

2012 Graduate Research Fellows

Preserving Utah's Water Resources



innovative **U**rban Transitions and **A**ridregion **H**ydro-sustainability



iUTAH is funded by the National Science Foundation (Project #1208732) to build critical observatory and modeling facilities across watersheds; create transdisciplinary research teams from many Utah institutions, government agencies, and the private sector; and enhance expertise and diversity through strategic recruitment of faculty and students.

ANDREA ARMSTRONG

Utah State University

Project Title

Water Organization Decision-Making in Irrigated, Urbanizing Utah Valleys

Abstract

Andrea's iUTAH research has two objectives: (1) to understand the behavior of water management organizations in areas transitioning from agricultural to residential land uses, and (2) to understand how water management decisions surrounding infrastructure change are shaped by and impact the coupled social-ecohydrological system. Over the next year, Andrea will work with water managers to identify their decision-making processes and use this information to develop a quantitative assessment of adaptive constraints.



Biography

Andrea is a doctoral student in Sociology, specializing in environment and community sociology. Andrea received a master's degree in Natural Resources from Cornell University in 2010. Her thesis examined riparian buffer implementation in an urbanizing watershed. A native of Upstate New York, Andrea also received her bachelor's degree cum laude from Cornell's Department of Natural Resources in 2006, with a concentration in applied ecology.

BRIAN BAILEY

University of Utah

Project Title

Simulating Urban Transport Across Scales

Abstract

This project has the following two objectives: (1) develop and use a highly complex model for energy, moisture, and momentum fluxes with tree-scale resolution over a domain footprint of several square kilometers, and (2) conduct field experiments to validate the aforementioned model as well as understand linkages between tree energy/moisture budgets and microclimate.



Biography

Brian is a PhD student in the Department of Mechanical Engineering at the University of Utah. His past research interests have included turbulent momentum and mass transport in canopy flows as well as energy budgets in urban and environmental settings. His work has primarily focused on developing and implementing numerical models to study these systems.

MOREY BURNHAM

Utah State University

Project Title

Participatory Climate Scenario Design for Adaptation Policy

Abstract

This research will assess the information needs of institutional agricultural and water management stakeholders in the Wasatch Region Metropolitan Area (WRMA) in order to co-produce hydroclimate scenarios for the WRMA. The scenarios will be used to facilitate discussions of climate change adaptation for water management policy, assess the political landscape on which adaptive decisions will be made, and brainstorm policy solutions with institutional stakeholders. In addition, the presentation of the hydroclimate scenarios to stakeholders will be evaluated in terms of how credible, legitimate, and salient they were to their audience so that best practices for enhancing communication between science and policy makers can be identified.

Biography

Morey is a doctoral student in Human Dimensions of Ecosystem Science and Management at Utah State University in the Department of Environment and Society. His research focuses on smallholder farmer perceptions and adaptation to climate change in semi-arid and arid Northwest China. Additionally, his research examines the historical, social, and institutional processes that produce smallholder vulnerability to climate change in the region. His secondary research focuses on institutional decision-making about climate change adaptation in the arid and semi-arid Intermountain West, with a particular focus on agricultural water management in Utah. He holds a master's degree in Environmental Studies from Antioch University New England.



ALLISON CHAN

University of Utah

Project Title

The Importance of Montane Forests and Snowfall as Water Resources for the Wasatch Region

Abstract

High elevation coniferous forests provide 60-80% of municipal water to the Wasatch Front Metropolitan area, primarily in the form of snowmelt water. However, only a portion of precipitation inputs contribute to municipal water resources. Snowmelt water is partitioned between runoff, groundwater recharge, and evapotranspiration. The degree to which a forest acts as a water source

depends primarily on the balance between precipitation and transpiration, which are both likely to be affected by climate change. In order to better predict future water resources, it is important to determine the environmental controls on plant ecophysiological processes and stand ecohydrologic processes. This project will assess the role of temperature and snowpack dynamics on total seasonal transpiration of conifer stands by measuring sap flux and snow water equivalent (SWE) at sites located along an elevational gradient. Over time, these measurements will help enhance our understanding of the sensitivity of coniferous forests to changing environmental conditions and the way in which ecophysiological and ecohydrologic processes interact.



