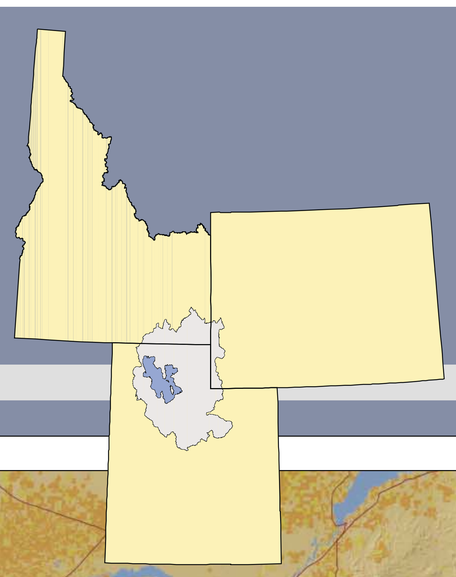
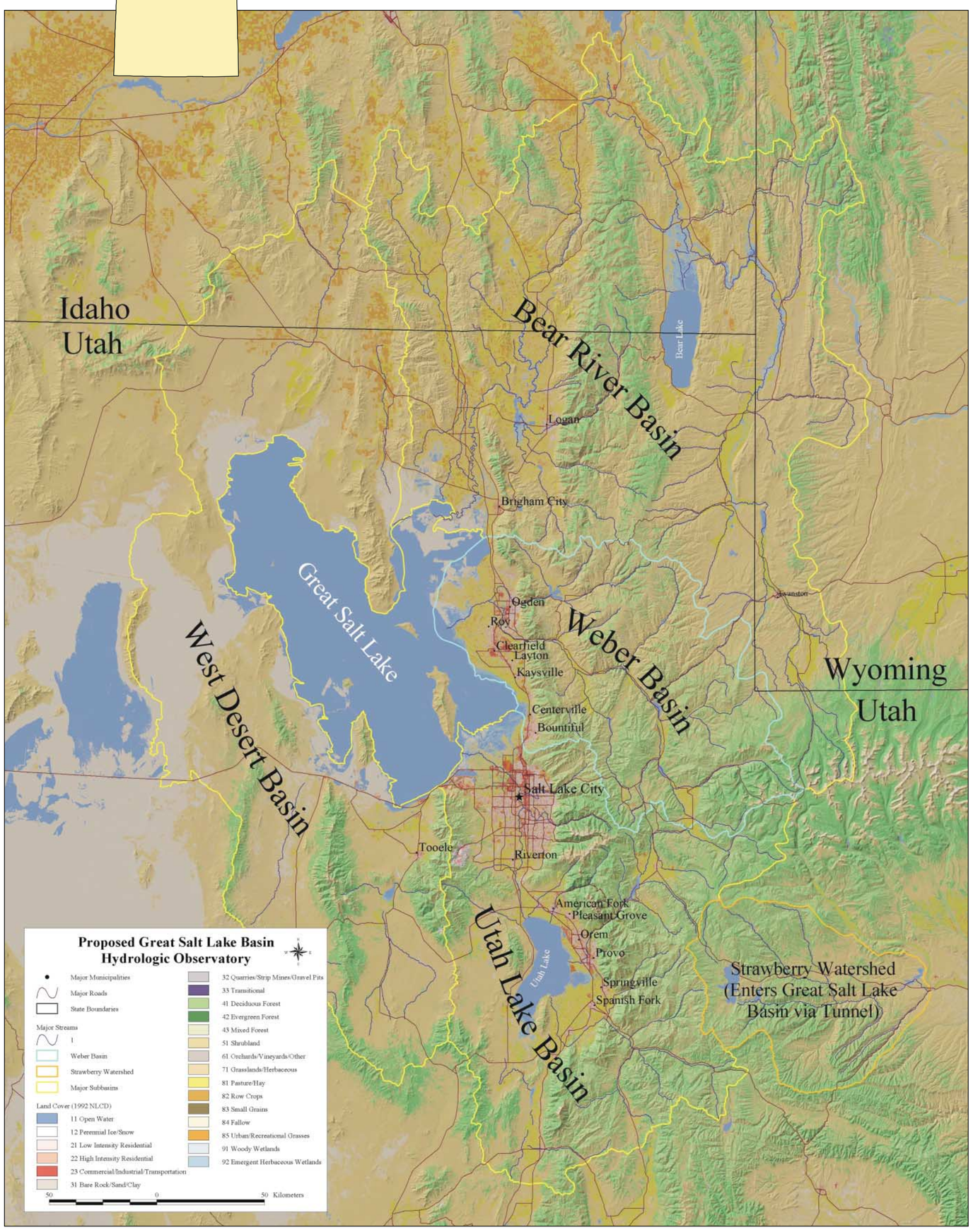
Great Salt Lake Basin
Hydrologic Observatory





