CGRER
THE CENTER FOR GLOBAL & REGIONAL ENVIRONMENTAL RESEARCH
WWW.CGRER.UIOWA.EDU

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The Center for Global and Regional Environmental Research (CGRER) was established in 1990 with the intent of promoting interdisciplinary efforts that focus on global environmental change. Housed on the University of Iowa (UI) campus in the Iowa Advanced Technology Laboratories (IATL), CGRER is supported by revenues generated from investor-owned utilities, as mandated by the State of Iowa’s Energy Efficiency Act. Funds are used to support research and provide services to faculty members and students across the state who are interested in environmental change. CGRER currently is composed of 128 members from 14 institutions.

While environmental change is constant and natural, CGRER focuses on the human-induced acceleration of such change caused by modern technologies, lifestyles and population growth. Concerns about global change encompass multiple issues including its effects on natural ecosystems, environments and resources, and on human health, culture and social systems. Because global change promises to touch virtually every aspect of life and requires the reinterpretation of many fields of science and engineering, the humanities, health and law, an understanding of global change requires collaborative efforts among the many disciplines involved. CGRER’s mission is to foster such collaborative interdisciplinary actions in three ways: by promoting dialogue among specialists and agencies, by educating students and the general public, and by fostering and supporting relevant research projects.

This annual report summarizes CGRER’s activities in each of these three areas. Because CGRER’s output is commensurate with that of its many members, a summary of which would require a small book, this annual report includes only a sampling of significant projects and efforts. Yet this sampling provides a vision of CGRER’s multiple efforts to achieve its ultimate goal: assisting Iowa’s agencies, industries and citizens in assessing and preparing for global change and its effects.
A s you will learn from this year’s annual report, 2016 was a year of transition and transformation for CGRER. On campus we see the many ways that the 2008 flood has transformed the University of Iowa. We have adapted to the floods by hardening infrastructure, relocating buildings, and enhancing emergency response capabilities. CGRER members have contributed to these transformations in many ways, and the lessons learned have given us an expanded vision of how we can be of use.

The new Hancher Auditorium, a replacement for a building damaged in the 2008 flood, opened in September on the UI campus. The UI has a system of removable flood walls around some of its buildings. (photo by IIHR)

Increasingly, our members and students are working with large amounts of data generated by our enhanced capabilities to sense the environment and our ability to perform sophisticated computer simulations. A great example is the Iowa Flood Information System (IFIS). This website helps inform the public about flood risks by bringing together information from sensors measuring the height of rivers with radar-observed rainfall rates and computer-simulated flood forecast predictions.

The new Hancher Auditorium, a replacement for a building damaged in the 2008 flood, opened in September on the UI campus.

The nature and breadth of the ways in which CGRER members engage in environmental-related big data can be seen by reading the profiles of our new members. Two of our new members, Caglar Koylu and Jun Wang, were brought to campus as part of the Iowa Informatics Initiative, which is hiring 24 new faculty in big data-related areas. Caglar’s research explores the development of computational and visual methods for analyzing spatial information with applications in diverse areas including disaster management. A main component of Jun’s research is related to developing new methods to observe atmospheric composition from space. To support such efforts, CGRER continues to invest in high-performance computing and visualization hardware and software.

Another important transition is related to the ways we carry out our scholarship. Our work is increasingly interdisciplinary and is closely coupled to real problems with diverse stakeholders. Mitigation and adaptation to changing environments are active research areas within CGRER. As we conduct our studies, communities are making decisions on actions to become more resilient to such changes. Connecting scholars with stakeholders in the larger world has become a major focus of CGRER. A great illustration of this is the Iowa Water Shed Approach described in the research section of this annual report. This grant connects diverse stakeholders from eight Iowa watersheds to develop strategies to reduce flood risks.

At forums sponsored by the Iowa Water Shed Approach, members of the public gave feedback on plans to reduce flood risk in their communities. (photo by IIHR)

The need to better connect communities and researchers is also impacting the way we train students. The education of the next generation of researchers to address the changing environment and related problems continues to be a top CGRER priority. For example, CGRER members are leading a newly funded $3 million NSF grant focused on transforming the way we train graduate students to address interconnected water, food and energy challenges. In addition, in October we hosted the fourth-annual Iowa Climate Science Educators Forum, during which up-to-date climate science was discussed and experiences in teaching climate science and communicating it to diverse communities were shared. We also launched the Iowa K-12 Climate Science Education Forum. CGRER and the UI College of Education are working with Iowa educators to engage in classroom investigational learning activities about climate change as part of the adoption of the Next Generation Science Standards.

