



Global Change &
Sustainability Center
THE UNIVERSITY OF UTAH



GLOBAL CHANGE & SUSTAINABILITY CENTER

An Inclusive and Interdisciplinary Hub

2012 - 2017 Strategic Plan Progress Report

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Report compiled by Liz Ivkovich, GCSC/Sustainability Office | Designed by Ayrel Clark-Proffitt, Sustainability Office

Cover photo: Researchers walk through Snow Canyon State Park in St. George. Photo by Brenda Bowen.

Facilitating New Approaches



Brenda Bowen studies changes in the Bonneville Salt Flats.

The Global Change & Sustainability Center (GCSC) was established on the premise that solutions to the grand challenges facing society require the best thinking from multiple perspectives and disciplines. The GCSC creates opportunities for scholars grappling with these challenges to engage in new ways beyond their departmental homes.

When I arrived at the University of Utah to take on the role of associate director of the GCSC, one of the first tasks that Jim Ehleringer, founding director of the GCSC, and I embarked on was crafting a strategic plan. Working with faculty affiliates from across the University, we created the 2012-2017 GCSC Strategic Plan to help refine and focus the goals of the center, and to define the metrics that would allow us to evaluate our success. Here we present the outcomes of the 2012-2017 GCSC Strategic Plan and demonstrate the significant positive impact that the GCSC has had on the University of Utah.

Over the last five years, the GCSC evolved, overcoming challenges and responding to new opportunities. Through this process, it has been critical to have this strong strategic plan to help guide priorities. As this report illustrates, the GCSC has had an incredible reach across campus and has achieved many important goals towards advancing sustainability research and education at the University of Utah.

Looking forward, it is exciting to imagine what the GCSC community will accomplish in the next five years. The environmental challenges we face locally, nationally, and globally highlight the profound importance of the work we do. There is a dire need for scientific literacy, advances in equity and diversity, and integration of ecological thinking to include both natural and social systems, across all disciplines and sectors. The work we do is not about problems, but rather, about pushing our imaginations to create solutions. How can we use our unique academic knowledge to create positive change in our society? What might thriving communities that are not predicated on environmental degradation and CO₂ emissions look like? I am honored to be a part of a community that is engaged in answering these questions and look forward to imagining the next strategic plan together.

A handwritten signature in black ink that reads "Brenda B. Bowen". The signature is stylized, with the first letters of the first and last names being large and prominent.

Dr. Brenda B. Bowen

Director, Global Change & Sustainability Center

Mission, Vision & History

THE GLOBAL CHANGE & SUSTAINABILITY CENTER'S MISSION

is to serve as an inclusionary and cross-cutting interdisciplinary hub at the University of Utah to coordinate, facilitate, promote, and accelerate research and training on issues related to the environment and sustainability, from local to global scales.

VISION

Our vision is to provide an interdisciplinary nexus at the University of Utah for addressing challenges in global environment and sustainability issues. We seek to develop the links between research, education, and outreach in order to unite faculty across University departments, facilitate communication, foster interdisciplinary education, and create opportunities for campus and community engagement in sustainability. The overarching goal is to facilitate new approaches to responsible management and viability of natural, social, and economic systems so that future generations may have the same opportunities to live, work, and play that we enjoy today.

HISTORY

The GCSC was created as a faculty-led initiative with the goal of bridging colleges, departments, and disciplines to stimulate environmental research and training. The affiliated colleges today represent a broad spectrum of faculty affiliates engaged in sustainability research.

The GCSC has grown steadily from the initial 34 faculty from four colleges to 129 faculty representing nine colleges



Research Areas

Faculty research is organized around nine wide-ranging themes:



Air Quality



Built Environment



Climate Change



**Ecological &
Environmental Change**



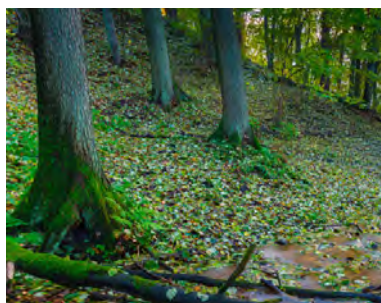
Energy



Food Systems



Justice, Equity & Diversity



Nature & Culture



Water

Affiliated Colleges

Affiliated colleges have at least one faculty affiliate in the GCSC.



2012 - 2017 Strategic Plan



Sarah Hinnners, director of the Center for Ecological Planning and Design, attends the iUTAH Broader Impacts Forum.

Our vision was that over a five-year period (2012–2017), the GCSC would become a nationally recognized leader in environmental and sustainability discoveries, education, and action-based initiatives, as well as an integral contributor to the University's programmatic, research, and training efforts.

Photo by Office of Undergraduate Research

2012 – 2017 STRATEGIC PLAN GUIDING PRINCIPLES

- 1** We will coordinate, promote, and accelerate cutting-edge research on environmental and sustainability issues pertinent to our region, applicable at national scales, and relevant to global issues.
- 2** We will produce leaders who are prepared to find creative solutions to the environmental and sustainability challenges facing our planet.
- 3** We will support the University community working at multiple levels of interaction, e.g. individual as well as multi-PI and broadly interdisciplinary efforts, recognizing that each of these scales can be effective in fulfilling our mission.
- 4** We will cultivate an inclusive and discipline-diverse GCSC community.
- 5** We will work with the campus community to help provide reliable, credible, and unbiased science-based data to inform sustainability policy, perceptions, and behaviors.
- 6** We will strive to optimize the interactions between humans and the environment in the pursuit of a sustainable civilization. Our view of sustainability is broad, and includes biological, physical, and behavioral sciences. We will encompass macro-level human processes such as urban design, politics of decision making, and technology, as well as micro-level processes including behavior and behavior change as well as individual and economic motivation.

Strategic Plan: Engagement

Interdisciplinary engagement lays the foundation essential for incubating faculty-initiated multidisciplinary projects. Through cultivating relationships, bridging departments and colleges across campus, and elevating public awareness of the GCSC, our strategic work in engagement advances our mission and vision.

GOAL

Coordinate opportunities for interdisciplinary engagement on campus, between campus and the community, and within the national and international arena.

MEASURES

- Expose more than 100 graduate students and 100 faculty per year to interdisciplinary seminars on broad topics related to global change and sustainability.
- Engage more than 100 local professionals and members of the public in global change and sustainability-related events per year.
- Engage more than 20 faculty members in interdisciplinary global change and sustainability education, research, and outreach.

HOW DID WE DO?

In 2012-2017, the GCSC engaged the University community through public seminars, focused networking events, and faculty and student retreats. These programs fostered conversations around the environment and sustainability between researchers from different disciplines, leading to innovative research and collaborative partnerships. These events also brought new graduate students and faculty members into an interdisciplinary community with shared interests.

