SCIENCE
FOR UTAH'S
WATER FUTURE

Utah's Water Future

How iUTAH is making a difference

EPSCoR
iUTAH

iUTAH stands for **i**nnovative **U**rban **T**ransitions and **A**rid-region **H**ydro-sustainability

The project is a university-community collaboration integrating research, training, and education to strengthen science for Utah's water future. This five-year project is funded under a cooperative agreement with the National Science Foundation's Experimental Program to Stimulate Competitive Research (EPSCoR). The purpose of iUTAH is to build capacity for addressing water, population growth, and climate change issues in Utah.

Water is Utah's most precious natural resource. Our state faces water issues that have economic, ecological, and human consequences. To sustain Utah's water resources, we must be prepared to address a highly complex array of environmental processes and social concerns.

Since 2012, the researchers, educators, and resource managers in iUTAH have been working together to understand these complexities. Our research is contributing to **predicting** the effects of natural events and human choices on water systems, **creating** better understanding of threats and measurements of Utah's water systems, and **informing** citizens and policy makers about water and the ways we can sustain it for future generations.

The knowledge we're gaining and the tools we're developing will help water professionals and other decision makers make informed choices and take appropriate action to secure Utah's water future.

Issue 1:
Impaired water quality

WHAT'S THE CONCERN?

Increasing population, aging infrastructure, and mountain development has led to increased nutrient inputs and harmful bacteria entering our streams and lakes, especially Utah Lake, Jordan River, and Farmington Bay.

WHAT ARE THE CONSEQUENCES?

ECONOMIC

Economic consequences include increased cost of water treatment, impacts to recreation industries, and periodic loss of water for crop irrigation

ECOLOGICAL

Ecological consequences include reduced fishery quality and ecosystem function, and increased occurrences of harmful algae blooms

HUMAN

Human consequences include reduced recreation opportunities, potential exposure to environmental toxins and disease, and loss of aesthetic value

iUTAH IS MAKING A DIFFERENCE BY...

1. **Managing** water quality data from sensors in Utah Lake, in collaboration with the Utah Department of Water Quality, that may be used as an early warning system for future harmful algae blooms
2. **Publishing** results of studies based on water quality of the Jordan River that will lead to better diagnostics and restoration of impaired urban rivers
3. **Building** a microfluidic device that measures oxygen levels of water in more detail than previous methods, allowing for better monitoring of Utah Lake following an algae bloom
4. **Developing** innovative visualization tools, based on iUTAH water survey results, to help city and state offices, and the general public, see how attitudes and opinions about local water issues vary

Issue 2:
Ag-to-urban conversion

WHAT'S THE CONCERN?

Meeting the needs of a growing population has meant converting some of Utah's best farmland to urban/suburban uses, with implications for water supply, allocation, and demand.

WHAT ARE THE CONSEQUENCES?

ECONOMIC

Economic consequences include increased cost of water infrastructure to agricultural producers

ECOLOGICAL

Ecological consequences include fragmented wildlife habitat, often forcing mule deer and other animals into urban areas

HUMAN

Human consequences include loss of open space and highly valued agricultural heritage

iUTAH IS MAKING A DIFFERENCE BY...

1. **Showing** how changes in urban forest composition, such as tree choice in Heber and Midway, affect total landscape water use when agricultural lands are lost to urban development
2. **Creating** dynamic simulations of urban growth in 2040 and 2090, looking at water availability and quality in the Jordan River Valley, to help communities and municipalities address water resource needs for the future
3. **Developing** methods for measuring variations in temperature, humidity, and wind, and for understanding how water vapor is transported from the soil to the air, which can lead to improved urban and agricultural planting practices aimed at retaining more moisture in the soil

Issue 3:
Stormwater management

WHAT'S THE CONCERN?

Managing water flows after heavy rains and rapid snowmelt is increasingly difficult as cities and towns face rapid population growth and aging infrastructure. Outflows of untreated runoff from urban areas can negatively affect water quality and human health in rivers, canals and lakes across the Wasatch Front.

WHAT ARE THE CONSEQUENCES?

ECONOMIC

Economic consequences include increased maintenance and infrastructure replacement costs for municipalities, and potential property damage due to localized flooding

ECOLOGICAL

Ecological consequences include harmful pollutants washing into lakes and streams when overloaded systems cannot handle stormwater flows

HUMAN

Human consequences include potential increased exposure to pollutants, as well as street and property flooding

iUTAH IS MAKING A DIFFERENCE BY...

