

# iUTAH EPSCoR 2014



Research & Innovation



Communicating iUTAH's Impact



Preparing Utah's Next Generation



Expanding iUTAH's Network



Meet the iUTAH Team



Did you know that iUTAH is partnered with insitutions and collaborators statewide? There are over 170 iUTAH partners working together toward the goal of creating a sustainable future!

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**Research & Innovation**

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Check out our website at  
[iUTAHEPSCoR.org](http://iUTAHEPSCoR.org)



Michelle Baker succeeds Todd Crowl as lead PI and new Director of iUTAH EPSCoR, effective July 2014.

**Letter from the new director, Michelle Baker**

As iUTAH's second year draws to a close we gather in Logan to celebrate our successes at the Annual Symposium. Strong collaborations across Utah institutions have resulted in the successful launch of a household water survey in the Wasatch Front – you may have seen the team wandering your neighborhood, or read about it in your local paper. iUTAH scientists have also successfully launched the GAMUT network along with the Data and Modeling Federation's GAMUT data visualization platform. iUTAH researchers are actively engaged with training the next generation of scientists: 13 undergraduate iFellows and 28 Summer Institute participants will be at the Annual Symposium, so be sure to ask them about their research projects! Year two also saw many transitions for iUTAH. This spring we bid farewell to Todd Crowl and

Rita Teutonico, who accepted positions at Florida International University. We heartily thank them for their past leadership as Director and Associate Director, respectively, and for getting iUTAH off to such a great start! Mark Brunson (Utah State University) has stepped into the role of State EPSCoR Director and will be actively engaged with iUTAH EOD activities. Diane Pataki (University of Utah) will be leaving Utah on a temporary assignment to work at the National Science Foundation, and Court Strong (University of Utah) will assume her role as iUTAH co-PI and co-leader for Research Focus Area 3. As I stepped down from co-leader for Research Focus Area 1 to take the helm of iUTAH, Dave Bowling (University of Utah) took my place. We also welcome Chris Elliott as an office intern in Logan. Please join me in welcoming our new team members.

Thanks for all that you do for iUTAH.

# Research & Innovation

Water is critical to almost every aspect of our lives and yet it is one of Utah's scarcest resources. With a significant population increase projected to occur in the near future, it has become more important than ever to find improved ways of using and preserving these finite water resources. In order to address Utah's critical water issues, iUTAH has established a statewide network of researchers to explore how variables such as population growth, climate change and land use effect water sustainability.



# Making the Connection: Solutions-Oriented Research

1



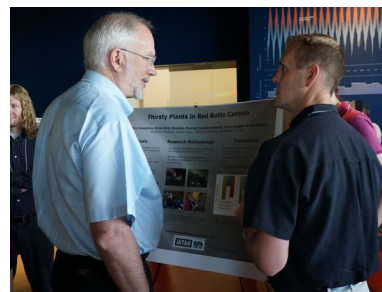
Assessing the current state of water supply, by monitoring water inputs (precipitation, snowfall) and outputs (evaporation) with an environmental observatory.

2



Determining the current drivers of water use behaviors and trends.

3



Equipping the state for adaptability by conceptualizing research findings in order to proactively prepare Utah decision makers, citizens and stakeholders for a changing climate.



## What is iUTAH?

iUTAH is an interdisciplinary research project dedicated to preserving Utah's water resources. Comprised of a vast network of researchers, universities, governmental agencies, industry partners and non-profit organizations statewide, this is the first water monitoring project of this scale to be attempted in the history of the state. Funded by the National Science Foundation, this five-year, \$20-million award went into effect August 2012.

In order to address Utah's critical water issues, iUTAH EPSCoR has established a statewide network of researchers to explore how variables such as population growth, climate change, and land use affect water sustainability.

iUTAH's three research areas focus on:

- Understanding the relationship between water and ecosystems;
- Assessing water use behaviors and decisions, and how these influence the urban environment;
- Establishing uniform data sets for a variety of audiences to convey research discovery

Achieving water sustainability in Utah will only be possible by understanding how the water system operates as an integrated physical, chemical, biological and social system. Proactively preparing Utah decision makers, citizens and stakeholders for a changing water future will further equip the state for more beneficial adaptability — ensuring the vitality of Utah's iconic environment, nationally acclaimed business status, growing population and expanding economy.