Iowa Climate Festival participants (photo by Josh Van Stippen)

CGRER’s outreach activities are designed to communicate the diverse ways that climate and environmental change impacts us. A sampling of activities in 2016 include: the release of the sixth-annual Iowa Climate Science Statement, signed by 187 faculty and researchers from 39 Iowa colleges and universities; co-sponsorship of the Iowa Climate Festival held at the UI Museum of Natural History; and the launch of a new monthly podcast, EnvIowa, hosted by our CGRER interns Jenna Ladd and Jake Mobs. In addition, CGRER was honored to receive the Iowa United Nations Association’s Garst Media Award for Iowa Environmental Focus, our blog, devoted to environmental news and research.

CGRER members are engaged in research, training and service that connect communities both near and far. At the international level, our activities included a focus on sustainable cities. We assisted with sustainability efforts in India and also participated in the United Nations Conference on Housing and Sustainable Urban Development (Habitat III), during which a new urban agenda was adopted.

In this annual report, we are excited to share with you our 2016 activities. We invite your comments and suggestions on how we can better connect communities and assist in efforts to address the impacts of a changing environment.

Gregory R. Carmichael,
CGRER Co-Director
with Jerald L. Schnoor

This year’s annual report is a reflection of the major projects of which the University of Iowa is proud. Two of these projects were the launch of the Iowa Water Shed Approach and the Iowa Climate Science Statement, adopted by 187 faculty and researchers from 39 Iowa universities.

The need to better connect communities and researchers is also impacting the way we train students. The education of the next generation of researchers to address the changing environment and related problems continues to be a top CGRER priority. For example, CGRER members are leading a newly funded $3 million NSF grant focused on transforming the way we train graduate students to address interconnected water, food and energy challenges. In addition, in October we hosted the fourth-annual Iowa Climate Science Educators Forum, during which up-to-date climate science was discussed and experiences in teaching climate science and communicating it to diverse communities were shared. We also launched the Iowa K-12 Climate Science Education Forum. CGRER and the UI College of Education are working with Iowa educators to engage in classroom investigational learning activities about climate change as part of the adoption of the Next Generation Science Standards.

At forums sponsored by the Iowa Water Shed Approach, members of the public gave feedback on plans to reduce flood risk in their communities. (photo by IIHR)
In 2016, a number of notable events and milestones related to climate change and extreme weather occurred in Iowa. These milestones underscore the importance of CGRER’s mission and the continued need to understand the effects of global environmental change.

In June, the University of Iowa celebrated a full recovery from the devastating flood of 2008. In the eight years since then, flood mitigation, expenditures, and permanent recovery efforts have totaled nearly $650 million for the 2.5 million square feet of space spread throughout more than 20 campus buildings, with all told, these investments will serve to mitigate future flood damages and allow the UI to move forward in providing services to students and the community at large.

As part of the flood response efforts, I worked with staff at the Iowa Flood Center (a CGRER member organization) to obtain flood inundation and preliminary flood modeling data for six communities on the Shell Rock and Cedar Rivers. The flood inundation data was available for most areas within the 100-year (blue) and 500-year (orange) floodplains. The online Iowa Flood Information System includes maps delineating 100-year and 500-year floodplains.

The statewide flood mapping project and the resources provided for planning and response efforts underscore the value of CGRER’s mission and the continued need to understand changing climatic conditions.

The third significant milestone that occurred in 2016 was the completion of the Iowa Flood Center’s statewide flood mapping project in November. The flood mapping project, which began in 2010 with funding from the Federal Emergency Management Administration (FEMA), provides high-quality flood inundation mapping and better flood forecasting, both developed in part due to the 2008 floods, allowed MidAmerican Energy operations to specifically target individual customer homes and businesses rather than disconnecting large areas based on broad-scale flood hazard mapping.