Biography

Allison is a second-year PhD student in the Biology Department at the University of Utah in Dr. Dave Bowling's lab. Her research interests include terrestrial biogeochemistry, ecohydrology, and disturbance ecology, primarily in high-elevation ecosystems. She has spent the last year as a research assistant investigating the effect of bark beetle outbreaks on forest carbon cycling in subalpine forests in Colorado. Before coming to Utah, she attended Bowdoin College in Maine, where she received her bachelor's degree in Biology and Environmental Studies. As an undergraduate, she conducted treeline research in Alaska for two summers and spent a semester in Svalbard, Norway, taking Arctic Biology courses. Outside of the lab, Allison is most often exploring the mountains by foot, bike, or ski—sometimes for work and sometimes for leisure.

SCOTT CHRISTENSEN

Brigham Young University

Project Title

Web-Based Data Storage and Visualization

Abstract

This project will develop a simulation environment for water resources modeling based on the ArcGIS server data model and geoprocessing tools. These tools will use a Google-Earth style visualization interface for easy access to water data and cloud-based computing for use by the scientific and non-scientific communities.

Biography

Scott is PhD student at Brigham Young University in Civil and Environmental Engineering, with an emphasis in water resources. He has a bachelor's degree in Civil Engineering and a minor in Computer Science from BYU. He is certified as an Engineer-In-Training by the National Council of Examiners for Engineering and Surveying and has conducted hydrologic analysis in the Dominican Republic as part of a dam feasibility study. He also helped update the Salt Lake County hydrologic master plan for a development in Herriman, Utah, as part of a student project. Scott is fluent in Spanish and is a member of the American Society of Civil Engineers.



CAROLINA GOMEZ-NAVARRO

University of Utah

Project Title

Vegetation's Effect on Temperature in Salt Lake City

Abstract

The transpiration of the urban forest has great potential to mitigate the heat island effect in cities by evaporative cooling. Although we know transpiration can vary at least by 15 orders of magnitude between species, little is known about the specific water use of urban tree species and their individual or in-conjunction potential for evaporative cooling. Besides cooling the local climate, urban trees can also mitigate greenhouse gases, regulate the water cycle, and enhance air quality and human health. Increasing the green infrastructure might thus result in considerable environmental benefits, but it would also entail substantial water costs unless the planting sites and species are chosen carefully. This is especially true for semi-arid cities such as Salt Lake City. This study aims to contribute to the knowledge of the main biological control of the water cycle in urban ecosystems and the potential of trees as urban heat island mitigation agents.



Biography

Carolina is a second-year graduate student in the University of Utah's Biology Department, being advised by Dr. Diane Pataki. She has a master's degree from the University of California, Berkeley in Plant Evolutionary Biology and a bachelor's degree in Biology from the University of Antioquia (Colombia). She worked for Ecopetrol, a petroleum company in Colombia, on pollen as a biostratigraphy tool. She also worked as a research assistant for the Smithsonian Institution in Washington D.C. and Panama on ecology and systematics of fossil plants and paleoclimate estimation. She had post-graduate training in ecodesign and sustainability and is currently interested in applying ecological principles to urban design, particularly how the urban forest affects microclimate characteristics in cities. The ultimate goal of Carolina's research is to provide information critical in urban planning, landscape, and water management.

DASCH HOUESHEL

University of Utah

Project Title

Implementing Low Impact Development at the University of Utah

Abstract

This project will create a plan to implement Green Infrastructure (GI) stormwater management facilities throughout the University of Utah Research Park to study the effects of GI implementation on the hydrology of Red Butte Creek. This work will require Low Impact Development (LID) design innovation to adapt GI designs used in other regions to perform in our semi-arid, cold desert climate. Collaborative relationships must also be built between the University of Utah, Salt Lake City and County public utilities, and State water agencies to achieve plan implementation. Both the design innovation and inter-agency communication will benefit the development of the EPSCoR Green Infrastructure Facility and iUTAH Summer Institute.