1. **Discovering** that stormwater management efforts may not be sufficient to protect urban watersheds where pollutants are delivered to the stream from contaminated groundwater
2. **Identifying** benefits of moving from concrete pipes to more natural 'green infrastructure' approaches to stormwater management
3. **Demonstrating** integrated approaches at the University of Utah showing ecological revitalization and watershed management practices appropriate to the local climate and urban green infrastructure
4. **Establishing** innovative stormwater management systems in Logan and Salt Lake City to test the role of native vegetation and green infrastructure in reducing flooding and improving water quality

Issue 4:
Water supply challenges related to climate change

WHAT'S THE CONCERN?

Warming of the atmosphere is predicted to change snow and rainfall patterns, potentially resulting in less water storage and supply during the growing season.

WHAT ARE THE CONSEQUENCES?

ECONOMIC

Economic consequences include increased cost of water, and potential crop and livestock losses

ECOLOGICAL

Ecological consequences include reduced water quality due to higher water temperature and nutrient concentrations

HUMAN

Human consequences include less water available for urban/suburban landscaping, and potential conflicts between agricultural and urban water users

iUTAH IS MAKING A DIFFERENCE BY...

1. **Creating** better models based on data from seven sites in the Salt Lake Valley to improve prediction accuracy for snowmelt converted to annual stream flow
2. **Influencing** water conservation efforts at Weber State University through social science research measuring attitudes that reveal support for more sustainable water practices and changes in irrigation system management
3. **Identifying** a timeframe in 40+ years when water usage will exceed supply and working in collaboration with the Utah Division of Water Resources to create models that couple climate and population growth projections linked to major water sources in Utah

Issue 5: Changes in seasonal snow cover

WHAT'S THE CONCERN?

The amount and timing of snowfall and snow cover has been changing; melted water from snow is projected to come earlier and faster in a future climate.

WHAT ARE THE CONSEQUENCES?

ECONOMIC

Economic consequences include negative impacts on Utah's winter recreation industry, and increased cost and/or reduced supply of agriculture and urban water derived from snowmelt

ECOLOGICAL

Ecological consequences include changes in snowmelt that threaten forest health, increase the risk of catastrophic wildfires, and threats to fisheries and stream ecosystems

HUMAN

Human consequences include reduced recreation opportunities, the loss of aesthetic value, and reduced potential for mountain development

iUTAH IS MAKING A DIFFERENCE BY...

1. **Engineering** a new ground sensor that can measure water flows in soils, soon to be commercialized as an improved way to measure snowmelt rates during spring runoff, helping water managers better understand water supply

2. **Publishing** results showing that spring snowpack may be more vulnerable to a warming climate in coming decades, based on high-resolution climate modeling of annual variability in precipitation and temperature in Utah's Wasatch Mountains and other ranges in the West

Issue 6:
Need for highly skilled, technically proficient water managers

WHAT'S THE CONCERN?

Water resource management is data-intensive. Managers must not only be able to make quality measurements, but also to manage and use the resulting data. The number of water-savvy professionals does not meet our current demand, much less future needs.

WHAT ARE THE CONSEQUENCES?

ECONOMIC

Economic consequences include costly, unnecessary, or misdirected expenditure of tax dollars based on inadequate data or data-interpretation expertise

ECOLOGICAL

Ecological consequences include potential failure to detect, recognize, and respond to environmental threats to stream and lake systems in a timely manner

HUMAN

Human consequences include potential failure to detect, recognize, and respond to threats to drinking water and irrigation systems before they happen

iUTAH IS MAKING A DIFFERENCE BY...

1. **Involving** over 100 top-achieving undergraduate students in iUTAH research projects through traineeships and summer research fellowships, with most continuing their education in the field of water science and some now employed in state and local government agencies
2. **Establishing** a new Research Traineeship on Climate Adaptation Science at Utah State University that anticipates preparing 80 graduate-level students over the next five years to meet the needs of a variety of STEM careers
3. **Developing** a graduate-level Hydroinformatics course, taught simultaneously each fall at UU, USU, and BYU, to prepare students for water-related, data-intensive research and work environments
4. **Launching** a new hydrology/water resources program with professional certification, offered over one semester at the University of Utah, which will rely on relationships and expertise established by iUTAH to offer courses statewide

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