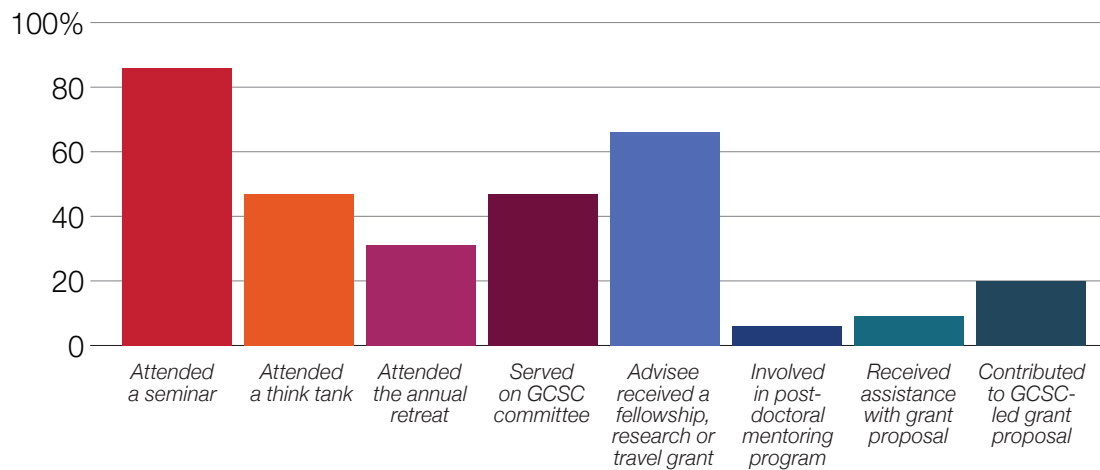
Doctoral candidate Christy Mancuso collaborates with other researchers at the GCSC annual retreat.



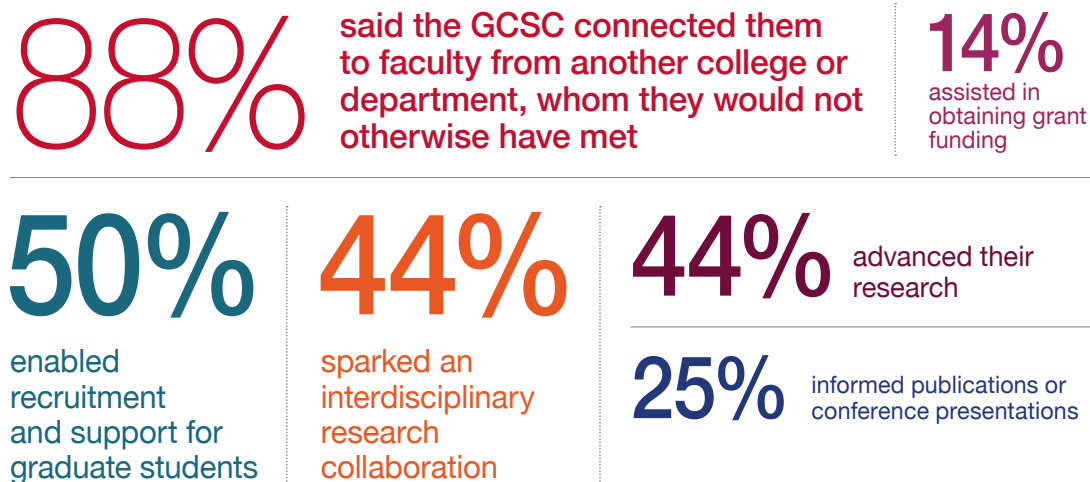
GCSC Faculty Affiliates Survey

(2016; 64 respondents)

How have Faculty Engaged with the GCSC?

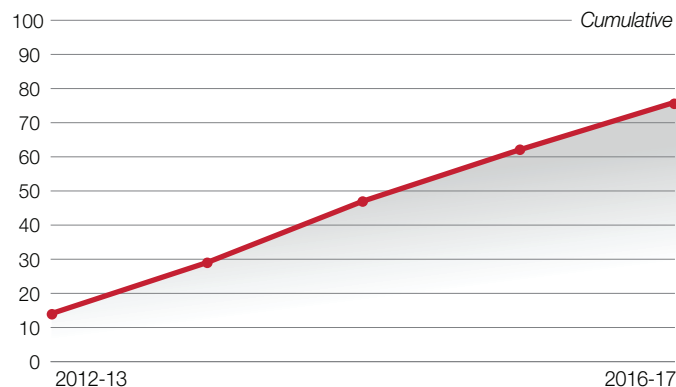


How has Involvement in the GCSC Impacted Faculty Research or Teaching?



Strategic Plan: Engagement

GCSC Seminars from 2012-2017



5,000+

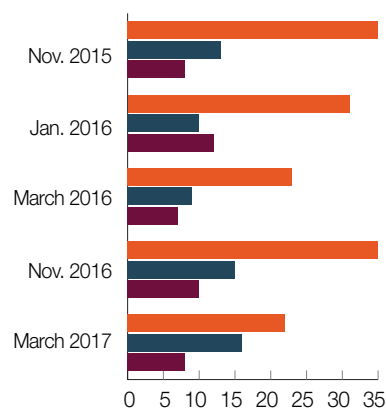
cumulative total attendance at GCSC seminars over past five years

198

cumulative total attendance at GCSC retreat over past five years

Think Tanks

- No. of Attendees
- No. of Departments
- No. of Presentations



Think Tank Themes

- The Nexus of Food, Energy, and Water Systems
- The Impact of Emissions and Air Quality on Health and Global Change
- The Ecology and Sustainability of Urban Water Systems
- Campus as a Living Laboratory
- Justice, Equity, and Diversity in Sustainability Research

2012–2017 Actions

INTERDISCIPLINARY SEMINAR SERIES

The bi-monthly Seminar Series brought to the University of Utah some of the best researchers from across the country whose work sheds light on global change and sustainability. Recent national presenters ranged from ecologist Lance Gunderson to geographer Julie Guthman to paleoclimatologist Joerg Schaefer. Speakers addressed topics such as “Anthropogenic Disturbance and Hydrologic Behavior,” “Environment, Development & Security in the Age of Climate Change Adaptation,” and “Class, Poverty and Urban Sustainability in Bangalore, India.” The series also featured 27 University of Utah researchers from 16 different departments.

FACULTY NETWORKING

GCSC faculty events brought faculty members together in a relaxed environment to learn about research being conducted at the U and to help shape the direction of the GCSC. “Think Tanks” gathered faculty to network at the S.J. Quinney College of Law Building. A diverse array of presentations in the speedy PechaKucha style around themes enabled faculty to offer their current research and learn more about the efforts of their peers.

ANNUAL RETREATS

The annual GCSC retreats have served to integrate new GCSC Fellows and other graduate students, postdoctoral researchers, and their faculty mentors, as well as new University faculty into our interdisciplinary community.



Advancing Collaborations through Seminars

On campus and around the country, scholars are conducting innovative research related to global change and sustainability. The GCSC highlights that research in the bi-monthly lecture series for an interdisciplinary audience. The series also provides a unique opportunity for faculty to form research partnerships with their nationally-recognized peers.



