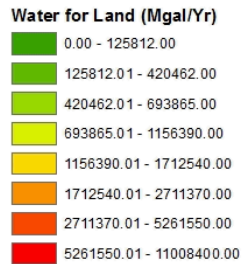
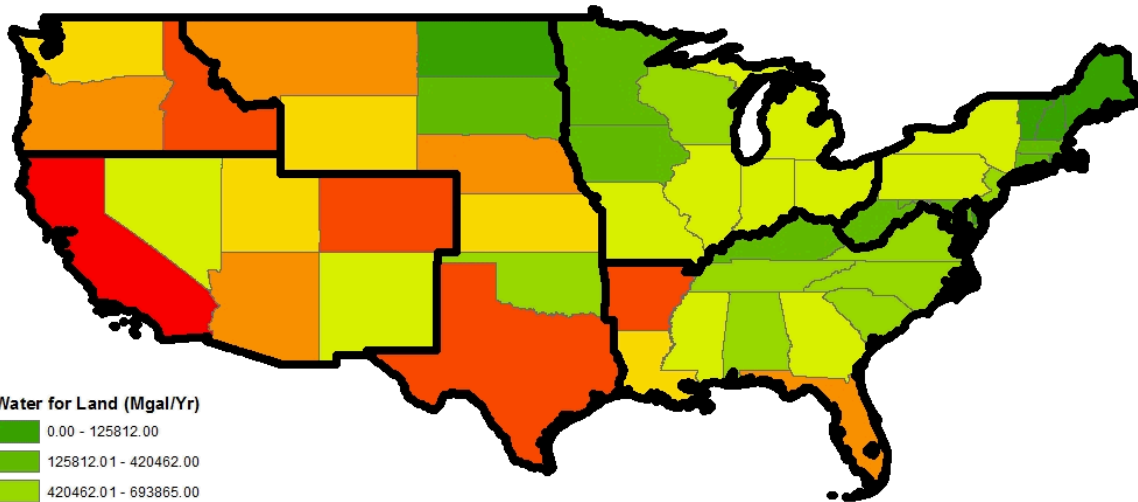
# Effect of Water on Land Use



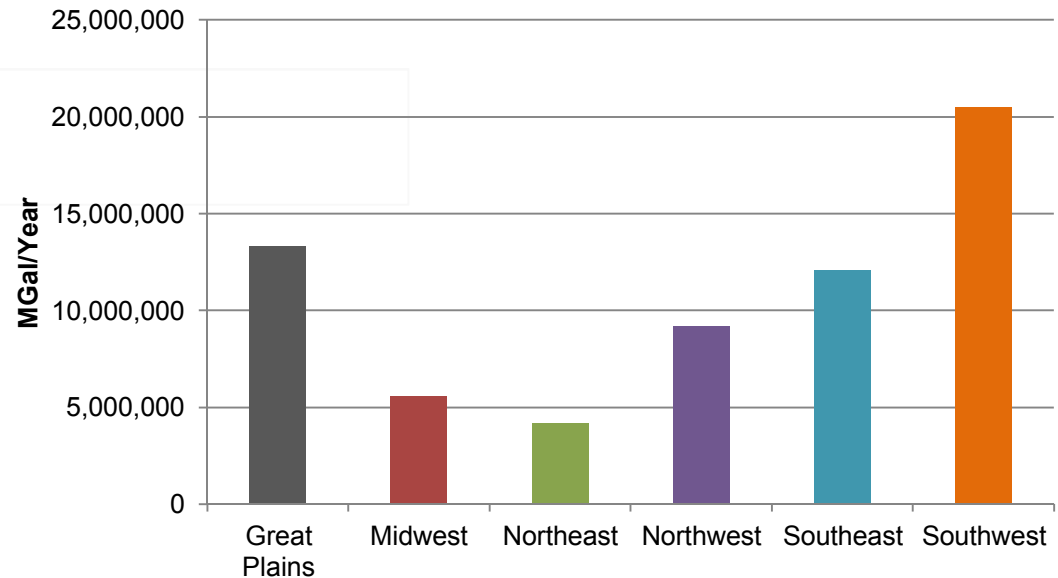
- Blue Water:
  - Irrigated farmland,
  - Reservoirs,
  - Urban land