## Connecting the Research

1 The mission of iUTAH's first research area is to improve Utah's capacity to monitor, understand and predict processes that affect the water cycle and water quality. Using the Gradients Along Mountain to Urban to Transitions (GAMUT) environmental observatory, researchers can obtain valuable climate and water quality and quantity data in an understudied region—such as precipitation, snow depth, soil temperature, moisture, water pH and oxygen levels—that will help scientists and managers better understand and prepare for the growing demands on Utah's water supply.

With GAMUT, interdisciplinary teams of experts across the state's various institutions can trace the travel paths of

water as it travels from the mountains down to urban cities. In doing so, researchers are able to collect a wealth of important information regarding how our actions and other factors affect our water supplies. This information can then be used to predict water availability in various situations in the future as well as help future generations continue to enjoy the attractions of Utah without depleting its water resources.

2 The second research focus of the iUTAH project seeks to increase the Utah science community's ability to understand the drivers of water use behaviors and decisions, and how these impact the urban environment. Utahns use 10,000-20,000 gallons of water a day; and, with a significant population increase projected to occur in the near future, it has become more important than ever to find improved ways of using and preserving this finite

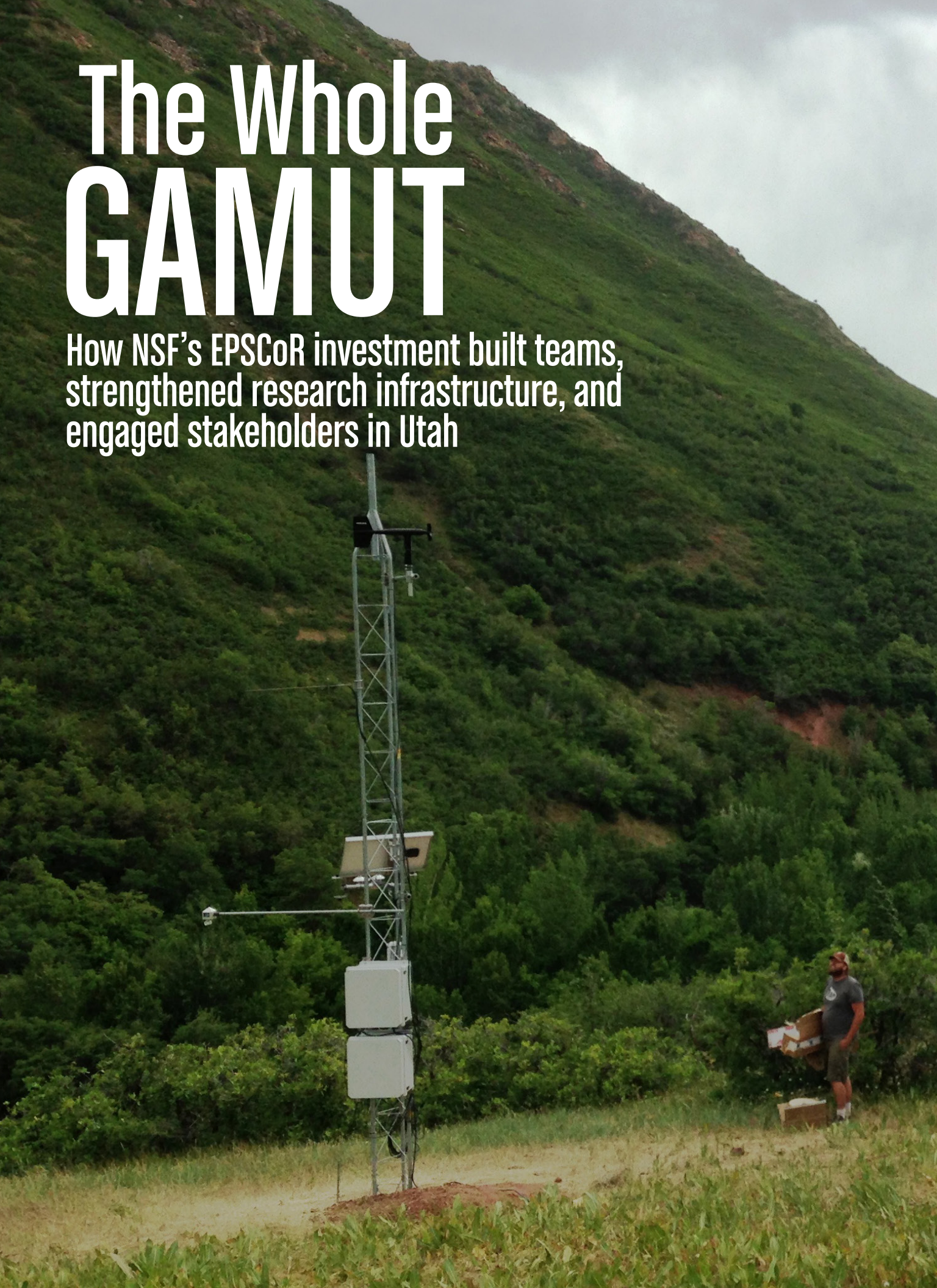
resource. After collecting systematic data on the social, engineered, and natural aspects of urban water usage in the Wasatch Range Mountain Area, iUTAH researchers will be able to provide local and state decision-makers with science-based information to guide decisions about how to build and manage Utah's future urban water systems.