Jeff Rose

The seminar series proved invaluable for Jeff Rose, assistant professor (lecturer) in the Department of Parks, Recreation, & Tourism in the College of Health, in his ongoing collaboration with Fernando Bosco, professor of Geography at San Diego State

University.

Fernando is nationally-renowned for his expertise in food systems and environmental justice. During fall 2016, he was in the middle of a large National Science Foundation-funded research project that brought community residents, local faculty, and graduate and undergraduate students together to explore food deserts and swamps in San Diego. Jeff knew from seeing Fernando in

action that he was an excellent speaker with research relevant to a number of units on campus. Jeff nominated Fernando as a speaker to the Seminar Committee for a fall presentation.

While Fernando was at the University of Utah, Jeff hosted him, arranging meetings with the Salt Lake City Food Policy Task Force, GCSC Fellows, and other faculty interested in Fernando's work. In between meetings, the two professors planned future collaborations. Since his seminar, Fernando has transformed his GCSC presentation into an article for a special issue of the Journal of Environmental Studies and Sciences that Jeff co-edited. In the future, the two scholars also hope to conduct comparative research between Salt Lake City, San Diego, and the Dallas-Fort Worth area. Both of these initiatives were spurred by Fernando's time at the University of Utah and the GCSC's collaborative ethos.

Through the seminar series, faculty affiliates like Jeff are able to advance their research, and the campus community as a whole is exposed to a broad range of ideas regarding global change and sustainability.

Retreat attendees plant trees
on the slopes of Alta Ski Area
during an annual retreat.



Building Community through Annual Retreat

Each fall, the GCSC convenes at beautiful Alta Ski Area to integrate new graduate students and faculty into its interdisciplinary community. Collaborative activities and shared meals become building blocks for future research on global change and sustainability.



**Danya
Rumore**

Danya Rumore, associate director of the Environmental Dispute Resolution Program (EDR) and research assistant professor in Law and City & Metropolitan Planning, knows that investing in collaborative space is critical for interdisciplinary work. Her participation in the retreat helped her make connections across campus, forming mutually beneficial research partnerships.



**Kelly
Bricker**

When Danya arrived at the University of Utah in fall 2015, she knew she wanted to work with gateway communities at the entrance of Utah's national parks. These communities are being significantly impacted by heavy tourism and by climate change; they are facing conflict around natural resource management and in

need of the mediation skills that Danya and the EDR program provide. At the retreat, Danya met Kelly Bricker, director of Parks, Recreation, & Tourism and GCSC faculty affiliate, who had already been working in this geographic region. Kelly introduced Danya to the community members she needed to know, opening the door for research even before the first day of class.

Relationship building at the retreat goes both ways, as new faculty and students are given the opportunity to share the expertise they bring to the GCSC community. Since the retreat, Danya has been asked to be a co-PI on several interdisciplinary grants. These invitations enable her to bring her skills to bear on work that's already happening, keeping research alive and vibrant in her portfolio. Additionally, Danya has been asked by several former GCSC fellows to serve on their dissertation committees.

For Danya and others, the retreat creates an informal collaborative space for members of the GCSC community to share expertise and build the long-term connections for future research.

Relationship building at the retreat goes both ways, as new faculty and students are given the opportunity to share the expertise they bring to the GCSC community.

Strategic Plan: Research

Central to the mission of the GCSC is the development and expansion of strategic interdisciplinary research initiatives. By working with affiliate faculty to secure external funding for these programs and initiatives, the GCSC advances the University of Utah as a leader in environment and sustainability research.

GOAL

Foster interdisciplinary research related to the environment, global change, and sustainability.

Implementation Strategies

- 1** Foster strategic interdisciplinary faculty growth
- 2** Establish the campus as a living laboratory
- 3** Launch and cultivate strategic cross-cutting research initiatives

MEASURES

- Research funding by GCSC-affiliated faculty of \$20 million annually.
- Develop five new interdisciplinary research initiatives in the theme areas of Water Sustainability, Fossil Fuel Emissions and Air Quality, Climate and Water, Environmental Records, and Sustainable Energy and Built Environment.
- Grow GCSC to include more than 120 faculty affiliates, 20 post-doctoral researchers, and 40 graduate students supported through external research funds.
- Foster submission of at least three large (> \$1 million total) interdisciplinary research proposals per year.

HOW DID WE DO?

The GCSC experienced significant growth in number of faculty affiliates, who represent a diverse range of disciplines. We fostered the submission of 27 large interdisciplinary research proposals and celebrated the \$62,920,169 in grant awards obtained by faculty affiliates during the strategic plan period. In 2017, the GCSC expanded to include the Water Center and the Center for Ecological Planning and Design. The research done by faculty affiliates can be organized into sub-areas of nine distinct but overlapping themes, each of which points to future opportunities for targeted research collaborations.



Research of supercapacitor energy storage at Assistant Professor Roseanne Warren's Advanced Energy Innovations Lab.

Photo by Jonathan Duncan/University Water Center

Faculty Perspective

“The connections made with other faculty have allowed my inclusion as a collaborator for a large NSF grant.”



— Wendy Wischer, Art & Art History

“GCSC connections have led to new collaborations and publications with affiliates in Engineering and Atmospheric Sciences, plus at least one grant submission.

These interactions have also helped us develop contacts and partnerships with local and regional stakeholder groups interested in our science. The greatest value has come from networking and regular contact with colleagues with whom I would otherwise have limited interaction.”



— Gabe Bowen,
Geology & Geophysics

“Through the GCSC, two field experiments have been performed by my research group that would not have happened. These were both large-scale collaborations with other universities that GCSC graduate fellowships allowed one of my students to participate in. One of these helped generate data and results that were included in a successful NSF CAREER award proposal.”



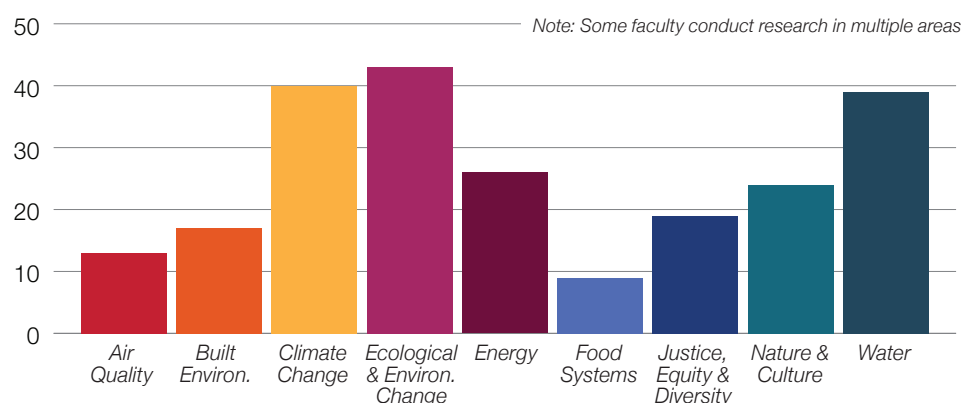
— Rob Stoll, Mechanical Engineering

Strategic Plan: Research

2012 - 2017 Actions



GCSC Faculty Affiliates by Research Theme



INTERDISCIPLINARY PROPOSALS

Interdisciplinary research proposals were supported by the GCSC with staff assistance in development, writing, and accounting. The GCSC helped to facilitate submission of 26 proposals between 2012-2016. Of those, eight were funded, including the following six interdisciplinary proposals:

- 1** Workshop on Water Quality and Other Environmental Impacts from Mining in Ecuador and Neighboring Countries. *NSF Office of International Science & Engineering (2012)*. William Johnson, Geology & Geophysics; Tariq Banuri, Economics; Thure Cerling, Geology & Geophysics; Sylvia Torti, Biology
- 2** The Uintah Basin Greenhouse Gas Study: Understanding Emissions of CO₂ and CH₄ from Oil and Gas Fields. *NOAA (2013)*. John Lin, Atmospheric Sciences; John Horel, Atmospheric Sciences; Jim Ehleringer, Biology
- 3** Undergraduate Sustainable Science Technology Engineering and Mathematics (U-S²TEM) Scholars. *NSF Division of Undergraduate Education (2013)*. Jim Ehleringer, Biology; Nalini Nadkarni, Biology; Holly Godsey, Geology & Geophysics; Brenda Bowen, Geology & Geophysics; Steven Burian, Civil Engineering
- 4** Predicting CO₂ Emissions Associated with Urban Development in the Western U.S. *NOAA (2014)*. John Lin, Atmospheric Sciences; Diane Pataki, Biology; Martin Buchert, City & Metropolitan Planning; Courtenay Strong, Atmospheric Sciences; David Bowling, Biology; Jim Ehleringer, Biology
- 5** USAID Global Center for Advanced Studies on Water (GCAS-W). *US AID (2014)*. Steven Burian, Civil & Environmental Engineering; Tariq Banuri, Economics; Christine Pomeroy, Civil & Environmental Engineering; Amy Wildermuth, Law
- 6** Adaptation, Mitigation, and Biophysical Feedbacks in the Changing Bonneville Salt Flats. *NSF Coupled Human-Natural Systems (2016)*. Brenda Bowen, Geology & Geophysics; Matthew Brownlee, Parks, Recreation, & Tourism; William Brazelton, Biology; Kevin DeLuca, Communication

Faculty Grant Awards

\$62,920,169 grant funding obtained by faculty affiliates in 2012-2016

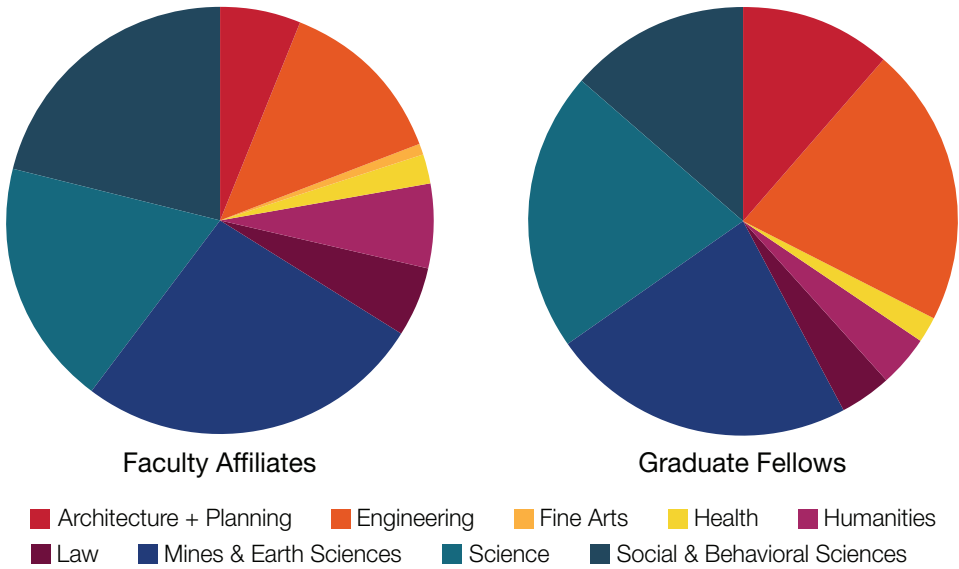
(Note: Figure represents all awards granted during time period; some funding may be ongoing.)



Students and faculty meet with Sumner Swaner, founder of the Ecological Planning Center.

Photo by the Center for Ecological Planning and Design

GCSC Faculty Affiliates and Graduate Fellows by College



Strategic Plan: Research

Supporting New Cross-Cutting Research Initiatives

The GCSC has expanded to include a partnership with two new research units: the University of Utah's Water Center and the Center for Ecological Planning and Design. These centers bring together individuals and research units around targeted themes, facilitating interdisciplinary strategies and solutions for local and global challenges.

The Water Center

Water has emerged as a critical area for research, teaching, and service in Utah, across the U.S., and globally. As Utah is the second driest state in the nation, water is a valuable resource to the citizens, recreation users, industry, farmers, and landscapes. The Water Center is a catalyzing hub for water research and associated activities at the University.

The GCSC played a pivotal role in the initiation of the two major grants foundational to the Water Center. The research trajectory of these projects—the USAID-funded U.S.-Pakistan Center for Advanced Studies in Water (USPCASW) and the NSF-funded iUTAH project will now continue in the Water Center.

iUTAH is an interdisciplinary research and training program aimed at strengthening science for Utah's water future. Initiated in 2011, with the leadership of GCSC Director Emeritus and Distinguished Professor of Biology Jim Ehleringer and the receipt of an NSF Research Infrastructure Improvement grant, iUTAH has become a statewide network of researchers addressing water issues in three watersheds: Red Butte Creek, Middle Provo River, and Logan River.

In 2014, GCSC Associate Director and Associate Professor of Civil & Environmental Engineering Steve Burian and Professor (lecturer) in Economics Tariq Banuri, with other faculty partners, initiated the USPCASW. The USAID-funded USPCASW is an education and applied research center dedicated to generating cost-effective and sustainable solutions to

Pakistan's water-related challenges through developing specialized human resources and technologies, academia-industry collaborations, and policy formulations.

For both projects, the GCSC helped facilitate funding by connecting experts with water-related interests from disparate departments across campus. One condition of the USPCASW's USAID funding was the establishment of a University-wide center for water research. Following the NSF iUTAH grant funding cycle, an opportunity arose to create a powerful research brand building on the USPCASW and combining with water research, education, and training strengths established by the GCSC and iUTAH.

The Center for Ecological Planning and Design

The focus of the Center for Ecological Planning and Design—formed in 2017 and jointly housed in the Global Change & Sustainability Center and the College of Architecture + Planning—is providing interdisciplinary, community-oriented research on the full complexity of the built environment and of human settlements as social-ecological systems.