Great Salt Lake Basin Hydrologic Observatory

The following critical infrastructure will be placed within the Weber River Basin to initiate the hydrologic observatory.

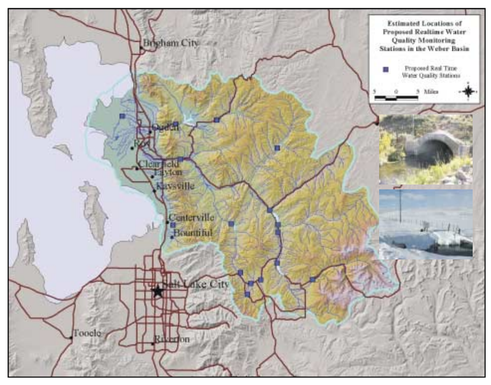
Precipitation, Evapotranspiration, and Infiltration

A well-instrumented flux tower will be installed in a high-elevation subalpine forest to continuously monitor 1) precipitation input, 2) evaporation and plant transpiration losses as moisture fluxes, and 3) surface energy balance. The flux tower measurements provide total moisture fluxes, which are composed of transpiration by forests and plants, evaporation by soils, and sublimation of snowpack in winter.

A tunable diode laser (TDL) absorption spectrometer will be used for measurement of stable oxygen isotope content of atmospheric water vapor to allow separation of the components of moisture flux.

Upgrades to U.S. Department of Agriculture (USDA) snowpack monitoring sites (SNOTEL) will be made in order to provide soil moisture (snowmelt infiltration), solar radiation, soil temperature, relative humidity, windspeed and direction data.

Water Quality Related Parameters



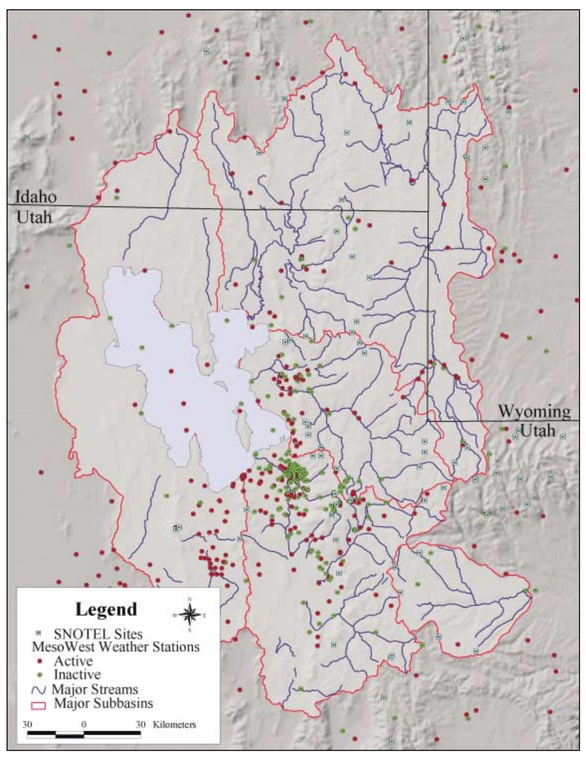
Real time data for water quality parameters in stream locations ranging from alpine catchment to the desert basin will allow determination of rates of water quality evolution across the hydrologic system during precipitation and snowmelt events. Twenty real-time water quality sensors (pH, conductance, dissolved oxygen, temperature, and turbidity) will be coupled with streamflow gages extending from the wetlands surrounding the Great Salt Lake to alpine catchment at the headwaters of the Weber River Basin. The system will be installed and maintained by the U.S. Geological Survey, who will also provide a 40% funding match to the proposed water quality sensor system.

