iUTAH EPSCoR 2016

Annual Newsletter

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INSIDE

SCIENCE
FOR UTAH'S
WATER FUTURE

iUTAH EPSCoR 2016 Annual Newsletter

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Cover photograph by Wayne Wurtsbaugh
Location: Great Salt Lake as viewed from Antelope Island, Utah

Image reversed for editorial reasons.

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iUTAH (innovative Urban Transitions and Aridregion Hydro-sustainability) is a 5-year project funded by a cooperative agreement with the National Science Foundation's Experimental Program to Stimulate Competitive Research (EPSCoR).

The vision for iUTAH is to lead the nation in scientific, educational, and innovative solutions for water management and sustainability.

The mission of iUTAH is to enhance collaborative partnerships to better understand how to sustain Utah's water resources by (1) developing novel approaches to integrated research and training, and by (2) expanding the state's economic, educational, and research competitiveness.

Michelle Baker, iUTAH EPSCoR Project Director

"We should be proud of *the* many achievements in transforming *our* research and training culture; making STEM education accessible to students from diverse backgrounds; and reaching all levels of learners to educate them on science-focused water issues facing the state."

Dear Friends of iUTAH,

Over the last four years, we have worked together on research, education, and outreach to find innovative answers to address Utah's water sustainability for the future. I have enjoyed the close personal connections that I have made with each of you.

As a team, we should be proud of *the* many achievements in transforming *our* research and training culture; making STEM education accessible to students from diverse backgrounds; and reaching all levels of learners to educate them on science-focused water issues facing the state.

iUTAH participants have worked hard over the past several years to make important contributions to Utah's water puzzle. Our comprehensive survey of water use behavior in over 2,300 households has been shared widely with decision makers in municipalities across the state. At the same time, iUTAH researchers are busy developing "smarter" meters to provide more informative household use data to water managers in our communities. Groundbreaking research on water partitioning in snow-dominated environments such as ours has implications that cut across all sectors of our water economy. These are but a few examples of the useable science in which iUTAH participants engage.

Despite all we have achieved, now is not a time for complacency: this has been a landmark year for water issues in our state. After years of drought and decades of water withdrawals, the Great Salt Lake—the iconic and spiritual presence in the social and environmental consciousness of our state that graces our cover—reached a near-record low elevation that exposes 48% of the lakebed, with unknown consequences of airborne mineral dust on human health. At the same time, Utah's legislature approved a funding mechanism to support new water infrastructure like the Lake Powell Pipeline and Bear River project. We saw deadly flash floods, toxic sludge from the Gold King Mine, harmful algal blooms, and the list goes on. Clearly there are many issues at the forefront of water in our state.

With so much already accomplished, and exciting and innovative research ongoing, iUTAH must now look to the future. There is no doubt that our interests are well-aligned with many other entities in Utah—we must capitalize on this opportunity to co-produce new knowledge to enhance Utah's water sustainability.

Michelle Baker, iUTAH EPSCoR Project Director

Research

TRANSFORMING SCIENCE

Logan River is one of three watersheds along the Wasatch Front where sensors measure climate, hydrology, and water quality, producing baseline data to inform research. iUTAH brings scientists, sociologists, and engineers together to explore, extend, and enhance Utah's water sustainability.

Photo by Wyatt Traughber

RESEARCH

Rain, Roofs, and Roads: Harvesting Stormwater

GAMUT Sensor Network Reveals Secrets of Urban Streams

THE HISTORY

Nearly four years ago, scientists and technicians designed and installed a network of aquatic and climate sensor stations along the Wasatch Front. Built to study water in “Gradients Along Mountain-to-Urban Transitions” (GAMUT), the network measures climate, hydrology, and water quality in three watersheds: Red Butte Creek, Logan River, and Provo River.

CHANGING LANDSCAPE

Utah is among the five states with the highest population growth in the United States. As such, land in Utah is being converted to buildings, roads, and parking lots at a fast rate. GAMUT not only helps us understand primarily rural rivers but it also provides data on streams in cities and towns, where most of Utah’s population growth and change is occurring.

“The comprehensive data being measured, in collaboration with iUTAH scientists, will enable the Salt Lake City Department of Public Utilities to gain a better understanding of the water quantity and water quality of the Red Butte Creek System”

Tracie Kirkham, Water Resources Scientist, Salt Lake City Department of Public Utilities

Although alike in their primary source of water—winter snow—these three watersheds are very different in terms of human use of the surrounding land. GAMUT is providing baseline data to inform research about a wide range of issues along the Wasatch Front.

The changes we make in these landscapes create a host of complicated problems whenever it rains. Water runoff, also referred to as stormwater, contributes to flooding as it flows across roofs, roads or other hard surfaces. This stormwater also carries pollutants, including road salt and nitrogen, to Utah’s basin valleys where much of the water ends up. Current systems built to handle the water were constructed primarily to control flooding, and do little or nothing to reduce the risk posed by polluted stormwater entering our waterways.

HELPING CITIES

The first step towards addressing this issue is to understand the problem. There are currently 38 GAMUT sensor sites, including four storm drain stations in Red Butte Creek, and two in each of the Provo and Logan River watersheds. All of these eight urban stations have been established to help researchers better understand water quality in urban settings.

In addition to collecting data, iUTAH has brought together an interdisciplinary team of biological and social scientists, and engineers who are using GAMUT data to help explore the potential of harvesting stormwater to recharge underground aquifers.

Many municipalities are working to address the impact of stormwater runoff in their communities. They are looking for new approaches that would minimize the need for stormwater treatment. This minimally treated water could then be returned to underground aquifers and used to satisfy future water needs.