Ecological planning and design is a way of thinking about and approaching the challenges

The GCSC played a pivotal role in the initiation of the two major grants foundational to the Water Center. The research trajectory of these projects – the USAID-funded U.S.-Pakistan Center for Advanced Studies in Water (USPCASW) and the NSF-funded iUTAH project – will now continue in the Water Center.

and opportunities of human settlements in the 21st century. It draws on multiple disciplines to consciously interweave human, biophysical, and built systems in the shaping of our environment. The goal of ecological planning and design is to create human habitat that is ecologically integrated, reflects local natural assets and community values, and enhances social, economic,



Members of the iUTAH EPSCoR project educate and train students on STEM-focused water issues facing the state.

Photo by iUTAH EPSCoR

and ecological well-being.

The Center for Ecological Planning and Design is the fusion of the Ecological Planning Center (EPC) and the Integrated Technology in Architecture Center (ITAC). The EPC was founded in 2011 with a gift to the Department of City & Metropolitan Planning by the Swaner family and has been directed by Sarah Hinnars, research assistant professor in City & Metropolitan Planning. Since its inception, the EPC worked closely with academic and community partners to shorten the pipeline between research and application. EPC faculty and graduate student members have applied principles of urban ecology, environmental planning, and design and engineering to generate sustainable solutions in planning for equitable, vibrant, and healthy human habitats.

ITAC was established in 2004 and has been directed by Ryan E. Smith, associate professor

and associate dean for research and community engagement in the College of Architecture + Planning. ITAC performed built ecology research focused on buildings and the environment, with research expertise in renewable structural materials, construction efficiency, and the market analysis for sustainable construction technologies.

In 2017, the new Center for Ecological Planning and Design will catalyze the strengths of the EPC and ITAC. The center will form a bridge between the College of Architecture + Planning and the GCSC to draw on multiple disciplines in order to understand and shape our environment by interweaving research and practice in human, biophysical, and built systems – people, place, and design. Hinnars will direct the center, with Diane Pataki, professor in biology and associate dean of student affairs in the College of Science, serving as associate director.

Strategic Plan: Training

The GCSC's work to prepare interdisciplinary scholars has established the center as an integral contributor to the University's programmatic, research, and training efforts related to the environment and sustainability.

GOAL

Research in a multi-disciplinary context requires that graduate students, undergraduates, and postdoctoral researchers receive training and mentoring on how to work in interdisciplinary teams where data sharing, collaboration, and communication are essential. The GCSC will develop interdisciplinary training, education, and mentoring opportunities that prepare our students and postdocs to address the complex challenges of sustainability and the environment. In order to achieve this goal, we have identified three strategies related to 1) interdisciplinary graduate student training, 2) undergraduate opportunities, and 3) postdoctoral mentoring.



2014 Global Changes and Society class.

MEASURES

- Provide graduate fellowships and scholarships that support more than 30 students per year.
- Graduate more than 20 students per year with the Graduate Certificate in Sustainability.
- Graduate more than 20 students per year with the Interdisciplinary Graduate Degree in Global Change.
- Enroll 50 students per year in GCSC Seminar course.
- Enroll 30 students per year in Global Changes and Society course.
- Support more than 50 graduate students per year through travel and research funding awards.
- Administer at least two faculty learning communities on global change and sustainability topics.
- Place at least five post docs per year into academic, research-related, and /or resource-management-related positions.

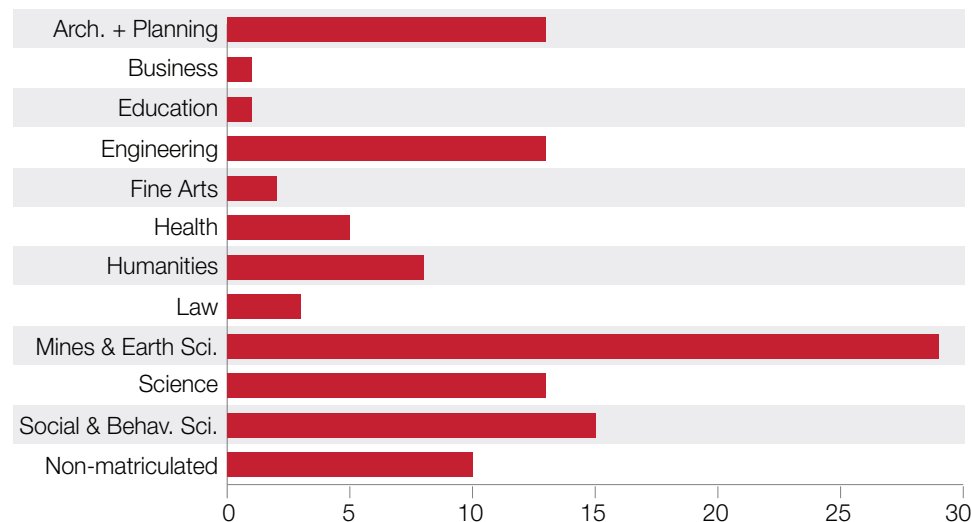
HOW DID WE DO?

During the strategic plan period, graduate students received excellent training on interdisciplinary collaboration through our fellowship program and affiliated courses. We supported graduate and post-graduate research with 178 small grants, a robust post-doctoral research training program, and our annual Environment and Sustainability Research Symposium. Through a partnership with the Center for Science and Mathematics Education, we initiated U-S²TEM Scholars, a scholarship and mentoring program aimed at increasing the number of outstanding and diverse undergraduate students who graduate with degrees in STEM fields that focus on the environment and sustainability. Finally, the GCSC worked with the Sustainability Office and the Graduate School to launch the Interdisciplinary Graduate Certificate in Sustainability, creating a new paradigm in interdisciplinary training to produce the leaders that society needs today.

2012 - 2017 Actions

Graduate Students in Interdisciplinary Certificate and Global Changes and Society Course, by College

Students in interdisciplinary certificate and Global Changes and Society (combined)



INTERDISCIPLINARY EDUCATION

Graduate students are trained to become experts in a single discipline. Yet, global change and sustainability challenges require cross-disciplinary collaboration, a skill that is not traditionally part of research-intensive training. For today's scholar to pair disciplinary depth with interdisciplinary breadth of knowledge requires practice and training in interdisciplinary research methods. In 2013, the GCSC, Sustainability Office, and the Graduate School launched the **Interdisciplinary Graduate Certificate in Sustainability** to meet the need for this kind of training.

The certificate program grounds students in the overlap between science, society, and policy to address global change and sustainability challenges. The 16-credit program draws together different disciplines in a cooperative way, leveraging existing courses. This fills a unique niche at the University in that the certificate provides a mechanism for graduate students across campus to complement their area of expertise with interdisciplinary literacy in sustainability themes, rather than competing with a department for graduate students.

Today, 33 students are currently enrolled or have graduated from the certificate program. Additionally, a total of 80 students have enrolled in the Global Changes and Society course between 2012-2017.