The floods of 2008 brought destruction throughout eastern Iowa. (IHR photo)

Dan Ceynar adjusts a stream stage sensor. (photo by Iowa Flood Center)

Tom Stoeffler checks on water quality sensors in an Iowa stream. (photo by Iowa Flood Center)

The high quality of the flood inundation data products allowed MidAmerican Energy to better refine response activities and to significantly reduce customer impacts as a result. For example, in Cedar Rapids, MidAmerican Energy temporarily disconnected approximately 1,700 natural gas meters at customer properties that were within inundation areas for the forecasted flood crest.

This number represents less than one third of the disconnects that were required during the 2008 floods. This reduction is attributable in no small part to the flood response and protection efforts of the city and citizens of Cedar Rapids. These efforts were aided not only by the fine-scale inundation maps developed by the Iowa Flood Center, but also by the more accurate flood forecasting made possible by the Iowa Flood Center’s real-time river gauge sensors deployed throughout the Cedar River watershed. Fine-scale inundation mapping and better flood forecasting, both developed in part due to the 2008 floods, allowed MidAmerican Energy operations to specifically target individual customer homes and businesses rather than disconnecting large areas based on broad-scale Federal Emergency Management Administration flood hazard mapping.

While I have only served on the CGRER Advisory Board since 2015, the impacts of a changing climate have held my interest from an early age. The experiences from the flood of 1993, including the displacement and rebuilding of my family’s small business in West Des Moines, Iowa, helped to shape and influence the course of my life, studies and career.

Those experiences were a large part of the reason I chose to pursue environmental studies at Cornell College in Mt. Vernon, Iowa, which included courses on climate change from my advisor and CGRER member Rhawn Denniston.

I am grateful for the varied and valuable accomplishments of CGRER during this past year.

Jesse Leckband
MidAmerican Energy

The statewide flood mapping project and the resources provided for planning and response efforts underscore the value of CGRER’s mission and the continued need to understand changing climatic conditions so that affected individuals, businesses and communities can evaluate, prepare for and respond to the increased frequency and magnitude of extreme weather events.

The floods of 2008 brought destruction throughout eastern Iowa. (IHR photo)
CGRER members shared their expertise with the larger world through a variety of initiatives during the year. Outreach efforts included the Iowa Climate Festival, a seminar on drinking water issues in Iowa, and the sixth-annual Iowa Climate Statement, which described ways agriculture can adopt climate-smart conservation practices.

**IOWA CLIMATE STATEMENT 2016**

The sixth-annual Iowa Climate Statement was released in October. Signed by 187 faculty and researchers from 39 Iowa colleges and universities, *Iowa Climate Statement 2016: The Multiple Benefits of Climate-Smart Agriculture* describes how conservation strategies can help Iowa improve soil and plant health, store carbon, and create cleaner water. Iowa farmers are experiencing real effects from climate change, including heavier rains and increased flooding and soil erosion. The statement advocated for proven climate-smart conservation methods, including reducing cropland tillage to prevent soil erosion and the promotion of land set-aside programs that can permanently store carbon in soils. Government representatives are urged to help Iowa’s farmers and land managers establish a multifaceted vision for land stewardship by vigorously implementing federal, state, and other conservation programs. The statement received significant press coverage throughout Iowa.

**DRINKING WATER SEMINAR**

David Cwiertny, Craig Just, Larry Weber and David Osterberg participated in the symposium *Iowa’s Drinking Water: Could Flint Happen Here?* Held in June at the Iowa Events Center in Des Moines, the day-long conference explored the challenges faced by water providers in their efforts to reliably deliver safe drinking water to Iowans.

**U.S. CONGRESSIONAL FELLOW**

David Cwiertny was selected to serve as a 2016-17 American Association for the Advancement of Science (AAAS) Congressional Fellow. AAAS creates opportunities for scientists to offer their expertise and analytical skills to legislators while also learning more about the policy making process firsthand. As a Congressional Fellow, he will serve as Democratic staff on the House Energy and Commerce Committee, providing technical and scientific expertise to both the Energy and Power and Environment and Economy Subcommittees.

**CLIMATE CHANGE MEMOIR**

Connie Mutel’s new book *A Sugar Creek Chronicle: Observing Climate Change from a Midwestern Woodland* weaves climate change science with the story of her life and her love for the natural world. Published by the University of Iowa Press and partially supported by a grant from CGRER, the book is meant to appeal to a general audience. It explains the science of climate change in a straightforward, compelling way and suggests practical ways individuals can take action to combat this global problem. Mutel has given presentations on her book in locations throughout the Midwest, and it has been featured in media outlets that include Iowa Public Radio, regional newspapers, and a variety of online publications.