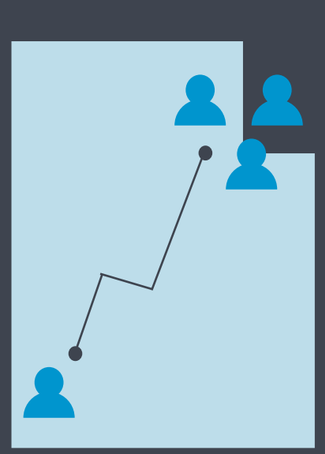
COLLABORATIVE RESEARCH

iUTAH researcher Ryan Dupont, a professor of civil and environmental engineering at Utah State University (USU), and other scientists hope to provide a viable solution. As water quality experts, he and a team of researchers are exploring a new approach to stormwater management.

Their solution would replace the current centralized, concrete piping system with a distributed, more natural system that minimizes contamination, and allows the treated water to be recovered and reused. Decentralizing the infrastructure is a key component of this design. Preliminary data on its effectiveness are being collected now.

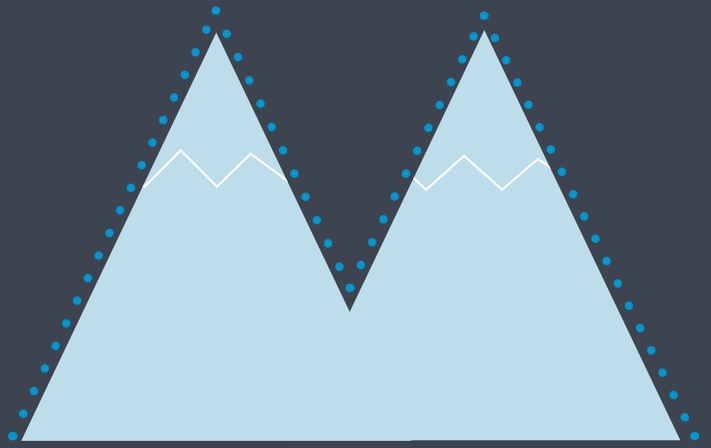
The project is a collaborative effort involving other iUTAH researchers. Doug Jackson-Smith, a professor of sociology at USU, will gather the opinions of stakeholders and the public on this method of stormwater management. Sarah Null, an assistant professor of watershed sciences at USU, will study the possible ecological benefits of the proposed system. The project was recently awarded an Environmental Protection Agency grant for continued research.

iUTAH’s research brings engineers, biologists, and social scientists together to solve water-related problems. Harvesting stormwater is one example of a collaborative research effort that may result in solutions to concerns across our state and the nation.

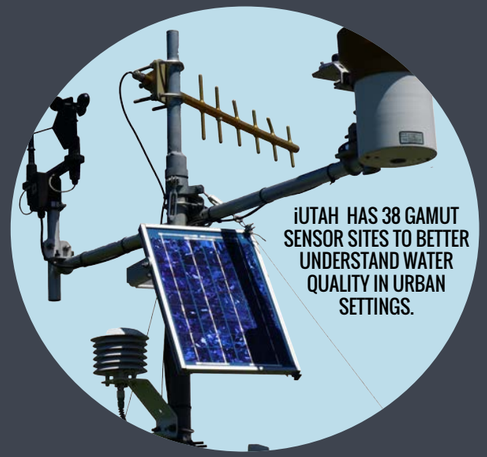


HIGH POPULATION GROWTH LEADS TO

MORE BUILDINGS AND ROADS, CAUSING POLLUTANTS AND STORMWATER RUN-OFF



INTO UTAH’S BASIN VALLEYS WHERE MUCH OF THIS WATER WILL END UP.



iUTAH IS WORKING TO BETTER UNDERSTAND THESE WATER CYCLES.

RESEARCH

What Matters Most to Utahns?

Understanding Water Concerns of Local Communities

THINKING ABOUT WATER

Experts predict rapid population growth and a shift in precipitation from snow to rain for Utah in the coming decades. This means a smaller, less stable water supply in the face of increasing demand. Understanding public perception of water use in our state has the potential to influence water policy decisions that will affect our citizens' quality of life in the future.

To understand and address these issues, iUTAH researchers from a consortium of Utah universities undertook a comprehensive survey of over 2,300 households. The purpose of the survey was to collect useful information about how residents use water and feel about related issues. This valuable information is available to local governments to assess current residential water management and public support for a range of water policies.

TEAM APPROACH

Researchers from Utah State University (USU) and the University of Utah came together as a team under the iUTAH program to conduct surveys in the summer of 2014. Surveyors visited 23 neighborhoods in Cache, Salt Lake, and Heber Valleys, interviewing randomly selected households with an extensive 16-page survey.

"This is the largest and most thorough academic assessment of attitudes and behaviors concerning water that has ever been done in the state," said project co-leader, Douglas Jackson-Smith, professor of sociology at USU. Since that time, survey results have been compiled and processed, and are available to researchers, water managers, and the general public at the iUTAH website.

PERCEPTIONS OF WATER CHALLENGES

As a whole, residents expressed strong support for a wide range of local and state-level policies and programs to address many of the water challenges Utahns will face in coming years.

> "Water use is among the most important political, economic, and quality-of-life issues facing our state. In Riverton City, we are taking advantage of data and analyses iUTAH has shared with us to provide better services to our citizens. I look forward to continuing this exciting collaboration in the future."
>
> ***Daniel Woodbury***
> ***P.E. Water Resources Engineer, Riverton City***

Among the issues important to quality-of-life, residents support incentivizing water conservation to reduce consumption, protecting water-based amenities, and recreational activities.