Strategic Plan: Training

2012 - 2017 Actions *(continued)*

GRADUATE TRAVEL AND RESEARCH GRANTS

The center awarded 228 research and travel grants to graduate students at the U. These grants enabled students to expand their research in a new interdisciplinary direction. Research conducted with these funds were presented at our annual environment and sustainability research symposium.



U-S²TEM SCHOLARS

The U-S²TEM Scholars program is an NSF-funded joint initiative between the Global Change & Sustainability Center and the Center for Science and Mathematics Education, aimed at increasing the number of outstanding and diverse undergraduate students who graduate with degrees in STEM fields that focus on the environment and sustainability. U-S²TEM Scholars receive scholarships for up to four years and work as a multidisciplinary cohort to explore how various scientific and engineering fields interact.



U-S²TEM Scholars

POSTDOCTORAL MENTORING

Postdoctoral mentoring is designed to engage first year and experienced postdocs with meaningful topics to help them gain knowledge and skills needed for successful careers, beyond the research experience gained in an individual lab. Postdoctoral fellows whose mentors are GCSC faculty affiliates were encouraged to participate in our cross-college mentoring program led by Gabe Bowen, Dave Bowling, Steve Burian, John Lin, and Diane Pataki. Ten post-doctoral researchers from this mentoring program are now in academic, research-related, and/or resource management-related positions, while nine remain in postdoctoral positions at the University.



Tofigh Sayahi, Chemical Engineering, presents his research poster at the Environment and Sustainability Research Symposium.

Sharing Student Research at Annual Symposium

On February 8, 2016, 86 graduate and undergraduate students from 20 disciplines gathered to showcase their research at the annual Environment and Sustainability Research Symposium.

Inside the Union Ballroom there was a buzz of excited voices discussing the displayed research posters, which addressed climate change, air quality, nature and culture, food systems, and more. Due to the diversity of topics and student backgrounds, the research symposium exemplified the interconnected nature of sustainability and the wide range of topics included under the sustainability umbrella.

Crystal Painter, graduate research assistant in Atmospheric Sciences, displayed her research poster, "Relationships Between Tropical Rainfall Events and Environmental Conditions." Her research advocated for smarter resource and land management practices

going forward by making people more aware of the climate they live in.

Mike Christensen, a graduate student in City & Metropolitan Planning and the Interdisciplinary Graduate Certificate in Sustainability, focused his research on the possibility of using existing Union Pacific tracks to create an intrastate passenger rail system for Utah. Christensen hopes his project will open up new venues for—and encourage increased use of—public transportation in the state of Utah.

For those who are passionate about student research and sustainability, participating in the symposium is an excellent way to share this passion with others. Given the wide variety of disciplines taking part, it is clear that sustainability will prove to be an integral aspect of many fields of research moving forward.

Strategic Plan: Training

Training GCSC Fellows in Interdisciplinary Research

Each year, the GCSC helps affiliated colleges recruit top graduate students from around the world to work with faculty advisors through a first-year GCSC fellowship. These GCSC Fellows have research interests related to the environment and sustainability, and seek graduate training that extends beyond the scope of a single discipline. While the fellows will receive their degrees from different departments across campus, the GCSC provides interdisciplinary training experiences that will help prepare them for broad engagement and collaboration in the professional realm.

For Crystal Tulley-Cordova, PhD candidate in Geology & Geophysics and 2012-2013 fellow, it was not just the fellowship funding that attracted her to the University of Utah. When Crystal learned about the GCSC's interdisciplinary research model she knew that being a GCSC Fellow would offer her the training she needed to fulfill her professional goals of conducting research in the Four Corners region.

Originally recruited by Gabe Bowen, professor in Geology & Geophysics, Crystal's fellowship supported a year of research on stable isotopes in an urban stream—Red Butte Creek. Crystal hit the ground running, gathering stream samples twice daily and gaining critical skills in the fundamentals of stable isotope research. Working at Red Butte Creek from her first day on campus afforded Crystal a strong start in her graduate program. Crystal is now an EPA STAR (Science to Achieve Results) Fellow, conducting a multi-year project collecting stable isotope data alongside hydrologic technicians from the Navajo Nation for better understanding of water resources.

During her fellowship year, Crystal was introduced to faculty working on water from a variety of perspectives, affording her a multi-faceted view of water issues and a diverse dissertation committee. Through the GCSC seminar course and Global Changes and Society—the two courses associated with the fellowship—Crystal also gained a supportive cohort of graduate students

from across campus, who still keep in touch regarding each other's research.

The Global Changes and Society course was similarly transformative for Chris Zajchowski, PhD candidate in the Parks, Recreation, & Tourism program, during his 2014-2015 fellowship year. The project-based learning format of Global Changes and Society placed Chris and his cohort in a real-world context, giving them the opportunity to apply their disciplines and knowledge to address a local problem.

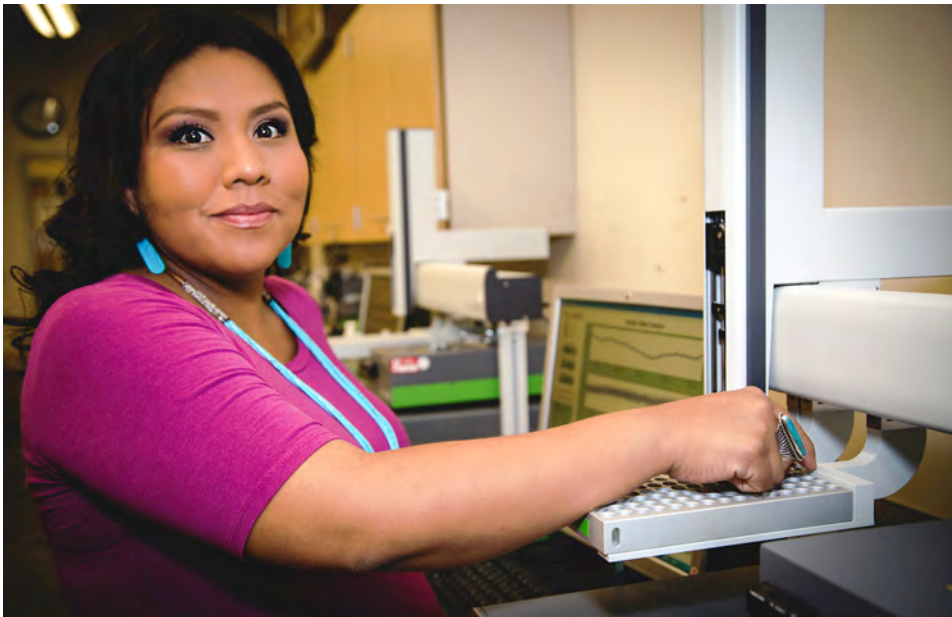
Chris and his class worked together to create "MovingU," a multifaceted initiative to help the campus community reduce daily air pollution emissions. Chris worked on "Real People, Real Stories," a narrative sharing component of the project, which solicited essays from University students, staff, and faculty about their experiences living with air pollution. A panel of outside judges evaluated the 46 essays received, publishing the winning submissions through various

Originally recruited by Gabe Bowen, professor in Geology & Geophysics, Crystal's fellowship supported a year of research on stable isotopes in an urban stream—Red Butte Creek. Crystal hit the ground running, gathering stream samples twice daily and gaining critical skills in the fundamentals of stable isotope research.

outlets. "Real People, Real Stories" has another life now in Chris' research, as he is currently working with a faculty member from his department to analyze these essays and publish the findings.