3 Lastly, researchers will synthesize the results from the first two research areas as well as other ongoing work to assess the linkages between the natural and human engineered water systems. These research, findings, will empower current and future generations with the knowledge of how to protect our limited water resources.

To learn more, visit our website at [iUTAHEPSCoR.org](http://iUTAHEPSCoR.org) or follow us on social media.

# The Whole GAMUT

How NSF's EPSCoR investment built teams, strengthened research infrastructure, and engaged stakeholders in Utah



By Michelle Baker

August 2014 marks the first birthday of iUTAH's Gradients Along Mountain to Urban Transitions (GAMUT) Network. The GAMUT network includes state-of-the-art sensors that measure aspects of the water cycle in the atmosphere, on land, and in streams along the Wasatch Front. This National Science Foundation EPSCoR infrastructure investment has served as the focal point of iUTAH's research and education activities related to ecohydrology (scientific study of the water cycle and water quality).

Designing GAMUT was a 12-month process involving faculty and technicians from across Utah's academic institutions. The design team reached out to all three iUTAH Research Focus Areas (RFAs) and worked closely with iUTAH's Modeling and Data Federation. Constructing the GAMUT Network included purchasing, building, and installing the towers and sensors that form the backbone of the network, and this took a village. Well over 20 people, including undergraduate and graduate students, technicians and faculty members, dug foundations, carried concrete, and raised towers to which the GAMUT sensors are anchored. These activities are tangible and obvious examples of how GAMUT construction fostered team building across Utah's campus communities.

Less obvious is the cyberinfrastructure core that drives the GAMUT Network and makes its data available to researchers, educators, and other stakeholders. The iUTAH Modeling and Data Federation is leading the way nationally in hydrologic cyberinfrastructure by developing the software and visualization platform and tools that deliver the GAMUT data. Key activities in year 2 included developing software to track instrument deployments and calibrations, implementing automatic tests for data quality assurance/control, and automatically loading GAMUT sensor data to centralized databases. The cyberinfrastructure team also developed tools for online visualization and access to the real-time sensor data. This cyberinfrastructure allows iUTAH's research teams to interact with the data to better understand Utah's water cycle. Data produced so far have been used as preliminary results for several new grant proposals and are being included in manuscripts for publication.

GAMUT data made available through iUTAH's Modeling and Data Federation are also being used by other stakeholders. The Utah Department of Environmental Quality's Division of Water Quality has used GAMUT sensor output to screen for water quality violations and will look to GAMUT as a guide for their own continuous monitoring and data management efforts. In addition, several university faculties have used GAMUT data in teaching their classes. Synergy is also achieved with other climate and water monitoring being conducted throughout Utah.

# Linking Air, Land & Water

## iUTAH Household Water Survey

By The Household Water Survey Team



How do Utah residents in different neighborhoods use and think about water in their daily lives? A major iUTAH research effort underway during the summer of 2014 explores this question with a survey of house-

The survey includes questions about household water use, resident experiences and concerns regarding water quantity, quality and other water related issues, and their perspectives on local and state-level water policies.

The information collected will allow the team to explore how households differ across the diverse neighborhoods and cities found in the Wasatch Range Metropolitan Area. Researchers also plan to use the survey findings to help explain why urban neighborhoods experience different rates of water consumption, water quality, and patterns of storm runoff.