# Effect of Land on Water Use

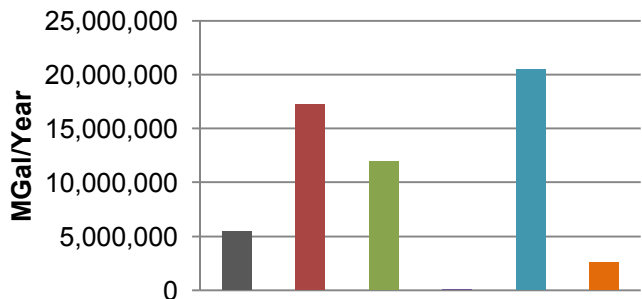


- Water withdrawals excluding energy sector

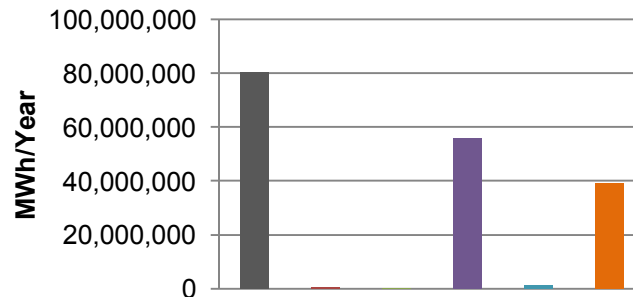


# NCA Region Comparison

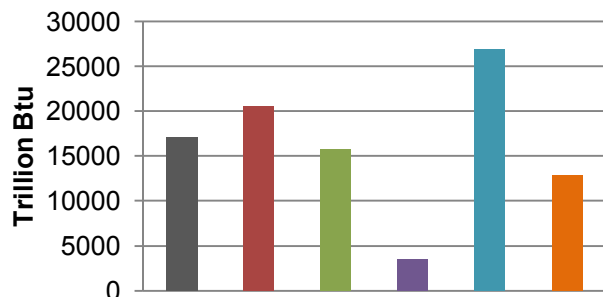
Effect of energy on water use



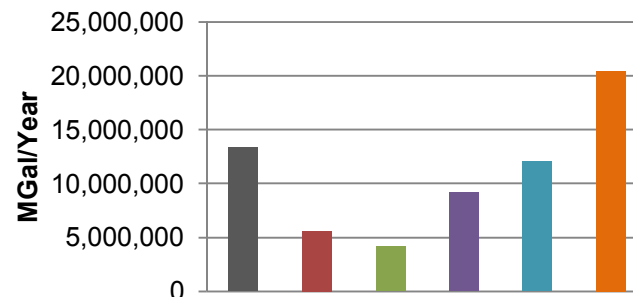
Effect of water on energy use



Effect of land on energy use

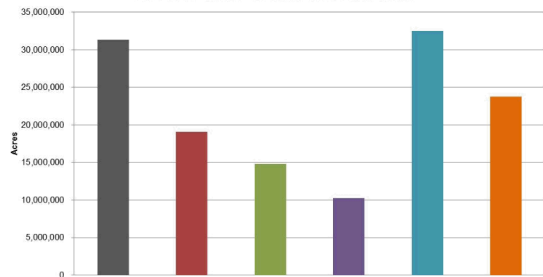


Effect of land on water use

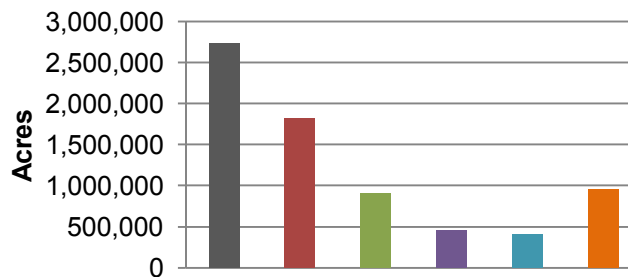


- Great Plains
- Midwest
- Northeast
- Northwest
- Southeast
- Southwest

Effect of water on land use: Bluewater

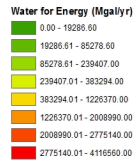
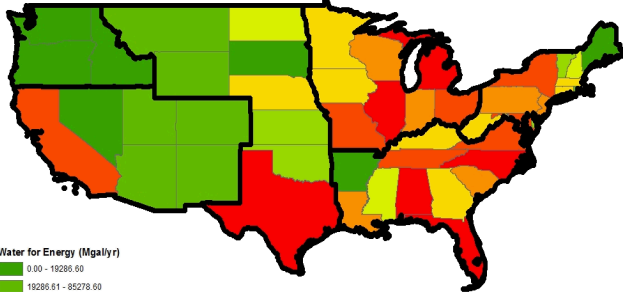


Effect of energy on land use

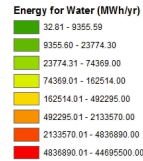
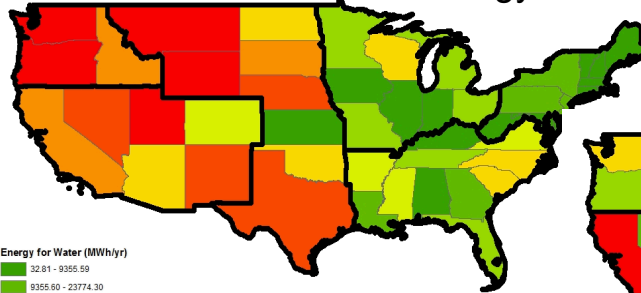