Biography

Dasch is a PhD candidate and iUTAH graduate research fellow in the Civil and Environmental Engineering Department at the University of Utah. He graduated from Oregon State University with a bachelor's degree in Arid Land Ecology and has worked as an ecosystem sciences research technician in arid systems in Oregon, California, and southern Utah. Dasch first became interested in water resources management while river guiding on the Colorado River through Utah and the Grand Canyon. The management challenges that threaten Colorado River ecosystems led him to change fields and complete a master's degree at the University of Utah in Water Resources Engineering. He is now combining his previous arid land ecosystems background with his technical Water Resources Engineering degree to improve the sustainability of water resources management in Salt Lake City's semi-arid climate. Specifically, Dasch's studies focus on engineering ecosystems that maximize on-site stormwater retention that reduces nutrient loading to receiving waters, replicates pre-development hydrology in urban settings, and is implemented as a no-irrigation landscaping alternative.

While studying at the University of Utah, Dasch has worked on a variety of water resources projects. The focus of his master's degree was to develop a Low Impact Development infrastructure cost estimation tool for the Environmental Protection Agency. Dasch has also worked with the City of Moab to analyze its culinary water distribution system and help plan for future growth, and with the University of Utah's Office of Sustainability to implement and monitor bioretention gardens on campus. Currently, Dasch is using stable isotope techniques to better understand the mechanisms of how bioretention immobilizes nitrogen from urban stormwater runoff to improve future garden design.

ENJIE LI

Utah State University

Project Title

Simulation of Future Residential Water Demands

Abstract

This research project will explore how population growth, urban form, water price, and climate change affect water demands at multiscale levels in the Wasatch Range Metropolitan Area. The study will couple agent-based urban growth and water demand models and further develop new land use planning tools for water resource management.

Biography

Enjie earned her bachelor's degree in Rangeland Science from China Agricultural University in 2010. In August 2010, she joined the Master of Bioregional Planning program at Utah State University. She will move into a doctoral program in Human Dimensions of Ecosystem Science and Management in January 2013. Enjie specializes in geographic information systems, spatial analysis, and modeling. Her thesis research is using a cellular automata model, SLEUTH, to simulate land use/land cover change in Cache County, Utah, under different climate change scenarios. Her PhD research will focus on landscape water use, land use/land cover dynamics, and nature-human interactions.



AUGUSTINA ODAME

Utah State University

Project Title

Modeling Water-Use Behavior Under Uncertainty

Abstract

This study will investigate day-to-day water-use behavior in the Wasatch Region Metropolitan Area (WRMA) using an agent-based approach to allow a more flexible representation of water-use behavior. Longer-term decisions to invest in irrigation infrastructure will be analyzed using financial economic models to understand how water-use behaviors adapt to social and natural sources of uncertainty.



Biography

Augustina is a doctoral student of the Applied Economics Department at Utah State University, with an emphasis in Natural Resource Economics. She received her bachelor's degree in Economics from the University of Ghana, Legon, where she served as a research and teaching assistant following her undergraduate career. Augustina held positions as a vice-presidential doctoral research fellow and as a departmental graduate research assistant at Utah State University prior to her current position as an iUTAH EPSCoR graduate research fellow. Her research interests include modeling the impact of social and natural uncertainty on economic behavior relating to the management and use of natural resources, which she has explored greatly working with her supervisor, Dr. Charles Sims.

OMAR PEREZ-REYES

Utah State University

Project Title

Multicultural Communication

Abstract

For iUTAH, Omar will prepare posters, presentations, and teaching materials in Spanish for the External Engagement and Workforce Development activities. These materials will provide students, educators, and the general public with the information and tools necessary to understand and analyze the health and function of local streams and to foster a sense of ecological stewardship.

Biography

Omar is a fourth-year PhD student in the Watershed Sciences Department at the Utah State University in Todd Crowl's lab. His research interests include population biology, conservation, natural history, and biogeography of freshwater invertebrates in the tropics. He performed field work in Puerto Rico where he also received his master's degree in Biology from the University of Puerto Rico. As a professor at the University of Puerto Rico, he designed experiences for the zoology, botany, invertebrates, ecology, and biology courses and labs. He also participated in different federal programs that involved science teachers and students from public schools located on the island.



PHILIP STOKER

University of Utah

Project Title

Wasatch Water Use 2040

Abstract

The population of the Wasatch Front will grow to nearly four million people by 2040, about 1.5 million more than in 2010. Anticipating this growth, regional planners and the public crafted a long-term vision for growth called “Wasatch Choice for 2040.” While this vision provides a preferred vision for growth in the region, there has been no analysis of how water resources will be impacted by different growth scenarios. This study will develop and validate water demand models that examine the effects of urban form, climate, and demographics on water use. Using these models, different growth scenarios will be evaluated, including a trend scenario, the Wasatch Choice for 2040

scenario, and an even more compact scenario development scenario. Results will be shared through interviews with stakeholders and experts to generate refinements to Wasatch Choice 2040, which will keep water use from exceeding available supplies.