Analytical capability for trace metals species concentrations in complex matrices (e.g. hypersaline water and wetlands sediment) will be developed to facilitate examination of sources and sinks of trace metals contaminants in the Great Salt Lake Basin. A facility with technical support will be established utilizing high performance liquid chromatograph (HPLC) interfaced to an inductively coupled plasma (ICP) mass spectrometer (MS) with an octopole reaction system (to eliminate interference from matrix by-products). This facility will be dedicated to the hydrologic observatory.

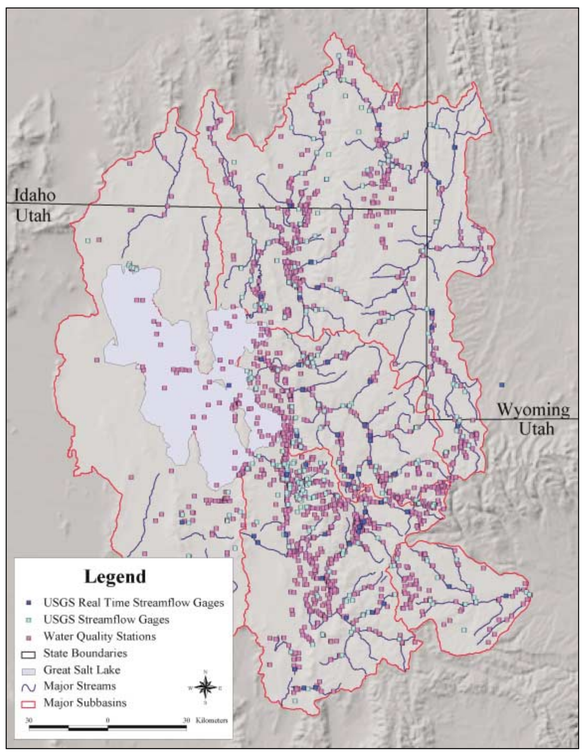
Spread-Spectrum Communications Network

A point-to-multipoint Ethernet communication network using spread-spectrum wireless technology will be developed and patterned after the NSF-sponsored High Performance Wireless Research and Education Network at the University of California, San Diego, and will build on existing partnerships with federal (National Weather Service and Federal Aviation Administration) and state (Natural Resources and Air Quality) agencies. Hydrologic information collected from existing and soon-to-be-deployed sensors will be made available directly to researchers and classrooms.