"Our analysis shows that people who are more active in water-related recreation are more concerned about water supply and quality," said Courtney Flint, professor of sociology at USU and project co-leader. Other highlights from survey findings have been summarized below. Some results are expected while others are surprising.

SHARING RESULTS

One aspect of the survey project is to engage local and state water decision makers with the experiences and priorities of Utah citizens. Beginning in January 2016, Douglas Jackson-Smith, with iUTAH researchers Melissa Haeffner and Sarah Hinners, presented the findings of the household survey to city councils in Salt Lake Valley and beyond. So far, presentations have been made to the Logan, North Logan, Nibley, Providence, South Jordan, Riverton, and West Jordan city councils, reaching between 13 and 63 participants per meeting.

As this process continues, iUTAH researchers have formed stakeholder groups consisting of local and state water managers. "We are excited to continue building relationship with decision makers and citizens in our study neighborhoods" said Jackson-Smith. "It was a great opportunity to return to the city to share our survey results while introducing our ongoing project to elected city council members."

iUTAH is committed to communicating regionally specific research findings to local and state water decision makers. By building ongoing relationships with local citizens, water managers, and public officials, our researchers will help address water sustainability for Utah's future water needs.

SHORTER SURVEY CAPTURES PUBLIC VIEWS

iUTAH iFellows and mentors use shorter Utah Water Survey on iPad to collect public views of water statewide.

Photo by Cynthia Elliot

Survey Findings

WATER AVAILABILITY

Residents believe that their communities currently have enough water to meet local needs, but are less likely to think future supplies will be adequate. They are much more worried about state-level water supplies than local water supplies.

CURRENT WATER CONSERVATION

2016

Most residents practice basic household water conservation (shorter showers, using more efficient appliances), and about a third have taken steps to reduce water use in their outdoor landscaping.

FUTURE CONSERVATION

Although experts say that changing outdoor landscaping irrigation has the greatest potential to reduce future water demand, most residents believe they can do more to conserve water indoors than outdoors.

AGRICULTURE

Most residents believe that household users are wasteful and should cut back on water use, but they do not think farmers waste water – and are not supportive of policies to shift water from agricultural to urban uses.

WATER QUALITY

Generally, residents consider water quality to be good, so concerns about water quality rank below most other water concerns.

WATER POLICIES

Residents express a high level of support for a wide range of local and state-level water policies, including more aggressive efforts to both improve supply and incentivize water conservation. However, policy priorities varied widely across our study communities.

RESEARCH

Predicting the Future

Helping Shape Urban Growth Along the Wasatch Front

Utah's water system is complex. Life-sustaining water flows through the air, streams, lakes, and soil—and pipes, faucets, and economy—of Utah, the second-driest state in the nation. This flow is a complicated ballet that plays out over time and through space. Its movements are influenced by human decisions, which are still being made at many levels by individuals, households, neighborhoods, cities, and beyond.

IMPACTS IN COMING DECADES

One of iUTAH's key aims is to increase our understanding of the integrated human + natural water system. We are modeling elements of this system to better understand how the region's changing climate and rapid urban growth may impact our water experience in coming decades. Researchers with backgrounds in climate science, stream hydrology, civil engineering, urban planning, and irrigation systems management have developed models representing different dimensions of the water system.

"The Utah Division of Water Quality is collaborating with iUTAH to address water quality impairments in the Jordan River Basin. Together we are developing predictive modeling tools that will be used to evaluate the impacts of climate change, population growth, land use conversion and stormwater management on water quantity and quality in this watershed, which serves more than a million of Utah's citizens."

Nicholas von Stackelberg,
Environmental Engineer
Utah Department of Environmental Quality

TOOLS AND TECHNIQUES

While individually, each of these models can help us understand some "slice" of the world better, they ignore other factors. iUTAH's coupled modeling team is developing software tools and techniques to connect these models together so that they can form a richer representation of the world's complexity. Using these coupled models, we and—more importantly—others, can then investigate the behavior and possible future conditions of this larger integrated system. Models of regional climate are feeding predictions of precipitation and temperature into streamflow models; urban growth models are being used to inform models of supply management, storm-water runoff, and water quality. By coupling individual models together, we can get a better understanding of how Utah's critical relationship with water is likely to play out in the coming decades.

Why Models?

Science is a way of creating knowledge about how the world is organized, and how it works. To do this, scientists "poke" things and watch how those things respond to being poked. But the world is hard to understand. It's a complex place: it's big, it's varied, and its contents and circumstances are changing all the time. Ethical, legal, financial, or other logistical reasons mean that things can't always be poked. What's more, we can observe the present and (indirectly) the past, but not the future - it hasn't happened yet.

Models allow researchers to poke virtual copies of the world in different ways to ask questions and better understand the parts of the world being modeled. A model is a simplified representation of a larger or more complex reality.

Models in Action

Wasatch Choice for 2040 (WC2040) articulates our region's vision for urban growth in the form of a map that was created with extensive public input. City planning departments from North Ogden to the southern end of Utah County, and state agencies like UDOT, are already using WC2040 to guide growth decisions.

The Equilibrium Growth (EQ) model, developed by PhD student Guang Tian and his advisor Reid Ewing at the University of Utah, analyzes factors that urban planners know influence parcel development—adjacent land use, or the number of jobs or residents that can be accessed within given travel times—and applies these measures to highlight parcels that are likely to be developed for other land uses by 2040, given changes in transportation infrastructure. The EQ model contributes a crucial "growth as usual" component to the work of the Wasatch Front Regional Council (WFRC) and Mountainlands Association of Governments (MAG), Salt Lake and Utah Counties regional transportation planning authorities.