**IOWA CLIMATE FESTIVAL**

CGRER was a co-sponsor of the 2016 Iowa Climate Festival, which was held in October at the UI Museum of Natural History. Elizabeth Stone was the organizer of the event and Jerry Schnoor was one of the presenters. The event included discussion of the recent Paris Agreement, climate change impacts in Iowa and strategies for mitigation, and how cities and individuals can adopt more sustainable practices. A Climate Science Fair was held in the afternoon, with hands-on experiments relating to topics such as what makes a gas a greenhouse gas, how clouds form, how particles in the air cool the earth, and how people’s carbon footprints affect the ocean.
CGRER COMMUNICATIONS

CGRER MEDIA OUTREACH
CGRER’s blog, Iowa Environmental Focus (www.iowaeenvironmentalfocus.wordpress.com), continues to be a valuable resource for online engagement and environmental education. Its stories, videos and photos about environmental news and research are created by CGRER’s communications interns.

In addition, a new monthly podcast was launched in September. EnvIowa, which is hosted by interns Jenna Ladd and Jake Slobe, discusses environmental news, research and initiatives that affect Iowans. Listeners can access the podcast on iTunes and Iowa Environmental Focus.

Elizabeth Stone records CGRER’s weekly news segments that are distributed to radio stations throughout Iowa. The one-to-two-minute segments highlight the work of CGRER members as well as current Iowa environmental issues and efforts toward greater sustainability. The audio recordings are available on Iowa Environmental Focus.

Jenna Ladd (left) and Jake Slobe (right) serve as media specialists for CGRER while pursuing a BA in Journalism and Mass Communication at the UI. Jake also plans to receive a Certificate in Sustainability. Before coming to the UI, Jake served as a writer and editor at the Communique while attending Kirkwood Community College. Elizabeth Stone records a CGRER radio spot with the assistance of student media specialists Cora Bern-Klug and Jenna Ladd. (photo by Joe Bolkcom)

CGRER INTERNS
Jenna Ladd serves as a media specialist for CGRER while working toward an MA in Rehabilitation and Mental Health Counseling. Her CGRER responsibilities include providing blog content, writing radio scripts and generating multimedia coverage of events. She also helped to create CGRER’s new podcast, EnvIowa. Upon graduation, she hopes to integrate climate change action with mental healthcare through the utilization of horticulture and outdoor therapy techniques.

Jake Slobe serves as a media specialist for CGRER while pursuing a BA in Journalism and Mass Communication at the UI. He also plans to receive a Certificate in Sustainability. Before coming to the UI, Jake served as a writer and editor at the Communique while attending Kirkwood Community College.

LEGISLATIVE BREAKFAST
In March, CGRER researchers discussed their work with lawmakers at the annual legislative breakfast reception at the Iowa State Capitol. CGRER sponsors the reception each year with the Iowa Flood Center. The event helps legislators and other public officials learn about the valuable work being done by researchers at the two centers, including research on flood mitigation and other environmental challenges. The event also allows faculty and staff at the centers to gather ideas and learn from state legislators about environmental issues in their home districts.

CGRER members in attendance included Witold Krajewski, director of the Iowa Flood Center and Larry Weber, director of IIHR—Hydroscience & Engineering. The two spoke about the recent $96 million grant from HUD to improve Iowa watersheds (see page 16). Craig Just gave an update on the Iowa Small Community Wastewater Technology Park and Training Program. Chandru Charavaryamath spoke about his work on the mechanisms of lung inflammation following exposure to swine barn air.

In May, CGRER was honored by the Iowa United Nations Association for its communications and outreach efforts. Jerry Schnoor accepted the Garst Media Award for Iowa Environmental Focus, CGRER’s blog devoted to environmental news and research. CGRER was lauded for its outreach efforts that share scientific research and expertise with the general public and policy makers. At the same meeting, Connie Mutel received the Garst Memorial Leadership Award for 2016.

IOWA UNITED NATIONS ASSOCIATION AWARD
A Sampling of Grants Awarded to CGER Members


Diane Debinski (co-PI) received a $439,000 USDA Agriculture and Food Research Initiative (AFRI) grant Adaptive Management of Invasive Species to Enhance Agro-ecosystem Services in Grasslands (2016-2019).