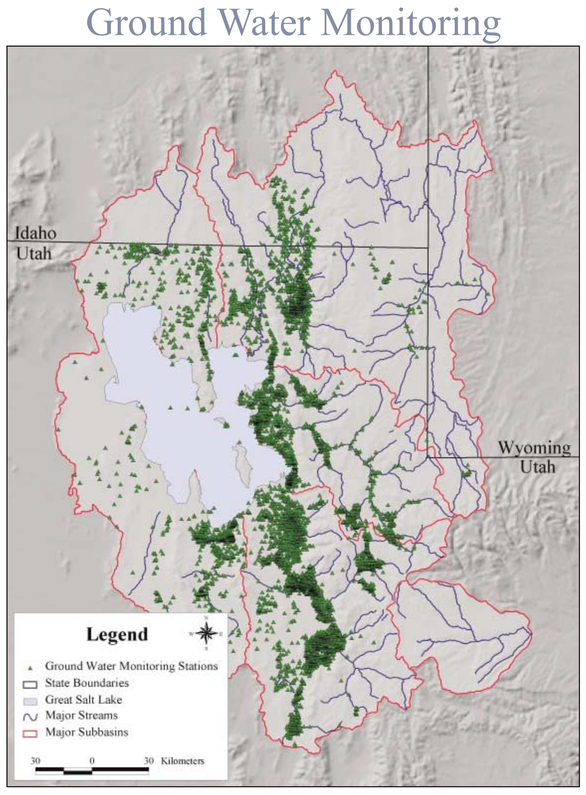
Weather and Climate Monitoring



Streamflow and Water Quality Monitoring



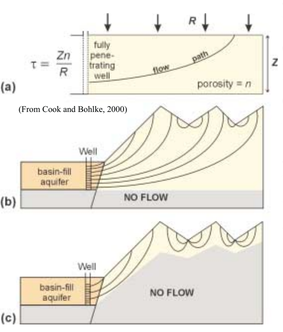
Ground Water Monitoring



Bottom Boundary Great Salt Lake

Vertical profiles of temperature and salinity in the Great Salt Lake will be developed in order to close the energy budget, and this function will be provided by a buoy or permanent platform on the Great Salt Lake to be deployed in cooperation with the NOAA National Buoy Data Center. Instrumentation on the buoy or platform will also include air temperature, relative humidity, pressure, incoming solar radiation, near-surface and subsurface (2 m intervals) lake temperature and salinity, wind speed and direction and gust, and wave height and surface currents.

Mountain Block Groundwater Recharge to the Basin



A deep multilevel groundwater sampling well extending to a depth greater than 1000 ft will be located east of the Great Salt Lake in order to capture the full range of groundwater residence times for water emanating from the mountain block associated with the Weber River Basin.

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A principal goal of CUAHSI is the development of the observational and data systems infrastructure necessary to acquire knowledge sufficient to address large scale hydrologic science problems. The global scale and complexity of hydrologic processes requires an open and integrated community effort. The Great Salt Lake Basin Hydrologic Observatory development team is highly committed to this concept of openness. It is our hope that researchers from across the United States will involve themselves and even lead aspects of the proposed observatory. Please contact us if you would like to become part of the Great Salt Lake Basin Hydrologic Observatory Team or for more information regarding the Proposed Great Salt Lake Basin Hydrologic Observatory.

Poster Created By:
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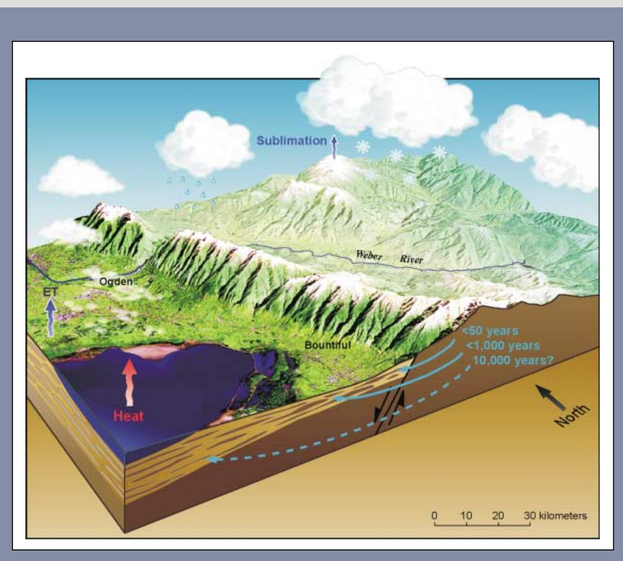
Science Themes