Using the land-use modeling platform SLEUTH, iUTAH graduate researcher Enjie Li and her co-advisors Joanna Endter-Wada and Shujuan Li at Utah State University examine urban growth. SLEUTH simulates the process by which rural land is developed into urban land from year to year, factoring in constraints like proximity to roads, slope, and existing restrictions to development. Public utilities apply this modeling framework to the challenge of extending water supply infrastructure to accommodate future growth.

SIMPLIFYING COMPLEXITY

Models simplify the awe-inspiring complexity of the world we live in by:

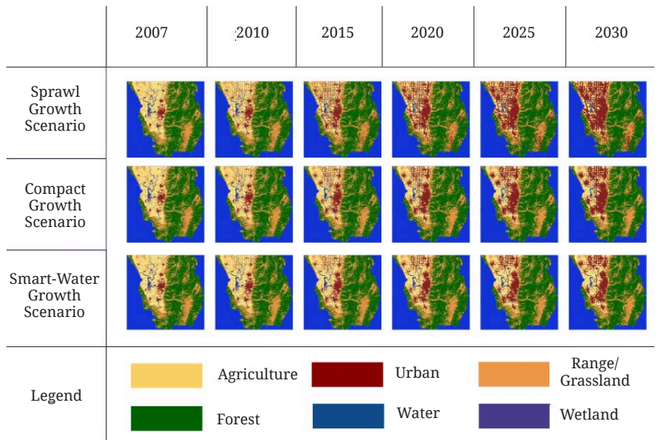
- looking at only a small region, rather than the whole world
- looking at only some rather than all of its interacting parts
- simplifying the processes that connect and act on those parts

Because they eliminate some of the amazing complexity of the real world, all models are "wrong" in some sense - but they can still be useful! The key challenge for researchers is to understand what details are the critical ones that most strongly determine the aspect of the world they're investigating.

USEFUL OUTCOMES

Connecting results from these different land-use models to models representing streamflow, or water quality, or urban water demand, can be challenging. They don't all generate outputs representing the land at the same scale, in the same time increments, or even predict the same variables. The models include—and ignore—different elements of the actual process of urbanization: WC2040 considers regional stakeholder plans and preferences; EQ accounts for the distribution of jobs and residences, and the impact of future roadways and transit; SLEUTH gets at how development in one year can change the equation for developers in the next and successive years.

Developing methods for coupling models together is challenging, but success can be rewarding. Because of these differences, researchers expect the models to produce different results. Comparing differences and overlap in their predictions can help us understand which factors are most important in determining where growth will happen, and where we can have the most confidence in model predictions.



Visual representation of simulation results of spatial layout for future urban growth in Cache County Utah. Image courtesy of Enjie Li.

RESEARCH

Leaving a Lasting Legacy

Sharing Data and Research Results

Reliable data can inform and change dialogue, decisions, and policies for the better. To publish the varied datasets being generated by iUTAH participants, we established the iUTAH Data Repository as a digital data library. This repository provides access to a broad range of observations and data products generated by iUTAH's many research projects.

The Data Repository stores, manages, and distributes scientific data collected by our researchers. Its inventory is large and varied, with data holdings ranging from interviews with water managers to data collected on sapflux in aspen and fir trees. The Data Repository is an open-access resource with datasets available for public viewing and use.

In addition to publishing, housing, and disseminating research data, iUTAH established policies for data publication and data reuse. Following standards for data publication results in data products that are well-documented and of high quality. This increases the value of iUTAH data and modeling research discoveries for a variety of audiences.

Researchers and scientists are using iUTAH data in publications and in grant proposals. Municipalities and state agencies, such as Utah Department of Environmental Quality's Division of Water Quality, also interact with our data to gain a better understanding of water quality, quantity, and public perceptions in our state.

With access to well-documented data, research scientists, water managers, and the general public are able to better understand and prepare for the growing demands on Utah's water supply. iUTAH believes that data science can enhance and impact innovative research as well as inform public policy decisions in Utah and beyond.

"One of the weaknesses that we as a city face is having good quality data to evaluate water quality impacts. The advantage of collaborating with iUTAH is that they provide us with a data management source for collecting data, including quality control. Then they store and warehouse it, so that it is not just available to Logan City, but also to all of the irrigation and canal companies, state agencies, the EPA, and researchers who are concerned about water quality."

Lance Houser
Assistant City Engineer at City of Logan

iUTAH Data Repository

Dataset Highlights

GAMUT OBSERVATORY DATA

The repository includes archival, file-based results for each site in the "Gradients Along Mountain-to-Urban Transitions" (GAMUT) network, which measures climate, hydrology, and water quality in three watersheds: Red Butte Creek, Logan River, and Provo River.

2014 HOUSEHOLD SURVEY

This dataset provides highlights and full reports that identify significant results of the household survey completed by over 2,400 households in 23 neighborhoods across 12 cities and 3 counties in Utah. It summarizes how residents use water and feel about related issues in their area.