Rahsen Denniston (PI) and colleagues received a $358,417 NSF grant Collaborative Research: Reconstructing Holocene Dynamics of the Indo-Pacific Tropical Rain Belt using Australasian Stalagmites and Coupled Climate Models (2016-19). Cornell College's portion was $104,085.


Witold Krajewski (PI) and Brian Hornbuckle (co-PI) received a $658,439 NASA grant Exploring Utility of SMAP Products for Real Time Flood Forecasting (2016-2019).

Maurine Neiman (PI) received a $7,140 NSF grant Improving Graduate Student Preparedness for Entering the Workforce (2016-2017) and a $19,825 NSF grant Transposable Element Dynamics Across Reproductive Modes and Ploidy Levels in Natural Populations (2016-2018). In addition, she is co-PI on two other grants: a $2,000 Iowa Center for Research by Undergraduates Research Fellow Grant Does Paraldehyde Pressure Drive the Evolution of Life History Variation (Part III) (2016-2017) and a $2,000 Iowa Center for Research by Undergraduates Research Fellow Grant Does Paraldehyde Pressure Drive the Evolution of Life History Variation (Part II) (2015-2016).

Scott Spak (co-PI) received a $100,000 NESI-SES grant Renewable Energy Planning for Smart Communities (2016-17).

Jun Wang is PI or Co-PI (institutional) on three grants. The first is a $99 million NASA Earth Venture grant Multi-angle Imager for Aerosols (2016-26). The UI's portion is $1,267,840. The second is a $1 million NASA grant GeoTASO Measurements of Aerosols and Tropospheric NO2, CH2O, and O3 Vertical Column Density (VCD) in Support of 820L/S-AC (2016-19). The UI's portion $151,116. The third is a $500,000 NSF and USDA grant Management Opportunities to Reduce On-field Losses and the Lifecycle Environmental Consequences of Accelerated Nitrogen Cycling in High Temperature Regions (2016-19). The UI's portion is $102,870.

Rahsen Denniston studies cave formations as part of his research on ancient climate change. (photo by Rahsen Denniston)
CGRER members are helping to educate the next generation of researchers and scientists who will help address the many environmental issues facing the world. Educational efforts during the year included several climate science teaching initiatives and the development of a new graduate program in sustainable water development at the University of Iowa.

**SUSTAINABLE WATER DEVELOPMENT PROGRAM**

A number of CGRER members are involved in a $3 million NSF grant that will establish a Sustainable Water Development Program at the UI. Set to launch in the fall of 2017, the program will train graduate students to address the water, food and energy challenges that face communities with limited resources. This often includes rural areas, agricultural-based communities and developing countries. Around 50 MS and PhD students will be accepted into the program over 5 years. The program will train students to become water professionals as researchers, professors, entrepreneurs, and consultants, as well as civic, professional and global engineers. In addition, a graduate certificate in Sustainable Water Development will be offered to students. The Sustainable Water Development degree will be housed in the Department of Civil and Environmental Engineering and will build upon strengths across the campus in the area of water sustainability. David Cwirney is PI for the grant and director of the program. Michelle Scherer is a co-PI and associate director; Eric Tate, Craig Just, and Gabriele Villarini are co-PIs. Jerry Schnoor, Witold Krajewski and Kelly Baker are senior personnel on the project.

**SCIENCE BOOSTER CLUB PROJECT**

Maurine Neiman received a Community Impact Grant from the UI Office of Outreach & Engagement. The $8,695 grant funds an expansion of the Science Booster Club Project, a partnership between the UI and the National Center for Science Education that has served more than 50,000 children and adults in Iowa. Science Booster Clubs engage in investigational learning about climate change-related topics. Art Bettis (at left) was co-leader of a day-long workshop in June attended by nearly two dozen eastern Iowa K-12 teachers. The workshop taught hands-on activities and lesson plans that educators can use to better connect with their students in the fields of science, technology, engineering and mathematics. Sponsors included the UI Department of Earth & Environmental Sciences, the UI College of Education, the UI State Hygienic Laboratory and the Intensively Managed Landscapes Critical Zone Observatory, an NSF-supported research collaborative that studies the impact agriculture has on land, air and water in the Midwest. In the morning, teachers were at a research site in rural Iowa County learning about hands-on activities and potential field trip opportunities. The teachers took water samples and tested them for metrics such as nitrate levels. In the afternoon, the teachers took part in a curriculum development exercise at the State Hygienic Lab.