http://greatsaltlake.utah.edu

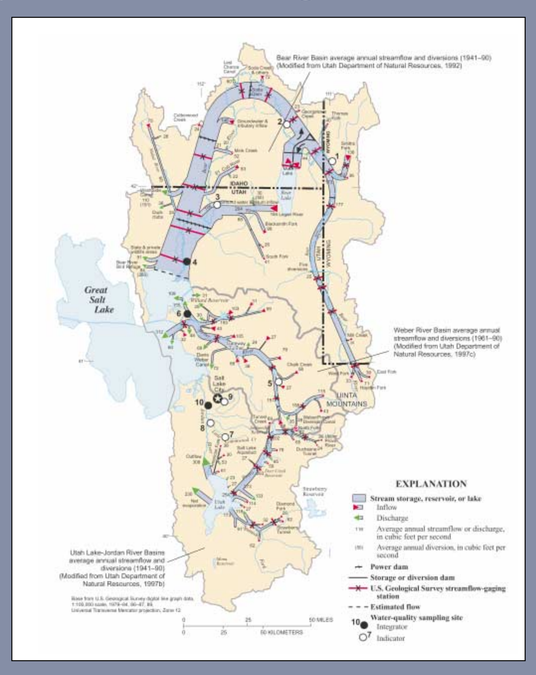
Nowhere in the United States is the societal importance of water more evident than in the arid west, where rapid population growth and limited water resources converge to reach near-crisis level during periods of drought.

A Hydrologic Observatory to measure the hydrology of the Modern West focused on the interactions between human influences and hydrologic processes.

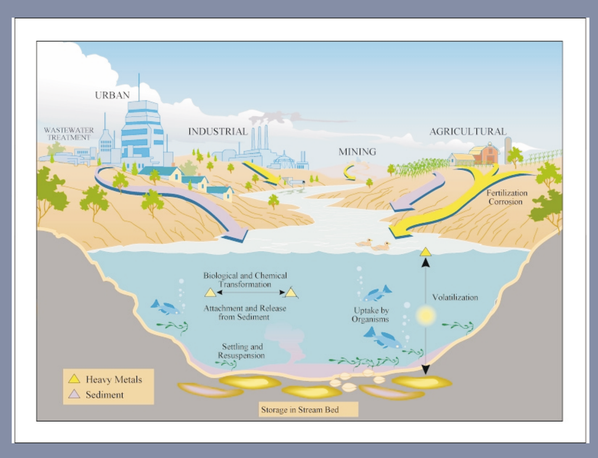


Overarching Questions

- How do climate variability and human-induced landscape changes affect hydrologic processes, water quality and availability, and aquatic ecosystems over a range of scales?
- What are the resource, social and economic consequences of these changes?



The terminal Great Salt Lake presents a unique opportunity to close the water, solute, and sediment balances that is rarely possible in a watershed of a size sufficient for the study of land surface-atmosphere interactions.