UTAH WATER SURVEY

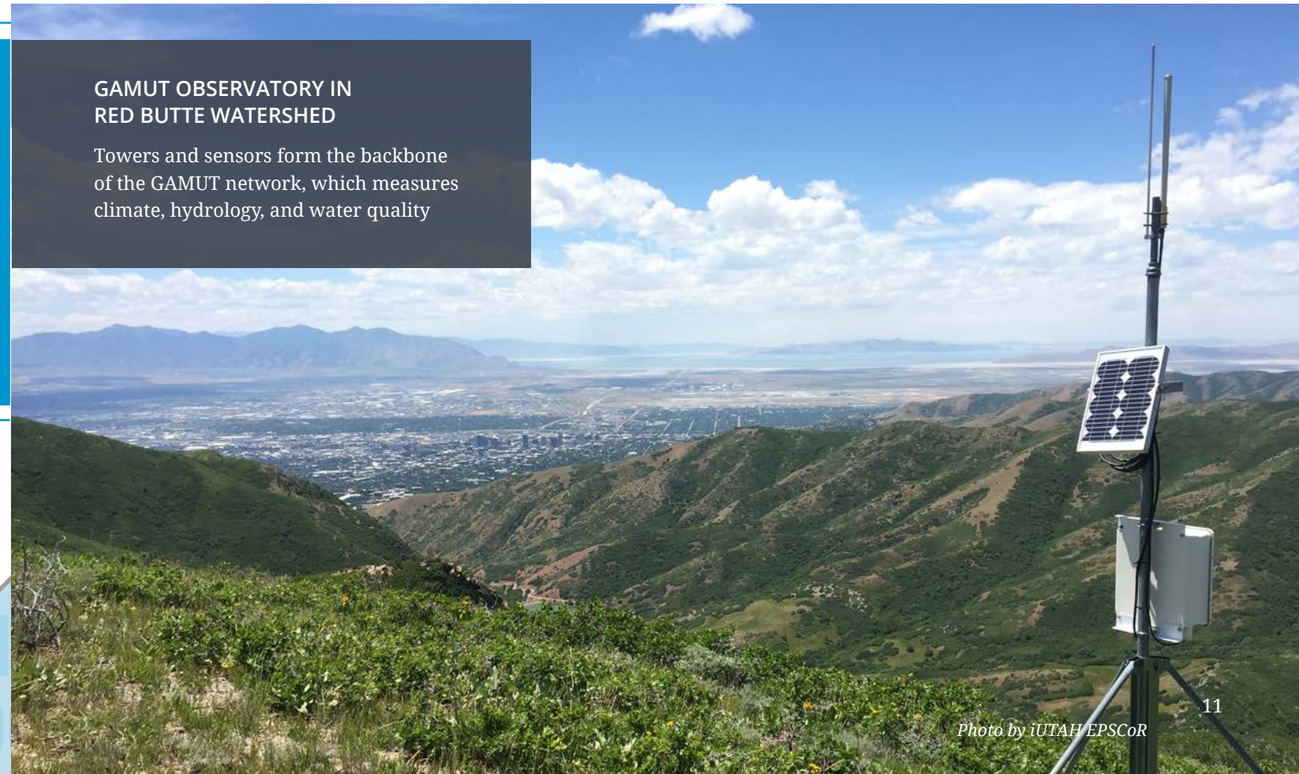
This dataset contains the responses from over 6,000 adults to a 3-minute iPad survey administered in public places statewide and focused on water-related issues.

SAPFLUX IN GAMUT WATERSHEDS

This effort measured sapflux for aspen and subalpine fir trees at sites in the Logan River and Red Butte Creek watersheds. The dataset contains raw and processed sapflux data as well as meteorological, soil temperature, and moisture measurements.

WATER MANAGER INTERVIEWS AND SURVEYS

Surveys and interviews were conducted with water managers from a variety of municipalities, irrigation companies, and the private sector. The resulting datasets include summaries of the interviews, survey results, and a compilation of stormwater organizations' annual reports and tables.



GAMUT OBSERVATORY IN RED BUTTE WATERSHED

Towers and sensors form the backbone of the GAMUT network, which measures climate, hydrology, and water quality

Photo by iUTAH EPSCoR

Education
Outreach
Diversity

REACHING ALL LEVELS OF LEARNERS

Students look on as Joydino Beyale, 2016 iFellow and student from USU Eastern-Blanding, speaks during a group training session of the USU Native American STEM Mentorship program. iUTAH works with students K-20 to educate them on science-focused water issues facing the state.

Photo by iUTAH EPSCoR

EDUCATION

Growing a STEM Workforce

Undergraduate Student Research that Makes a Difference

Job prospects in the fields of science, technology, engineering, and mathematics (STEM) are expected to expand twice as fast as those in other professions by 2022, according to projections from the U.S. Bureau of Labor Statistics. Employers are also seeking a more inclusive workforce representing more race, gender, and ethnic diversity. Thus, there is a strong need to help students in Utah grow their interest in STEM research fields.

SOLVING REAL PROBLEMS

iUTAH is working hard to address this need. Through its iFellows program, undergraduate students are involved in cutting-edge research and scholarly work on water-related issues. This program takes place over an 11-week period each summer, beginning in May. Since 2013, the program has funded 63 iFellows undergraduate researchers, bringing students from around the state to Utah's premier research institutions: the University of Utah, Utah State University, and Brigham Young University.

> "I am proud to collaborate with iUTAH to make STEM interesting and accessible to everyone! At Weber State University, iUTAH's support helps us create dynamic learning opportunities that cultivate critical thinking, experiential learning, and transferable skills for students from diverse backgrounds."
>
> ***Adrienne Gillespie Andrews, Chief Diversity Officer at Weber State University***

One of the best parts of the iFellows program is that it stimulates interest among talented undergraduates in research science careers by introducing them to the work researchers are doing. Students are involved in a wide range of research topics, ranging from aquatic biology to urban planning to environmental engineering. A key component of the program is identifying and matching student interests to research projects and mentors. Once they are assigned to a faculty member, graduate and peer mentor, students become involved in current iUTAH research projects.

CUTTING-EDGE RESEARCH

In addition to completing an independent research project, iFellows participate in skill-building seminars on such topics as research ethics, science communications, and how to make a poster and give a presentation. iUTAH's iFellows typically present their work via posters at a symposium, held in late July. Many of the students continue working on projects after the program ends, by presenting their work at state, national, and international conferences.