**IOWA K-12 CLIMATE SCIENCE EDUCATORS FORUM**

CGRER and the UI College of Education are helping teachers in Iowa K-12 classrooms adapt to new science education standards. The Next Generation Science Standards (NGSS) emphasize investigative learning rather than rote memorization. The standards are the result of a collaborative effort between states and stakeholders in science, science education, higher education and industry. Within the four major domains of physical science—life science, earth and space science, and engineering—students will engage in investigational learning about climate change. Scott Spak of CGRER and Ted Neal of the UI College of Education are leading efforts to ease the transition for educators, including surveying teachers and administrators to see what resources they need to teach climate change science effectively. While the new standards aren’t mandatory for another three years, many school districts are already implementing them. CGRER and the College of Education have hired two graduate research assistants to help implement this project: Susanna Herder is pursuing a MA in Teaching in Secondary Science and Andrea Malek is working on an M$ in STEM Education.

**ENVIRONMENTAL SCIENCE EDUCATOR WORKSHOP**

In October, CGRER hosted the fourth-annual Iowa Climate Science Educators Forum in West Des Moines. The event provided educators, researchers, and students the opportunity to discuss the most up-to-date climate-related research as well as learn methods for engaging students when teaching about climate change. The event, which attracted 45 participants, included presentations by a number of CGRER members. Event organizer David Courard-Hauri presented information on the Iowa Climate Statement 2016. Scott Spak spoke about the Next Generation Science Standards implementation in Iowa. Elizabeth Stone shared educational tools from the Center for Aerosol Impacts on Climate and the Environment. Connie Mueler spoke about her recent book (see page 7) and offered suggestions on how climate scientists can more effectively communicate their work to the general public. Diane Debiniski discussed her research on climate change adaptation within grassland ecosystems, and Rick Cruise shared information about the impacts of increasingly intense rainfall on soil erosion.

**IOWA CLIMATE SCIENCE EDUCATORS FORUM**

In September, Jerry Schnoor taught a four-week course on Climate Change in the UI’s Senior College. The course examined the physical basis of climate change and how scientists know that humans are the major cause of global warming, as well as the ways its effects can be mitigated.

**NEW AGRONOMY COURSE**

Brian Hornbuckle developed a new course for first-year agronomy students, a class that is part of a re-design of ISU’s agronomy undergraduate curriculum that will help students better deal with the increasingly large amounts of data relating to environmental conditions and agriculture. The goal is to prepare students to make science-based decisions relating to the environmental impacts of agriculture. This course was launched in the fall semester and will be taught once a year.
CONFERENCE TRAVEL GRANTS FOR GRADUATE STUDENTS

In 2016, $21,300 was awarded to graduate students advised by CGRER members who were traveling to professional conferences to make oral or poster presentations.

Ibrahim Al-Naisme
Chemistry, UI
American Association for Aerosol Research Conference

Laura Bankers
Biology, UI
International Conference on Polyplody, Hybridization, and Biodiversity

Can Dong
Chemical & Biochemical Engineering, UI
American Geophysical Union Fall Meeting

Oronde Drakes
Geographical & Sustainability Sciences, UI
Annual Meeting of the Association of American Geographers

Junehuan Fan
Geographical & Sustainability Sciences, UI
GIScience 2016

Nicholas Herkert
Environmental Engineering & Science, UI
SETAC World Congress/SETAC North America Meeting

Xu Huang
Chemistry, UI
American Chemical Society National Meeting

Nathan Janechek
Chemical & Biochemical Engineering, UI
American Association for Aerosol Research Conference

Thilina Jayathilake
Chemistry, UI
American Geophysical Union Fall Meeting

Rebecca Kauten
Geographical & Sustainability Sciences, UICGAA Annual Meeting

Kathryn Klarich
Civil & Environmental Engineering, UI
SETAC-Society of Environmental Toxicology & Chemistry Meeting

Joanna Krajewski
Journalism & Mass Communication, UI
American Public Health Association Annual Conference

Yinggang Lai
Urban & Regional Planning, UI
American Planning Association 2016 National Conference

Xikun Liu
Civil & Environmental Engineering, UI
International Symposium on Microbial Ecology