The study researchers are also working closely with municipal water managers and state agency representatives to ensure the needs and priorities of residents are reflected in future water plans, programs and policies. The researchers also plan to send summary reports of findings to survey respondents and make presentations at local meetings in each of the studied communities.

The project is led by Dr. Douglas Jackson-Smith and Dr. Courtney Flint, both natural resource sociologists at Utah State University and members of iUTAH research focus area 2.

holds in 20 neighborhoods across three Utah valleys – Cache, Salt Lake, and Heber/Midway.

Researchers from Utah State University, the University of Utah and Weber State University are using a drop-off/pick-up methodology. Fourteen students from multiple universities have been hired to contact residents at their homes and return a day later to pick up completed surveys. This methodology typically yields much higher response rates than mail or phone surveys.

Households in the study have been randomly selected from within specific neighborhoods in 12 cities. Neighborhoods were chosen to represent the various types of urban settings found in Utah (based on their land use, land cover, housing, and socio-demographic characteristics).

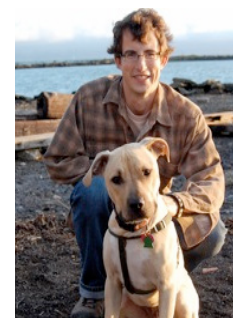
During the winter months, urban valleys in the Western United States are often characterized by periodic pools of cold air that accumulate atmospheric pollution, specifically particulate matter, to concentrations that are hazardous to human health. The photos to the right show the Salt Lake Valley during a period of relatively clean air (top right), contrasted with an inversion period depicting an atmosphere rich in particulates (bottom right). Nitrogen (N) compounds (ammonium and nitrate) make up a dominant portion of atmospheric particulate matter during inversions, and often represents a limiting nutrient for biological growth in terrestrial and aquatic ecosystems. In excess, N can cause shifts in species composition and drive the degradation of aquatic ecosystems.



iUTAH researchers are examining linkages between air pollution, snow chemical composition, and water quality across three focal watersheds located along the Wasatch Front. During an in-depth study in Red Butte Creek, researchers traced the movement of nitrogen from snow to meltwater, soil water, groundwater and streams. They observed high concentrations of both ammonium and nitrate in snow (~30  $\mu\text{eq l}^{-1}$ ), not only in the urban sites of Salt Lake City and Logan, but also in the protected montane watersheds. Their ongoing analysis has linked variation in nitrogen inputs over time with concentrations of urban particulate matter.

Intriguingly, little nitrogen from snow appears to be exported to Red Butte Creek, neither in its urban nor natural reaches. In fact, nitrogen concentrations decreased markedly as water moved from snow to soils to groundwater to streams, even in an urban setting. The metabolism of soil microbes likely provided a major sink for this nitrogen. Some microbial species are able to use nitrate for respiration in a process called denitrification, which converts nitrate into a gaseous form and thus decreases nitrate losses to streams. Researchers have documented periodic depletion of oxygen in urban lawn soils during winter and spring, an important pre-requisite for denitrification.

Ongoing measurements will further explore the fate of nitrogen derived from atmospheric pollution and its potential linkages to water quality across the three iUTAH watersheds. The participation of a broad group of students, faculty, and citizen scientists was crucial for collecting this unique dataset of snow chemical composition. Several undergraduate students have been trained in sample preparation and analysis for this project.