As an added bonus, students from primarily undergraduate institutions such as Weber State University or Salt Lake Community College are introduced to state-of-the-art research labs that are less available at their home institutions. During the first three years of the program, nearly half the students attending were from these types of schools. Additionally, iFellows were 44% female and 11% were from under-represented minorities, thus addressing our need for the development of a more globally diverse workforce.

ADDRESSING STATE EDUCATION NEEDS

The iFellows program also helps the state address a critical need identified in Utah's Science, Technology, Talent and Innovation Plan. Utah exceeds the U.S. in the proportion of 18- to 24-year-olds who earn Bachelor's degrees, but confers fewer graduate degrees than the national average. The concern is that the state's universities may be supplying a steady stream of STEM graduates for day-to-day science and technology work, but perhaps not enough to bring Utah to the forefront of innovation and problem-solving.

Does an iFellow experience inspire students to go on to graduate study? Just ask Sean Bedingfield. Sean was one of our earliest iFellows, participating in 2013. After working with iUTAH researchers David Rosenberg and Ryan Dupont, he went on to complete a bachelor's degree in biological engineering. This year, he was awarded a prestigious National Science Foundation (NSF) Fellowship, and is currently pursuing graduate work in Biomedical Engineering at Vanderbilt University. When asked about his time with the iFellows program, Sean said, "iFellows are treated as peers in a common cause by accomplished faculty and graduate students. Their candid thoughts and professional advice lead myself and others to realize more of our potential and make educated life choices. Much of my iFellow experience guided my pursuit of graduate education and the NSF graduate fellowship."

ENCOURAGING STUDENTS OF ALL DISCIPLINES

This year's 18 iFellows represent iUTAH's continuing commitment to STEM education and diversity with 71% female and 18% under-represented minority students participating.

"This summer's iFellows program is off to a great start," said Ellen Eiriksson, iUTAH Education, Outreach and Diversity (EOD) Coordinator. "Students have arrived eager to contribute to iUTAH's multi-disciplinary research and to gain valuable experience working with the project's many inspirational faculty and near-peer mentors."

These students come from disciplines ranging from general studies and communications to environmental science and engineering. All are bringing new ideas and insights together to help address Utah's future water concerns.

Photo by Wyatt Traughber

UNDERGRADUATE RESEARCH EXPERIENCE PROGRAM

With 63 students trained to date, the iFellows program has allowed participants to gain valuable skills and experiences, and learn how to communicate and present their research findings.

Bringing Science to the People

Museum Display Informs on Local Watershed

What is the best way to help people to understand issues surrounding changing climate and water quality in Utah's watersheds? If you can't bring the people to the watershed, the next best way is to bring the watershed to them. That's what iUTAH has done.

EXPLORING WATERSHED SCIENCE

Working in collaboration with the Natural History Museum of Utah (NHMU), iUTAH has developed a touch-screen interactive exhibit to help visitors learn about stream dynamics. Here they can connect directly with real-time data collected from a local watershed.

The touch-screen interactive exhibit, designed by Becky Menlove, Associate Director for Visitor Experience at NHMU, along with staff from both iUTAH and NHMU, allows visitors to explore the dynamic changes in our streams as they happen. The exhibit explains in simple and straightforward language what a watershed is, why Red Butte Canyon is unique, and what type of data iUTAH collects. It allows a visitor to interact with live data from the Red Butte Creek watershed. The museum, the largest of its kind in Utah, serves approximately 250,000 visitors annually, including 43% adult-only groups, and 57% families with children.

VISITORS CONNECTING WITH iUTAH GAMUT

Visitors connect with iUTAH's GAMUT where real-time data from their local watershed is displayed at the Natural History Museum of Utah.

Photo by Tim Lee, Natural History Museum of Utah

SCREEN SHOT OF GAMUT TOUCH SCREEN INTERACTIVE EXHIBIT

LOCAL IMPACT

The exhibit incorporates the iUTAH network of aquatic and climate sensor stations from "Gradients Along Mountain-to-Urban Transitions" (GAMUT), that measure climate, hydrology, and water quality in three watersheds: Red Butte Creek, Logan River, and Provo River. GAMUT is providing baseline data to inform research about a wide range of issues related to water quality and quantity along the Wasatch Front.

NHMU's touch-screen interactive exhibit shares information on its own watershed, Red Butte Creek, located in Red Butte Canyon. The watershed is 7.25 sq. miles and ranges in elevation from approximately 4,900 feet to nearly 7,900 feet. Red Butte Creek Canyon is a Research Natural Area managed by the U.S. Forest Service to preserve its significant natural ecosystems for scientific education and research.

It's a place where natural processes can be observed and compared to other areas where people regularly impact natural systems; and it's one of three streams where iUTAH is monitoring aquatic and climate data around the clock.

INTERACTIVE LEARNING

Because the exhibit is interactive, visitors are able to access information on water temperature, quality, and quantity by location and compare in real-time. Five aquatic stations along Red Butte Creek, each solar-powered and self-contained, use state-of-the-art sensors to produce this information.

In addition to displaying data collected by iUTAH, the exhibit explains what a watershed is and how it works. This portion of the display is based on an interactive display developed by Utah State University's Water Quality Extension team, lead by Nancy Mesner. It goes into specific details about the enormous 35,000 square mile Great Salt Lake watershed. By explaining that the watershed is a converging system of drainages that all flow into the Great Salt Lake, visitors can see the impact that they have on this iconic body of water.

The NHMU touch-screen interactive exhibit has been on display at NHMU since December 2015. Plans are underway to adapt the exhibit for displays at the other two regional GAMUT watersheds along the Logan and Provo Rivers.