Like Crystal, Chris continues to participate in GCSC activities, and remains connected to members of his cohort and GCSC faculty affiliates.

Chris and Crystal were both drawn to the University of Utah not only for the funding provided by the GCSC fellowship, but for the interdisciplinary training that the fellowship promised. Throughout their fellowship year, each became part of a supportive cohort, built diverse dissertation committees, and developed relevant research skills with which to grow successful careers.



Crystal Tulley-Cordova, PhD candidate in Geology & Geophysics, collects and analyzes samples for her research on stable isotopes.

Photo by Cat Palmer

Strategic Plan: Infrastructure

Fundamental to the GCSC's mission of advancing environment and sustainability research at the University of Utah is providing information about opportunities, and access to centralized facilities that support research activities and encourage this research.

GOAL

Fostering larger-scale research requires adequate resources. The GCSC will secure the human and physical infrastructure needed to support interdisciplinary engagement, research, and training.

MEASURES

- Identify projected staffing needs to successfully promote and achieve goals.

HOW DID WE DO?

2012-2017 was a significant period of growth for GCSC's infrastructure. With changes in budget and reporting structure, the center is now supported by the Sustainability Office, under the Vice President for Academic Affairs. Recognizing the value of interdisciplinary collaboration, eight colleges on campus contribute financial support to the GCSC. We have brought on two additional support staff, moved into a new space at the Frederick Albert Sutton Building (FASB) equipped to support interdisciplinary collaboration, and upgraded the website. Space in FASB was made available by Geology & Geophysics in the College of Mines & Earth Sciences with the support of the Vice President for Academic Affairs.

New funding model

The GCSC was initially established on a temporary funding model based on returned overhead from GCSC mission-related grants successfully obtained by affiliate faculty. With the support of the Sustainability Office, the Vice President for Research, and University administration, the GCSC has moved to a more stable budget model where funding support is requested and granted on an annual basis in the same manner as departments and colleges. Additionally, nine colleges on campus have begun to contribute to the work of the GCSC.

Thanks to the following deans and colleges for providing funding for staff support:

Robert Adler	COLLEGE OF LAW
Cynthia Berg	COLLEGE OF SOCIAL & BEHAVIORAL SCIENCE
Richard Brown	COLLEGE OF ENGINEERING
Darryl Butt	COLLEGE OF MINES & EARTH SCIENCES
Keith Diaz Moore	COLLEGE OF ARCHITECTURE + PLANNING
Dianne Harris	COLLEGE OF HUMANITIES
David Perrin	COLLEGE OF HEALTH
Henry White	COLLEGE OF SCIENCE

INFRASTRUCTURE



New GCSC office and conference room in the Frederick Albert Sutton Building.



GCSC staff and administration, from left to right: Ming Li, Julie Johnsson, Brenda Bowen, Laurie Mecham, and Liz Ivkovich.

GCSC Faculty Affiliates

Current GCSC faculty affiliates as of Spring 2017 and their engagement with the center.

*Robert Adler	Law	Lisbeth Louderback	Anthropology
*Fred Adler ³⁴	Mathematics	Zach Lundeen	Geography
William Anderegg	Biology	Huilian Ma	Geology & Geophysics
Tariq Banuri	Economics	Shane Macfarlan	Anthropology
Edward Barbanell	Philosophy	Jeffrey McCarthy	Environmental Humanities
Keith Bartholomew ¹³	City & Metropolitan Planning	*Dan McCool	Political Science
Tabitha Benney ²	Political Science	Meredith Metzger ²	Mechanical Engineering
Haimanti Bhattacharya ⁵	Economics	Shelley Minter	Chemistry
Lauren Birgenheier	Geology & Geophysics	Jeff Moore	Geology & Geophysics
Amanda Bordelon	Civil & Environmental Engineering	Barb Nash	Geology & Geophysics
+Brenda Bowen ¹²³⁴⁵	Geology & Geophysics	Lindsey Nesbitt	Geology & Geophysics
Gabe Bowen ²⁴⁵	Geology & Geophysics	*Jim O'Connell ³⁴	Anthropology
*David Bowling ¹²³⁴	Biology	*Eric Pardyjak ¹²⁴⁵	Mechanical Engineering
William Brazelton ²	Biology	Masood Parvania	Electrical and Computer Engineering
Joan Brenner-Coltrain	Anthropology	Diane Pataki ¹²⁴	Biology
Simon Brewer ²⁴	Geography	*Christine Pomeroy ²⁴⁵	Civil & Environmental Engineering
Kelly Bricker ¹	Parks, Recreation, & Tourism	*Mitch Power ¹⁵	Geography
Paul Brooks	Geology & Geophysics	Kody Powell	Engineering
*Frank Brown	Geology & Geophysics	Zhaoxia Pu	Atmospheric Sciences
Matthew Brownlee ⁵	Parks, Recreation, & Tourism	*Thomas Reichler ³	Atmospheric Sciences
*Andrea Brunelle ¹²⁴⁵	Geography	Kathleen Ritterbush ¹	Geology & Geophysics
*+ Steve Burian ¹³⁴⁵	Civil & Environmental Engineering	Jeffrey Rose ²	Parks, Recreation, & Tourism
Sarah Bush ⁴⁵	Biology	Jörg Rügemer	School of Architecture
+Adrienne Cachelin ¹²⁵	Environmental & Sustainability Studies	Danya Rumore ¹⁵	Law
Marc Calaf ²	Mechanical Engineering	Summer Rupper ²	Geography
David Carter	Political Science	Mostafa Sahraei-Ardakani	Electrical and Computer Engineering
*Thure Cerling ¹⁴⁵	Geology & Geophysics	Caroline Saouma	Chemistry
Marjorie Chan	Geology & Geophysics	Michael Scarpulla	Materials Engineering/ Computer Engineering
Divya Chandrasekhar	City & Metropolitan Planning	*Jon Seger ⁵	Biology
Brett Clark ²⁵	Sociology	Cagan Sekercioglu ²³⁴⁵	Biology
*Dale Clayton	Biology	*Pat Shea	Biology
Brian Coddling ¹²⁵	Anthropology	Eric Sjöberg	Economics
*Phyllis Coley ⁴	Biology	Ryan Smith	Integrated Technology in Architecture Center
Julia Corbett	Communication	Amanda Smith ⁵	Mechanical Engineering
Robin Craig ¹²⁴	Law	*Kip Solomon	Geology & Geophysics
Lincoln Davies ¹	Law	Taylor Sparks	Materials Engineering
*Denise Dearing ¹³	Biology	*John Sperry ¹³	Biology
Kevin DeLuca	Communication	Jim Steenburgh ¹²⁴	Atmospheric Sciences
*Phil Dennison ¹⁴	Geography	Rob Stoll ¹³⁴	Mechanical Engineering
Isabel Dulfano	Languages & Literature	Michele Straube ¹	Law
*Jim Ehleringer ²³⁴⁵	Biology	*Court Strong ²⁴	Atmospheric Sciences
Danielle Endres ¹⁴	Communication	Leona Yi-Fan Su	Communication
Reid Ewing ⁴	City & Metropolitan Planning	Michael Timberlake	Sociology
Zak Fang	Metallurgical Engineering	Brett Tipple ⁵	Biology
Colleen Farmer	Biology	*Sylvia Torti	Biology
*Don Feener	Biology	Thanh Truong	Chemistry
*Diego Fernandez ⁴	Geology & Geophysics	Neng Wan	Geography
Jennifer Follstad Shah	Geography	Roseann Warren	Mechanical Engineering
*Rick Forster ³	Geography	Yehua Wei	Geography
Michael Free	Metallurgical Engineering	Jennifer Weidhaas	Civil & Environmental Engineering
Tim Garrett	Atmospheric Sciences	Carol Werner	Psychology
Ramesh Goel ¹	Civil & Environmental Engineering	Dave Whiteman	Atmospheric Sciences
*Ken Golden	Mathematics	Amy Wildermuth ¹²³	Law
Stephen Goldsmith ¹⁴	City & Metropolitan Planning	Wendy Wischer	Art & Art History
Gannet Haller	Atmospheric Sciences	Sara Yeo ⁵	Communication
+Sarah Jack Hanners ¹²⁴	City & Metropolitan Planning	Robert Young	School of Architecture
Sebastian Hoch	Atmospheric Sciences	Ilya Zharov	Chemistry
*John Horel ³	Atmospheric Sciences	Cathleen Zick	Family & Consumer Studies
*Randy Irmis	Geology & Geophysics	Ed Zipser	Atmospheric Sciences
*Paul Jewell ¹⁵	Geology & Geophysics		
*Bill Johnson ⁵	Geology & Geophysics		
*Cari Johnson ²	Geology & Geophysics		
*Robert Keiter	Law		
Kerry Kelly	Chemical Engineering		
Leslie Knapp	Anthropology		
Mark Koopman	Metallurgical Engineering		
Steven Krueger	Atmospheric Sciences		
*Tom Kursar	Biology		
John Chun-Han Lin ²⁴⁵	Atmospheric Sciences		
Peter Lippert	Geology & Geophysics		