Biography

Philip is a PhD student in the Department of City and Metropolitan Planning at the University of Utah and is very excited to be working with the iUTAH research team. Philip received a Master of Resource Management from Simon Fraser University (Vancouver, BC), where he researched sustainable cruise ship tourism, the social impacts of the Vancouver 2010 Olympic Games, and protected area management. While attending the University of Redlands in southern California, Philip conducted research on coyote habitat use in the Joshua Tree National Park that was recently published in the *Southwestern Naturalist*. Philip also had the opportunity to investigate community perceptions of wildlife tourism in Kenya. His current research includes urban water use, pedestrian safety, and the impact of jobs-housing balance on home values.

CAROLYN STWERTKA

University of Utah

Project Title

Keeping Freshwater Flowing in Utah

Abstract

This project involves modeling and observing the water cycle in the urban transitional regions of the Greater Wasatch Metropolitan Region. The project's objectives are as follows: (1) develop a computationally efficient modeling framework that will quantify water vapor balances along the Wasatch Front and their sensitivity to projected changes in climate, land use, and urban development, and (2) participate in iUTAH's instrumentation activities to inform and validate the modeling framework.

Biography

Carolyn is a first-year PhD student in the Department of Atmospheric Sciences at the University of Utah. She recently defended her master's thesis in Atmospheric Sciences titled "Carbon Dioxide Variability with the Urban Salt Lake Valley: An Observational and Modeling Study." Her thesis was funded by the National Science Foundation (NSF) GK-12 Think Globally Learn Locally (TGLL) program at the University of Utah. This NSF GK-12 fellowship allowed Carolyn to become heavily involved in science education, outreach, and multi-disciplinary networking, which she will continue to passionately pursue throughout her career.

In addition to modeling, Carolyn is very interested in being involved in field programs to enhance her understanding of the physical environment. She has designed and implemented field programs to study quasi-vertical CO₂ variability in the Wasatch Mountain Range and in the Cordillera Blanca Range in Peru. She is a lead scientist in the American Alpine Club's newly formed Climber Scientist Program. In her spare time, she enjoys forecasting, digging avalanche pits, skiing on and off piste, ski-jouring with her amazing dog, mountain biking, climbing, analyzing clouds, and windsurfing.



LAURA VERNON

Utah State University

Project Title

Communication Boot Camp

Abstract

iUTAH participants will improve their scientific communication skills through a series of webinars, individual consultations, and editing support.

Biography

Laura is a PhD candidate in the Theory and Practice of Professional Communication program at Utah State University. Her research area emphasizes environmental rhetoric and strategic communication. She has a bachelor's degree in Journalism from Brigham Young University and a Master of Professional Communication from Westminster College of Salt Lake City. Before returning to school for her doctoral degree, Laura enjoyed a successful 12-year career in journalism, public relations, and organizational communication.



THOMAS WALSH

University of Utah

Project Title

Enhancing Education and Outreach via iUTAH Summer Institute

Abstract

The Red Butte Creek Project was the result of an interdisciplinary project involving graduate students from across the University of Utah, whose goal was to define how research, teaching, and outreach can be melded together with Red Butte Creek. Thomas will continue this work and develop a strong foundation for the iUTAH Summer Institute projects and training. This will include collaboration with various iUTAH teams to establish research/monitoring stations within the Red Butte Creek watershed in order to develop the educational and outreach components of the Summer Institute (K-12 students and the public), thereby enhancing communication and providing feedback to iUTAH and stakeholders.



Biography

Thomas is a graduate research assistant in the Civil and Environmental Engineering Department at the University of Utah. His research is related to the engineering of sustainable urban water resources systems, focusing on stormwater management and demand supplementation. His specialty areas include the planning, design, and hydrologic simulation of Low Impact Development (LID) practices across both individual and municipal scales. Additional areas include consideration of vulnerabilities and adaptations of urbanized areas in order to develop a sustainable system that optimizes social, environmental, and economic factors.