Tracing atmospheric pollutants from air, to soils, to streams

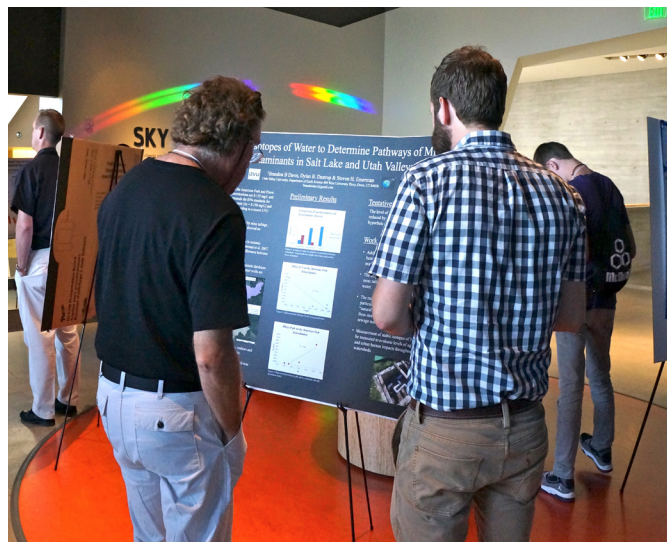
by Steven Hall

# Workforce Development & Diversity

iUTAH Education, Outreach & Diversity (EOD) is a state-wide effort dedicated to providing educational outreach activities that communicate scientific findings to the general public. Through various programs focusing on workforce development, museum partnerships, citizen science, stakeholder engagement, and diversity enhancement, iUTAH is reaching a wide audience throughout Utah. To achieve iUTAH's goals to create sustainable infrastructure improvements that benefit water-related science and technology throughout the state. The iUTAH EOD has developed activities to increase participation of underrepresented groups (including women, Hispanics, and Native Americans) in STEM, and provided hands-on opportunities that target K-12 students, teachers, and undergraduates. Through these and other activities, the EOD team is extending societally relevant science and education about Utah's current and future water resources.



# The iFellows Undergraduate Research Program



iUTAH's Undergraduate Research Experience, known as the iFellows Program, was established in the summer of 2013. This program was developed to give students from any institution of higher education first hand research experience at one of the State's research-intensive universities: University of Utah, Utah State University or Brigham Young University. Through this program, students engage with a research mentor at one of these institutions, conducting iUTAH-related research, interacting with graduate students and learning how to become effective science communicators.

We are proud to say the inaugural year of the program was a huge success. Twelve undergraduate students participated in the program. These selected students represented 5 institutions statewide: Utah State University, The University of Utah, Brigham Young University, Westminster College and Weber State University. Based on interest, each iFellow was paired with at least one iUTAH faculty mentor and a near-peer graduate student mentor to conduct research under one of iUTAH's three Research Focus Areas. This near-peer mentoring allowed students the opportunity to gain research skills, increased their confidence as scientists, and provided them with strong science role models and mentors for their future professional growth.

In addition to spending time in the field or lab, the cohort gathered together six times throughout the summer for cohort-building sessions. These sessions focused on enhancing the iFellows' professional development, including training on presentation skills, diversity awareness, and science communication. These sessions also required iFellows to provide updates on their program experiences, develop project posters and presentations and discuss career choices with panels of science professionals from a variety of backgrounds.

Ultimately, iFellows presented their project results in a poster session at the 2013 iUTAH Symposium in Salt Lake City and in an oral presentation at the final iFellows Symposium, in Logan, UT. Several 2013 iFellows went on to present their research locally at the Utah Conference for Undergraduate Research (UCUR), and on a national stage, at the National Conference for Undergraduate Research (NCUR) in Kentucky.

Many thanks to the 2013 iFellows and Mentors for a fantastic year!



Adam Henrie, WSU  
Mentor: Sarah Hinners, UU



Anne Thomas, BYU  
Mentor: Rick Gill, BYU



Andrew Butterfield, Westminster  
Mentor: Michelle Baker, USU



Kenyon Gentry, UU  
Mentor: Steve Burian, UU



Michelle-Kei Williams, SLCC  
Mentor: Christine Pomeroy, UU



Allison Albert, USU  
Mentor: Ryan Dupont, USU



Samuel Stout, WSU  
Mentor: D. Jackson-Smith, USU



Tobias Brotherton, Westminster  
Mentor: Steve Burian, UU



Claire O'Donnell, UU  
Mentor: Diane Pataki, UU



Tim Beach, USU  
Mentor: Sarah Null, USU



Katlyn Hicks, WSU  
Mentor: Courtney Flint, USU



Jeffrey Josephson, WSU  
Mentor: Sarah Hinners, UU

## 2013 iFellows & Mentors

### iFellows

- Sean Bedingfield, USU
- Luke Bell, BYU
- Zackary Bjerregaard, WSU
- Hayden Campbell, USU
- Brant Cook, USU
- Jeff Frandsen, USU
- Andrew Hagedorn, Westminster
- Jem Locquiao, UU
- Stephanie Mitts, WSU
- Kari Norman, USU
- Brianne Palmer, USU
- Dusty Pilkington, WSU