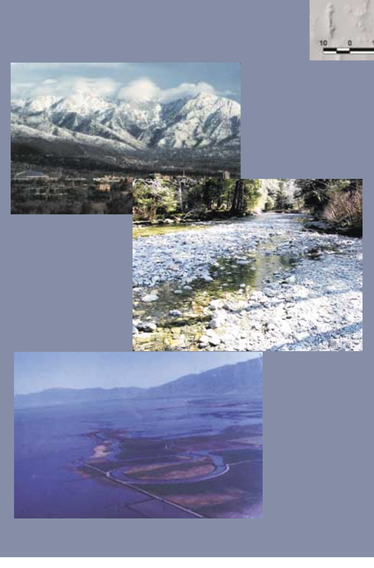


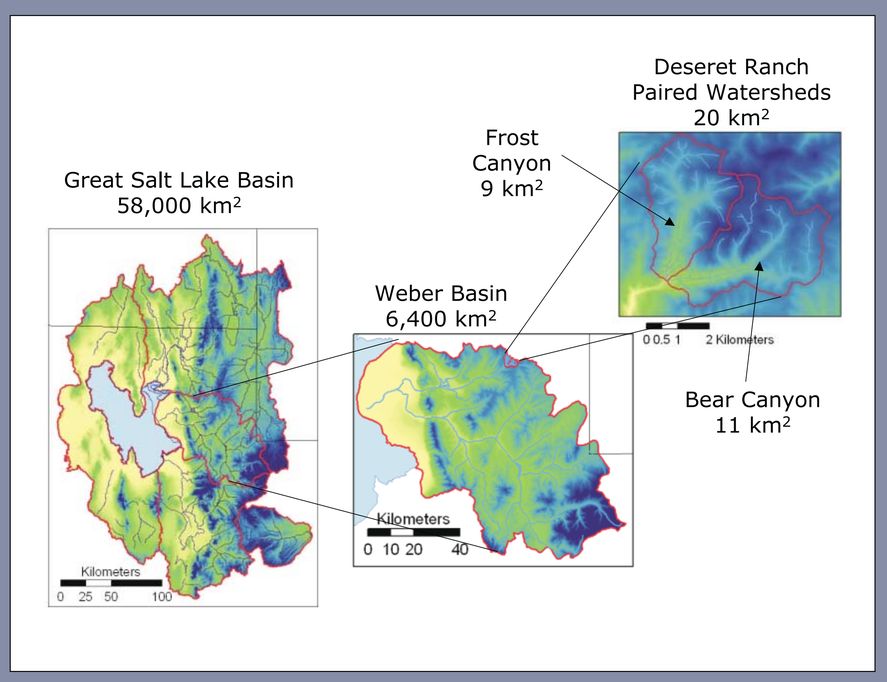
Transport of Chemical and Biological Contaminants

What is the trajectory of selenium, dioxin, and other contaminant concentrations in wetlands surrounding the Great Salt Lake? What are the dominant biogeochemical processes (e.g. chemical reduction and sequestration in sediment, methylation and volatilization) that govern the concentrations of contaminants in the system?

Linking Hydrologic and Biogeochemical Cycles

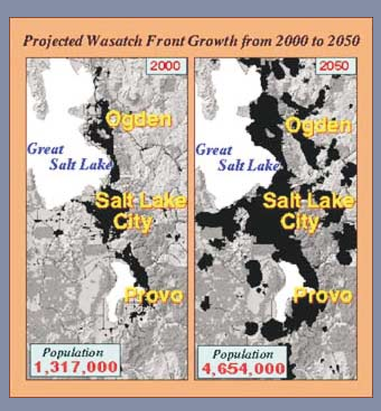
What are the effects of snowmelt pulse on the balance among hyporheic biogeochemical processes? What effects do lake-volume fluctuations (e.g. cyclic saturation and exposure of lake bed sediments) have on biogeochemical sequestration and release processes? How do land-use driven changes in the magnitude and timing of seasonal hydrologic processes alter these balances?

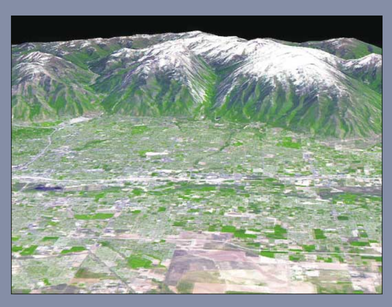




Scaling

To what extent do the Great Salt Lake and surrounding salt playas affect the temporal and spatial variability of precipitation throughout the basin relative to the role played by larger-scale atmospheric moisture fluxes into the basin?





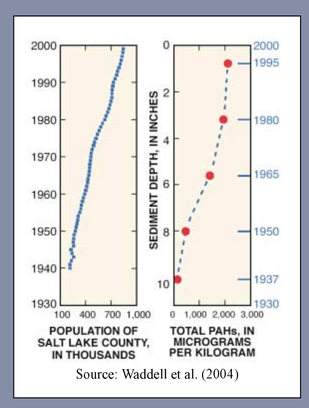
Hydrologic Influence on Ecosystem Function

How are aquatic species and resources related to climate, topography, and geology, and how will these systems respond to changes in the magnitude and timing of seasonal hydrologic processes?