"As an outreach partner, iUTAH provides us with expert resources and funds, which has made it possible for us to bring parts of our in-house water exhibit to a larger audience across the state as a traveling exhibit.

Just this spring we hosted our first educator workshop with author Nancy Bo Flood, who brought creativity and passion to water lessons based on *Water Runs Through This Book*. We've never had a teacher workshop fill up so quickly!"

Shanna Futral
Director of Programs at The Leonardo Museum

DIVERSITY

Breaking Down Barriers

Building a Diverse Workforce for Utah's Future

For decades Utah's population has been among the fastest growing in the nation. Not only is Utah growing, but it's also changing. Nearly four out of every 10 new Utah residents identify as a racial or ethnic minority. More than one-quarter of Utah's preschool-aged populations are minority group members. To address this upward trend, it makes sense that the state's educated workforce should reflect Utah's growing diversity.

CHANGING POPULATION

Unfortunately this diversity isn't yet reflected in Utah's higher education system, especially in STEM disciplines. And, if members of these traditionally under-represented groups aren't recruited into science careers, Utah's STEM workforce will lag behind and we'll miss opportunities to hear creative ideas and fresh perspectives on critical issues.

Only about 6 percent of students enrolled in Utah's three research universities are Hispanic, even though 15 percent of 18- to 24-year-olds are Hispanic. Similar trends are seen among African-American, Pacific Islander, and Native American populations. Moreover, while Utah colleges and universities graduate slightly more women than men, only about 20% of STEM graduates are female.

REACHING OUT TO ALL AGES

That's why iUTAH has worked hard to reach out to under-represented groups in Utah. We have targeted many public outreach activities to women and members of racial and ethnic minorities, and our workforce development programs have focused on encouraging members of under-represented groups to pursue careers in water science and engineering.

In 2016, we joined in Utah State University's (USU) Native American STEM Mentorship Program (NASMP) for a second year, introducing water sustainability topics to the program's 22 participants and inviting two students from USU Eastern's Blanding campus to conduct research alongside iUTAH faculty and students for three weeks in May and June. We redoubled our efforts to recruit under-represented students from Utah's primarily undergraduate institutions to join our iFellows summer research experience program. The iUTAH WaterGirls program, which offers a water-focused field experience for middle school girls mentored entirely by women scientists, grew to include an 8-week after-school program at a minority-serving school on Salt Lake City's west side.

We believe we're beginning to "move the needle" in our efforts to help build a more diverse STEM workforce for Utah's water future. Last July, our Summer Institute program, geared toward high school students and teachers, served a population that was 44% female and 21% under-represented minorities. This year, 71 percent of our summer iFellows participants are female, and 18 percent are under-represented minorities.

BRINGING THE SKILLS HOME

One of these students is Joydino Beyale, a Navajo student at USU Eastern-Blanding who spent three weeks in iUTAH labs in 2015 as part of the Native American STEM Mentorship Program. Soon after Joydino returned to his home on the Navajo Reservation, he used his newly learned skills in water quality monitoring to sample the San Juan River after 3 million gallons of polluted water spilled from a Colorado mine. This year, Joydino is back with iUTAH, this time as an iFellow spending the summer conducting research with members of iUTAH engineer Ryan Dupont's water quality lab.

As we enter the final year of iUTAH, we plan to keep strengthening our diversity programs, to help build a STEM student population and eventual statewide environmental science workforce that is truly representative of the state that it serves.

WOMEN IN STEM

While participating in USU Eastern-Blanding's NASMP program, students are placed with iUTAH researchers. This student is involved in stormwater research at an outdoor test site in Logan.

Photo by iUTAH EPSCoR

"We appreciate the partnership that we have made with iUTAH over the past two years. By allowing our students to gain hands-on experience in research labs on iUTAH projects, they also learn about water-related issues facing Utah that they can be involved in when the return to Blanding. It also helps us further our mission of providing greater college access to primarily Native American, first generation students."

Curtis Frazier
Program Coordinator, Native American-Serving Nontribal Institutions Program
USU Eastern, Blanding Campus

USU NATIVE AMERICAN STEM MENTORSHIP

Mark Brunson, iUTAH Education, Outreach & Diversity Director, speaks to students visiting USU's Water Research Lab from USU Eastern-Blanding's NASMP program.

Photo by Wyatt Traughber

Spotlight on People

DARIANNE WILLEY
Undergraduate Researcher

"Becoming an iUTAH iFellow propelled me into a position in which I could actually perform research and interact with data, as well as take on more responsibility. I built stronger relationships with my mentors and fellow researchers and learned how to ask questions and participate in research meetings. Because of iFellows, I was able to establish myself as a valuable and enthusiastic team member at the lab and have continued to work there on the same project ever since."

Photo by iUTAH EPSCoR

Darianne is an undergraduate student working on a double-major in environmental engineering and watershed and earth systems at Utah State University. As an iUTAH iFellow, she became familiar with autosamplers, data loggers, programming, and sample processing. She has used these skills to program and set-up an autosampler at the 900 W GAMUT station site in Salt Lake City where she takes storm drain samples during storm events. In the lab, the samples are then analyzed to assess the influence of storm flow events on the river, and implement mitigation. She presented her research findings at the National Conference of Undergraduate Research in North Carolina this year.

SIMONE KA-VOKA JACKSON
Undergraduate/Graduate Researcher

"Through my experience with iUTAH, I have gained knowledge and skills in ecology and hydrology. New opportunities have arisen with conferences, collaborations with other scientists, and graduate school. All of these have helped me develop my career path and goals for the future."