### Mentors

- Michelle Baker, USU
- Harsha Balam, UU
- Dave Bowling, UU
- Martin Buchert, UU
- Steve Burian, UU
- Allison Chan, UU
- Ryan Dupont, USU
- Joanna Endter-Wada, USU
- Sarah Hinners, UU
- Dasch Houndeshel, UU
- Doug Jackson-Smith, USU
- Scott Jones, USU
- Enjie Li, USU
- Sarah Null, USU
- Christine Pomeroy, UU
- David Rosenberg, USU
- Philip Stoker, UU



Alexis Holzwarth, WSU  
Mentor: Martin Buchert, UU





# Education, Outreach & Diversity Catalyst Grants

## iUTAH Summer Research Institute

As a statewide grant, iUTAH is dedicated to broadening its outreach to benefit stakeholders across Utah. In year 2 of the grant, iUTAH invited stakeholders to submit proposals for iUTAH EOD partnership. iUTAH was proud to fund 13 proposals to support informal and formal science education statewide. These projects added a great variety of EOD activities to the existing iUTAH portfolio, including new museum exhibits, elementary school outreach programs, water films and radio stories, a Native American children's book, and many others. Additionally, several pro-

grams partnered exclusively with iUTAH research and researchers, and iUTAH outreach efforts, including a partnership between Dr. Steven Burian, UU and Southern Utah University's Garth & Jerri Frehner Museum of Natural History Coordinator, Dr. Jacqueline Grant. All innovation awards were chosen based on their alignment with the iUTAH goals and milestones. They not only increased the breadth of iUTAH's portfolio, but also created partnerships with numerous statewide institutions and impacted hundreds of students, stakeholders, and the general public.



The inaugural iUTAH Summer Institute took place July 15-19, 2013 at the University of Utah. This annual week-long program seeks to encourage and maintain interest in science careers by engaging Utah students and Teachers in iUTAH-related projects. 2013 participants included six High School Teachers, eight High School Students, and eight Undergraduate students (from Primarily Undergraduate Institutions). The research projects were led by



University of Utah graduate students, advised by University of Utah faculty and aided by graduate students from Utah State University and BYU.

Throughout the week, participants were divided into three groups that rotated among three half-day research projects. The projects were carried out in the Red Butte Creek watershed, which is one of three focal watersheds for the iUTAH project. In one project, participants collected data on water insect species, rock size, stream flow and stream channel shape at locations along the Creek.



Another project involved collecting temperature data in natural and built environments at several distances from the creek. For the third project, participants collected data on the amount of water present in tree species, starting at the Creek and moving up the hillside away from it. Each project was based on research being done by iUTAH Graduate Students, who provided near-peer mentorship in research techniques to the group.

Teams connected their findings to the greater implications for water sustainability issues in our area and prepared a poster to present at the 2013 iUTAH Symposium.

### Year Two Partners

Explore Utah Science	Utah State University Water Quality Extension	Loveland Living Planet Aquarium
Thanksgiving Point Institute	Bear River Watershed Council	Garth & Jerri Frehner Museum of Natural History
The National Center for Women & Information Technology	Jordan School District	The Leonardo

# External Engagement

The mission of iUTAH External Engagement is to design and implement programs to enhance the development of a diverse, well-prepared STEM workforce and a more scientifically literate public in the state of Utah. Through research, outreach and communication, iUTAH External Engagement seeks to engage the public in discussions about water sustainability issues throughout the western United States. Together with several collaborative partner institutions, iUTAH External Engagement will develop research-based resources, websites, curricula, traveling exhibits, and other visual displays to communicate iUTAH research results with K-12 audiences and the public.



## Utah Water Watch: Outdoor Stewardship and STEM learning

by Brian Greene

Walking by a lake or stream people often stop to admire the beauty of the water. In a dry state like Utah, water is one of the most important natural resources. So how can we tell if the water is clean enough for drinking, farming, recreation and the environment? We have to accurately monitor the water quality and quantity. That is how a network of trained citizen scientists are helping out. Utah Water Watch is a volunteer water quality monitoring program that empowers every day citizens to collect data on their local lakes and streams.