The Great Salt Lake acts as a collector and integrator of hydrologic signals from the surrounding basin providing the opportunity to investigate fundamental hydrologic processes at scales that have been previously unexplored. Lake sediments in closed basin lakes extend our knowledge of hydrologic processes and water quality trends well beyond the historic record.

Predictions and Limits to Predictions

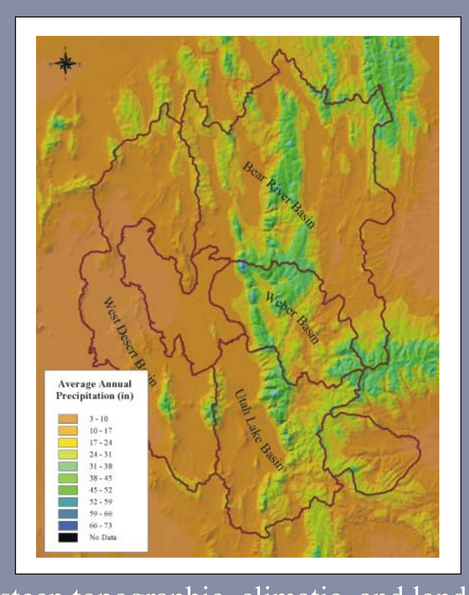
How can historical records (e.g., tree rings, contaminant accumulation in GSL sediments, GSL water levels, etc.) be used to better quantify and understand natural and human induced changes in the hydrologic cycle in order to predict responses to changes and plan for and adapt to uncertainties in water resources?



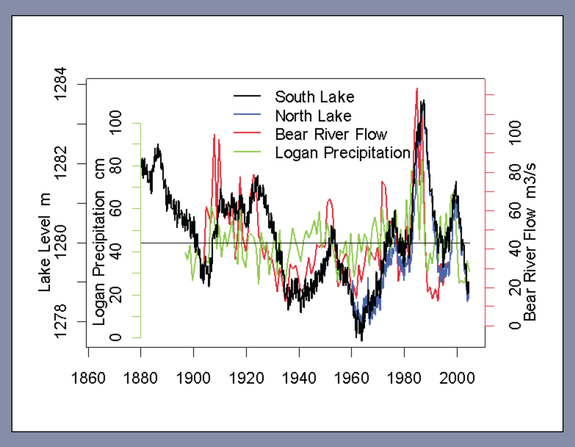
Source: Waddell et al. (2004)

Forcing, Feedbacks, and Coupling

How does the aggregate water balance reflect the integrated effect of nonlinear dynamic interactions among runoff, vegetation, mountain block groundwater, urbanization, and water use?

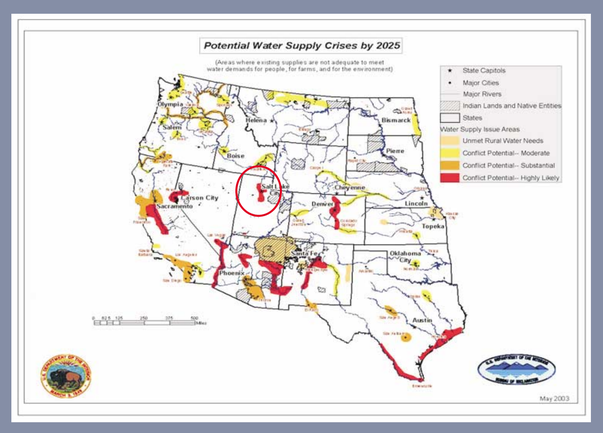


The steep topographic, climatic, and land-use gradients in the Great Salt Lake Basin provide a compactness that is unparalleled and more proximal to logistical support than any other comparable location in the U.S.



Hydrologic Extremes

How can we better understand extreme events, both floods and droughts, in a system driven by potentially changing external climate forcing and internal dynamics?



Sustainability of Water Resources

How do hydrologic fluxes, flow paths, and residence times change in response to development that is prevalent in much of the western U.S.