# State-Level Comparison

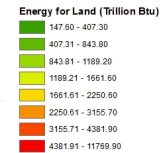
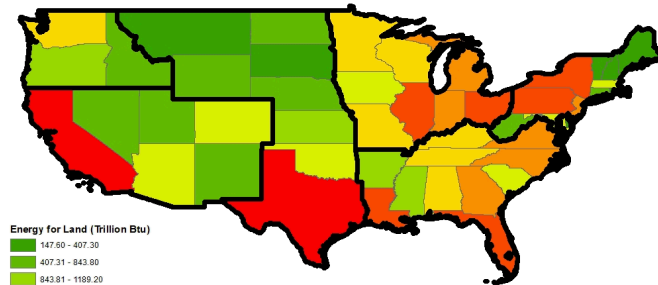
Effect of energy on water use



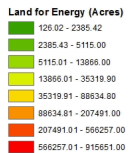
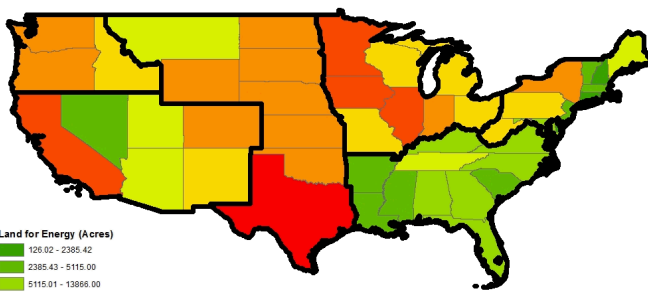
Effect of water on energy use



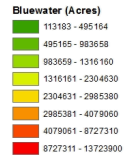
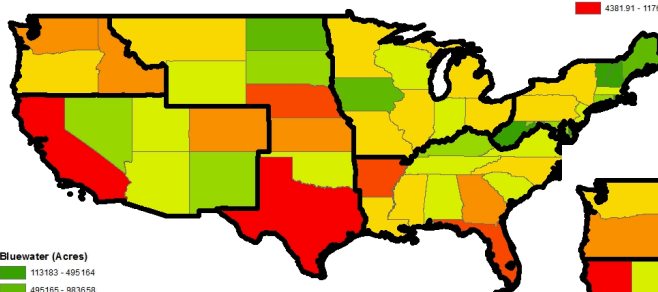
Effect of land on energy use



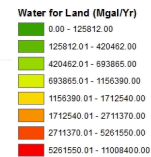
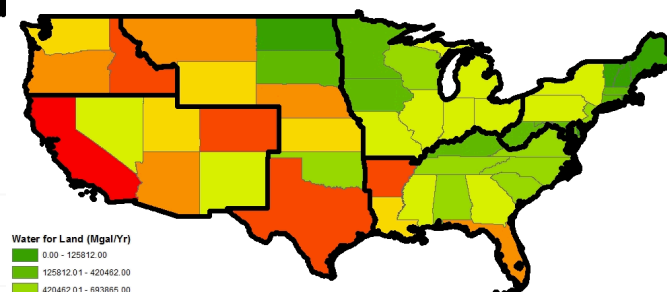
Effect of energy on land use