With over 2,000 lakes and 89,000 miles of streams within Utah's borders, it's a tall order for scientists to monitor every location. Subsequently, water managers and scientists have much to gain from engaged volunteers who can act as lookouts as they regularly monitor a site near their homes. Volunteers are trained how to monitor important water quality parameters such as temperature, dissolved oxygen, and *E. coli* bacteria. They then report the data back online for educators, scientists, and the general public to use. While this data doesn't have the same high frequency of the GAMUT monitoring sites, volunteers are able to cover more locations and can provide an early warning system to potential problems. In 2013 volunteers monitored 81 sites from the Virgin River in St. George, to Bear Lake on the Idaho border. The power of the Utah Water Watch program is not from one person doing everything, but engaging the public to be scientists and report their observations.

Utah Water Watch volunteers are as diverse as the landscapes in Utah. They are teachers and students, families, retirees, and professionals from all careers including engineers, police officers, cooks, and bus drivers. All volunteers enjoy being stewards of their local water body and helping to collect important data.



For example, volunteer Ken Paul monitors Willard Bay because, "it is virtually out my back door so I feel the necessity to assist in being a good steward and custodian of the reservoir." Volunteers regularly comment that they enjoy learning more about the watersheds that are so important to their communities. Another volunteer monitors the American Fork River and said, "I love being more intimately involved with areas that I already hiked regularly. It is fascinating to learn how to monitor and see how seasonal changes affect the water." One volunteer who monitors the Jordan River with her Rose Park Elementary 4th grade class in Salt Lake City said that participating in Utah Water Watch "has increased my students' understanding of our local watershed. The trips to the Jordan River have also increased students' observation, interpretation, and questioning skills. Collecting data has been a successful tool for engaging students in inquiry based science learning."

With over 400 monitoring events reported by volunteers in 2013, Utah Water Watch is a successful example of how citizen science can benefit the individuals who participate and add to our water knowledge. Utah Water Watch is a partnership between iUTAH, USU Water Quality Extension, and the Utah Division of Water Quality.



## How have the RCGs done this?

How have the RCGs done this? In the first two years of the program, over \$100,000 has been distributed through a competitive application process. Principal investigators must be based at an undergraduate institution, and proposals must target an iUTAH research question through collaboration—across disciplines, across institutions, and/or with non-academic groups, such as local or federal agencies or non-governmental organizations. Undergraduate engagement isn't required, but is such a win-win, providing enthusiastic research workers for the project and valuable skills and experience to the students, that most successful proposals have included an undergraduate research component. Awards for Year 2 have recently been announced, and include projects addressing morphological and ecological effects of dams on the Provo River, chemical changes in runoff resulting from lawn and garden watering in Cedar City, and the behavior of the highly toxic chemical monomethyl-mercury in the wetlands surrounding Great Salt Lake. Social science research has been supported, too: one project is using focus groups and interviews to examine stakeholder attitudes towards water conservation and use at Weber State University. All of these projects include undergraduate researchers.



# Research Catalyst Grants

By Dan Bedford

The iUTAH Research Catalyst Grants (RCG) program exemplifies some of the best aspects of the iUTAH project as a whole. RCGs stimulate research at primarily undergraduate institutions (PUIs) across the state, building Utah's STEM capacity by engaging undergraduates in hands-on research, and by growing a network of collaborations between undergraduate institutions, research universities, and local, state and federal agencies. External reviewers have identified the RCG program as an iUTAH standout, providing big payoffs for relatively small investments.

Some Year 1 RCGs have already led to—literally, catalyzed—new successful grant proposals between researchers at undergraduate institutions and research institutions across Utah. The stage is now set for successful RCG awardees to enter a virtuous circle, with an initial RCG building capacity to compete for additional research funding, which then further builds the institution's capacity to grow STEM capability in Utah. RCGs, then, are a low-cost, high-impact contribution to the iUTAH enterprise.

# iUTAH Engagement & Outreach



FWS Conference  
Portland, Oregon



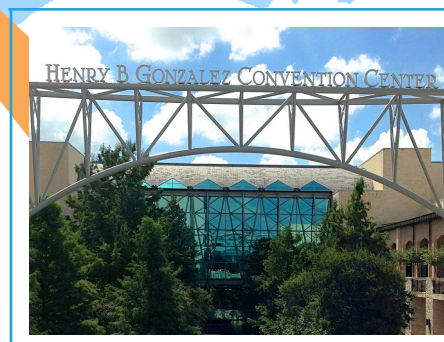
AGU Conference  
San Francisco, California