AFFILIATIONS

- * Founding Member
- + Associate Director (current and former)
- 1 Executive Committee
- 2 Seminar Committee
- 3 Curriculum Committee
- 4 Student Recruitment Committee
- 5 Grant Committee



GCSC faculty affiliate
Gabe Bowen explores
Snow Canyon State
Park near St. George.

GCSC Graduate Fellows

GRADUATE FELLOWS

2012-13

Kenneth Dudley
Derek Mallia
Sabrina McNew
David Proffitt
Jeffrey Ross
Pratibha Sapkota
Kimberly Smith
Hassan Tavakol-Davani
Rebecca Terry
Crystal Tulley-Cordova
David Wheatley

DEPARTMENT

Geography
Atmospheric Sciences
Biology
City & Metropolitan Planning
Biology
Civil & Environmental Engineering
Atmospheric Sciences
Civil & Environmental Engineering
Mathematics
Geology & Geophysics
Geology & Geophysics

FACULTY ADVISOR

Philip Dennison
John Lin
Dale Clayton
Reid Ewing
Jim Ehleringer
Christine Pomeroy
Court Strong
Steven Burian
Fred Adler
Gabe Bowen
Marjorie Chan

2013-14

La'Shaye Ervin Cobley
Logan Frederick
Derek Jensen
Zacharia Levine
Emily Nicolosi
Emily Schulze Breiner
Megan Walsh

Biology
Geology & Geophysics
Mechanical Engineering
City & Metropolitan Planning
Geography
Biology
Civil & Environmental Engineering

Diane Pataki
William Johnson
Eric Pardyjak
Sarah Hinnens
Simon Brewer
David Bowling
Christine Pomeroy

2014-15

Joshua Barnett
Xiaorui Huang
Annie Putman
Loren Santana
Pratiti Tagore
Tho "Thomas" Tran
Danielle Ward
Chris Zajchowski

Communication
Sociology
Geology & Geophysics
Mathematics
City & Metropolitan Planning
Mechanical Engineering
Geography
Parks, Recreation, & Tourism

Danielle Endres
Andrew Jorgenson
Gabe Bowen
Fred Adler
Reid Ewing
Amanda Smith
Andrea Brunelle
Matt Brownlee

2015-16

Vanessa Bailey
Cassandra Gallegos
Nipun Gunawardena
Julia Howe
Meaghan McKasy
Crystal Painter
Lauren Zuromski

Geography
Law
Mechanical Engineering
Geology & Geophysics
Communication
Atmospheric Sciences
Atmospheric Sciences

Simon Brewer
*
Eric Pardyjak
Paul Jewell
Sara Yeo
Ed Zipser
John Lin

2016-17

Emerson Arehart
Debolina Banerjee
Kevin Craft
Dale Forrister
Majid Heidarifard
Kimberly Kernan
Jory Lerback
Cody Lutz
Emily Post

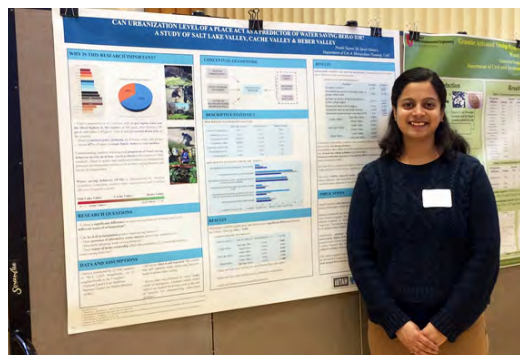
Biology
City & Metropolitan Planning
Atmospheric Sciences
Biology
Electrical & Computer Engineering
Law
Geology & Geophysics
City & Metropolitan Planning
Anthropology

Fred Adler
Sarah Hinnens
John Horel
Phyllis Coley & Thomas Kursar
Masood Parvania
*
Brenda Bowen
Danya Rumore
Shane MacFarlan

* Law students do not have a single faculty research advisor.



GCSC fellows get to know each other during a volleyball match at the annual retreat.



Pratiti Tagore, 2014-15 fellow, displays her winning research poster at the 2017 Intermountain Sustainability Summit at Weber State University.

La'Shaye Ervin Cobley, 2013-14 fellow, advocates for active transportation as part of the Global Changes and Society course.



**Global Change &
Sustainability Center**

THE UNIVERSITY OF UTAH

115 South 1460 East, Room 234 FASB
Salt Lake City, UT 84112
801-581-6414 | environment.utah.edu