Photo by Simone Ka-Voka Jackson

Simone is a graduate of the University of Utah, and has a Bachelor of Science in biology with an organismal and environmental emphasis. During her time with iUTAH, she was in our Traineeship program working directly with the Red Butte Creek GAMUT technicians on their research, as well as other research scientists and graduate students. Her current project involves conducting research on nitrogen and carbon stable isotopes of macroinvertebrates, algae, and moss in Red Butte Creek to assess human impacts on the stream. She plans to use this knowledge and experience pursuing new academic and professional goals when she starts a master's degree in plant conservation and restoration at the University of Nevada Las Vegas this fall.

YUSUF JAMEEL
Graduate Researcher

"Besides helping me in my own scientific research, support from iUTAH has provided me with a chance to look at research questions from different points of view, and allowed me to appreciate the importance of collaboration and holistic approaches to answer real life research problems. Over the last two years, I have had numerous opportunities to interact with researchers and faculty members, engage with government employees and policy makers and attend seminars, talks, and workshops which has broadened my scope of knowledge and made me a much better researcher."

Photo by Yusuf Jameel

Yusuf is a fourth year PhD student at the Department of Geology and Geophysics at the University of Utah. He is working on understanding the connections between climate, water extraction, water use, and water use impacts, in areas experiencing drought and land-use change, such as the rapidly urbanizing areas of semi-arid Utah. As an iUTAH graduate research assistant, he is developing techniques to study urban water systems using water isotopes. In his work, he has combined extensive field sampling campaigns, spatial analysis, and integration of theory and ideas from hydrological science, climate science, and social science.

MELISSA HAEFFNER
Post Doctoral Researcher

"I really do believe that if we're going to be talking about climate change, if we're going to be talking about natural resources, we can't just study ice and water and air and carbon. The reason why these are problems is because they are problems for humans, problems for our human survival. They are anthropogenic problems, because of our impacts on the earth. And so to study these things without social sciences, I think, is just setting ourselves up for failure. It's too big, too important a piece to miss."

Photo by Donna Barry, USU

Melissa is a postdoctoral researcher working at Utah State University. She is interested in how cities grow in arid regions. She explores this question by examining how the climatological, hydrological, and socio-political contexts in which we live shape how we are able to manage water resources. She employs a variety of social science methods: surveys, interviews, stakeholder focus groups, scenario planning, mental mapping and visual sociology. Pursuing her research goals requires the ability and willingness to transcend disciplines, which is why Melissa seeks out opportunities to work with engineers, geographers, atmospheric scientists, and others.

COLLABORATION

Cultivating Statewide Collaboration

iUTAH EPSCOR Projects & Partners

The Leonardo

Putting Water Science "on Wheels"

The Leonardo created an interactive water exhibit and K-12 curriculum through an iUTAH EOD Innovation Award in 2014. To complement this exhibit, which is still in use, the museum received additional funding to build two Water Carts for their mobile science outreach program, "Leo on Wheels." These Water Carts travel around the state bringing Utah-specific water-related lessons directly to middle school students and teachers. Since their debut in March 2016, the Water Carts have reached over 11,600 people, and are expected to reach many more as they make their way across the state for years to come.

Utah Public Radio

Tracking Water News Across Utah

The Source, produced by Utah Public Radio (UPR) during USU's Year of Water in 2015, was created to report on Utah's water resources. Each hour-long episode, 12 in total, explored a different aspect of water use in the state, and was supported by a 2015 iUTAH EOD Innovation Award. This year, Jennifer Pemberton and her team won an award for an episode under the category "Best Investigative Reporting" from the Associated Press Television and Radio Association. UPR reports a base of 40,000 listeners per day, and the show is still available online at both the UPR and iUTAH websites.

Utah Water Watch

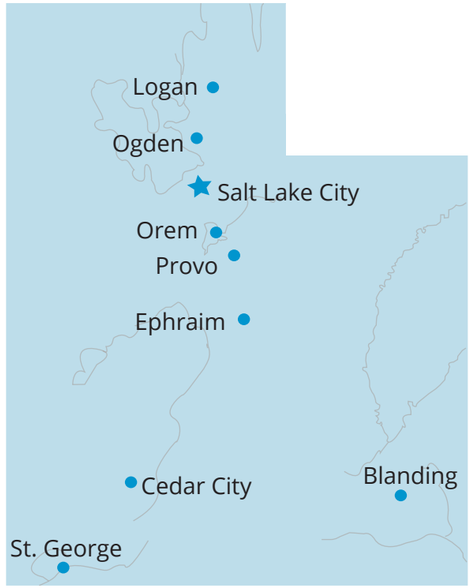
Helping Citizens Understand Their Local Watershed

Utah Water Watch (UWW) is a water quality education and data collection program supported by iUTAH. As a part of the larger Utah State University Water Quality Extension, which works in partnership with the Utah Division of Water Quality (WQE), the program seeks to increase awareness about the importance of water quality and promote stewardship of Utah's aquatic resources. In addition to coordinating an active outreach program, UWW received an iUTAH EOD Innovation Award in 2013 to create and install three streamside signs near popular recreation areas within the iUTAH-studied watersheds. Traversing the state through its UWW citizen science training and other outreach programs, WQE has educated over 5,100 people in the past year.

COLLABORATION

Higher Ed Partners

Campus Collaboration Statewide



LOGAN

Utah State University

OGDEN

Weber State University

OREM

Utah Valley University

PROVO

Brigham Young University

SALT LAKE CITY

The University of Utah

Westminster Salt Lake City

Salt Lake Community College

EPHRAIM

Snow College

BLANDING

Utah State University Eastern - Blanding

CEDAR CITY

Southern Utah University

ST. GEORGE

Dixie State University

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