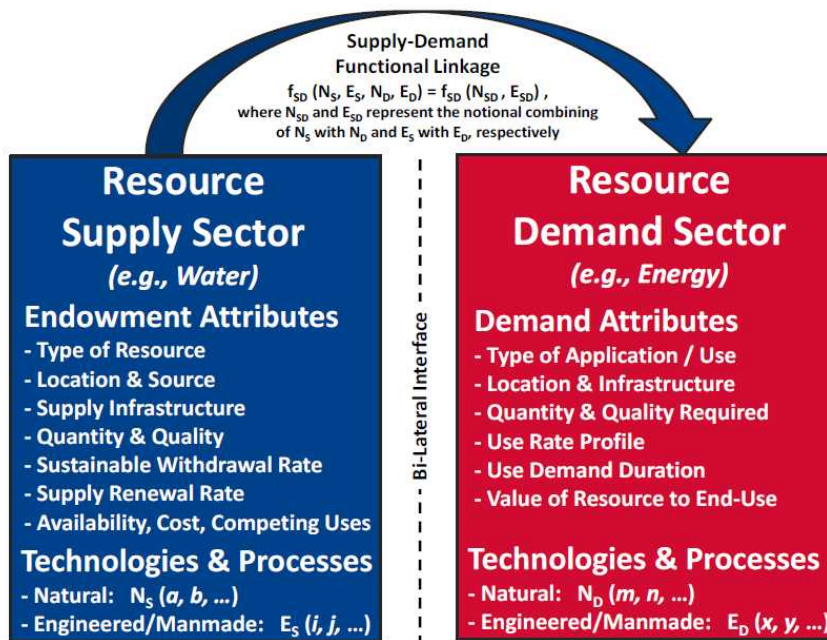
Effect of land on water use



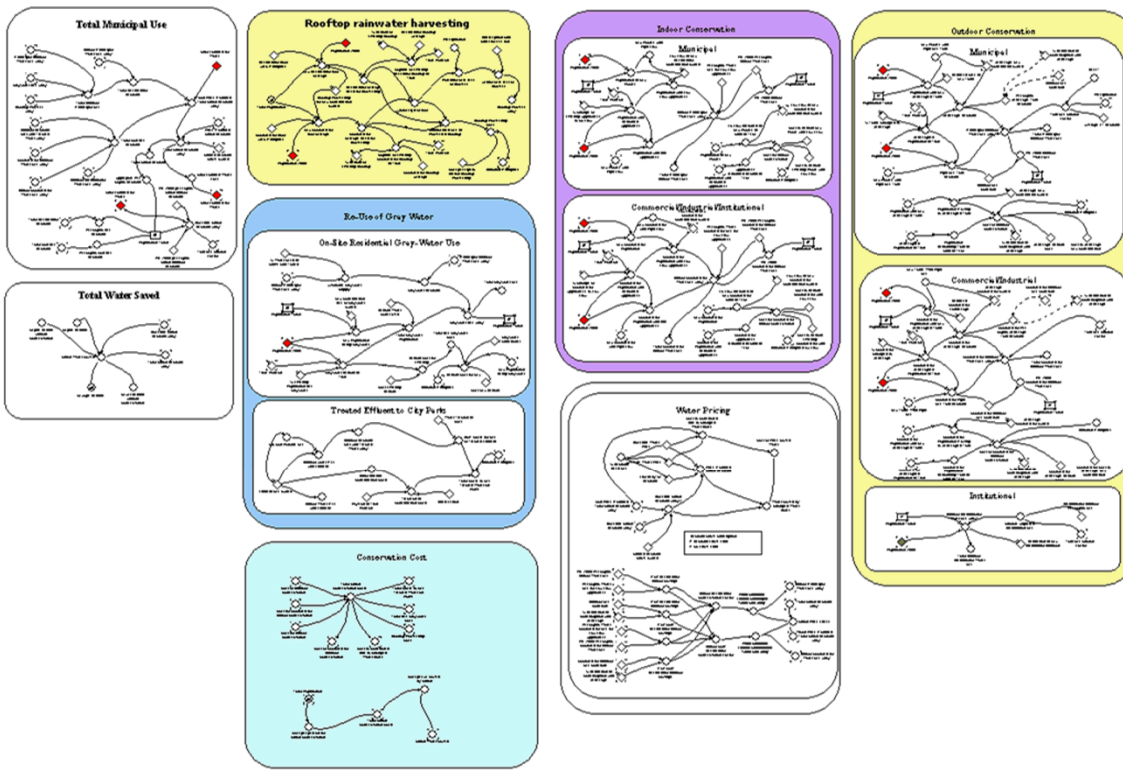
Effect of land on water use



# Interpretation



Demand	Endowment	Technology	Climate
Energy on Water Use	Solar Intensity	PV/Batteries	GHG Policy
Energy on Land Use	Cropland	Feedstock Conversion	GHG Policy, Precipitation
Water on Energy Use	Water Availability	Advanced Treatment	Extreme Events
Water on Land Use	Water Availability	Groundwater Pump	Intensifying Drought
Land on Energy Use	Population Density	Energy and Fuel Transmission	Migration
Land on Water Use	Range Land	Feed Lots	Vegetation Change, Wildfire



**Residential/Non-Residential Control: Residential**

Existing Population to Convert to Low Flow Appliances: 0% to 100% of Existing Homes

Low Flow Appliances in New Homes: No / Yes

Existing Homes Changing Yards to Xeriscape: 0% to 100% of Existing Homes

Xeriscaping of New Homes: No / Yes

Reduce Size of Yards in New Homes: 0% to 100% Size Reduction

Reduction in Consumption by Xeriscape: 0% to 100% Reduction in Consumption

Water Pricing Controls

Re-use and Harvesting Controls

A 100% change in some of these variables might not be realistic.



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