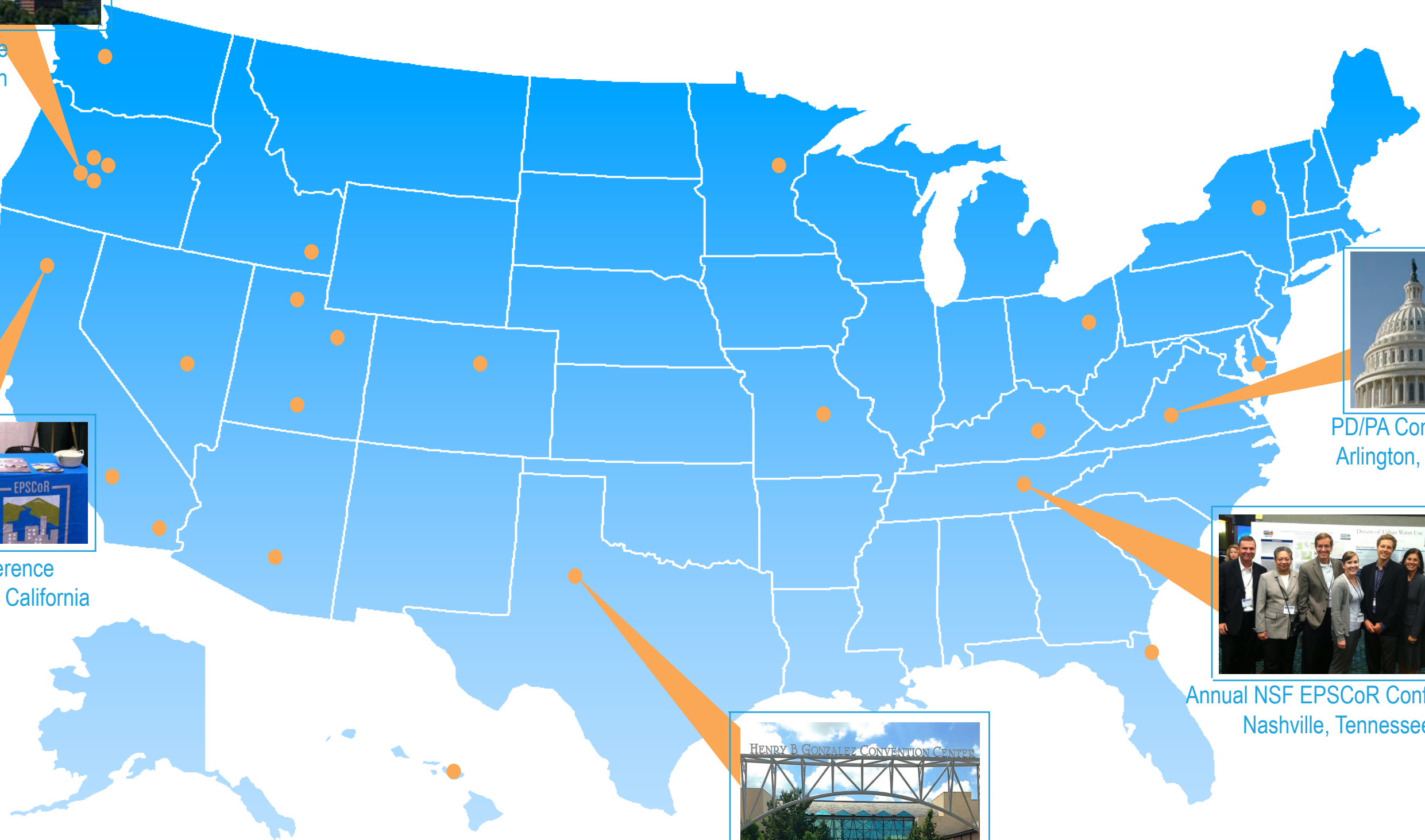
PD/PA Conference  
Arlington, Virginia



Annual NSF EPSCoR Conference  
Nashville, Tennessee



SACNAS Conference  
San Antonio, Texas



# iUTAH Office



**Michelle Baker**

*Project Director (July 2014)*



**Todd Crowl**

*Project Director (2012-2014)*



**Rita Teutonico**

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# The iUTAH Team



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**Gill, Richard - Brigham Young University**  
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**Hildebrand, Terri - Southern Utah University**  
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**Hinners, Sarah - University of Utah**  
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**Horns, Daniel - Utah Valley University**  
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