Juliana Lucchesi
Urban & Regional Planning, UI
American Planning Association National Conference

Audrey McCombs
Ecology, Evolution & Organismal Biology, ISU
CREATE Yellowstone Ecosystem Biannual Conference

Kyle McElroy
Biology, UI
International Conference on Polyplody, Hybridization, and Biodiversity

Munir Ahmad Nayak
Civil & Environmental Engineering, UI
Workshop on Bayesian Environmetrics

Finn Piatscheck
Ecology, Evolution & Organismal Biology, ISU
International Fig Symposium

Elizabeth Rumpza
Urban & Regional Planning, UI
American Planning Association National Conference

Muhammed Sermet
Civil & Environmental Engineering, UI
NASA Soil Moisture Active Passive (SMAP) Validation Experiment

Kathleen Goff
Earth and Environmental Sciences, UI
Geochemical Analysis of Fracture Networks in Loess and Till of Iowa: Implications for Modeling Geochemical Evolution of a Quaternary Landscape

Jared Becker
Mechanical & Industrial Engineering, UI
Cooking in Developing Countries, a Solar Solution

Mohamed Elastdani
Civil & Environmental Engineering, UI
NASA Soil Moisture Active Passive (SMAP) Validation Experiment

Camille Kanatz
Natural Resource Ecology and Management, ISU
Assessing the effectiveness of best management practices to increase infiltration in urban and rural environments

Bret Lang
Natural Resource Ecology and Management, ISU
Urban habitat use by butterflies: Adapting protocols for routine monitoring in urban settings

Audrey McCombs
Ecology, Evolution & Organismal Biology, ISU
Using occupancy surveys and genetic analysis to examine the viability of the Parmassius clodius butterfly population in Grand Teton National Park

Camille Kanatz
Civil & Environmental Engineering, UI
Quantifying morphological and chemical trends in mafic eolian environments from Askja, Iceland as an analog to Mars

Michael Sara
Earth and Environmental Sciences, UI
Adapting protocols for routine monitoring in urban settings

Gabriel Perez Mesa
Civil & Environmental Engineering, UI
NASA Soil Moisture Active Passive (SMAP) Validation Experiment

Jared Becker
Mechanical & Industrial Engineering, UI
Using occupancy surveys and genetic analysis to examine the viability of the Parmassius clodius butterfly population in Grand Teton National Park

Kathleen Goff
Earth and Environmental Sciences, UI
Quantifying morphological and chemical trends in mafic eolian environments from Askja, Iceland as an analog to Mars

Michael Sara
Earth and Environmental Sciences, UI
Adapting protocols for routine monitoring in urban settings

Below: Michael Sara in the Icelandic Highlands with volcanoes and glaciers in the background.
CGRER supports research that deepens our understanding of environmental change and provides solutions to local, regional and global problems. Initiatives in 2016 included a major flood mitigation and watershed improvement program in Iowa, research on the forecasting of hurricanes, and efforts to help develop farming practices that will improve water quality.

HURRICANE RAINFALL

Just weeks before Hurricane Matthew caused record flooding in North Carolina, Gabriele Villarini published research in the journal of Hydrology that examined how accurate current forecasting systems are at predicting rainfall from tropical cyclones. Comparing five state-of-the-art weather prediction models, he and his fellow researchers found that current models can forecast reasonably well both where and how much rainfall a tropical cyclone can produce up to two days in advance. However, the forecast’s accuracy decreased drastically when the lead time increased to five days. However, the forecast’s accuracy decreased drastically when the lead time increased to five days.

WaterRESEARCH IN THE IOWA/cedAR RIVER BASIN

A supplemental $200,000 NSF grant is funding research on sustainability, resilience, and adaptive capacity in the Iowa/Cedar River Basin, with a goal of helping farmers to adopt better nutrient management practices and improve water quality despite increasingly severe storms and a changing climate. The project is a supplement to a larger grant from NSF’s Coupled Natural and Human Systems Program, which funds research on the complex ways human actions interact with biological processes. The project involves an interdisciplinary team from four institutions. At the UI, the principle investigator (PI) is David Bennett, with Mariam Muste and Jerry Schnoor serving as co-PIs. Their research includes working with farmers in the Clear Creek Watershed to install sensor equipment that gives real-time information on the interaction between farming practices and water quantity and quality. It is part of the NSF Smart & Connected Communities initiative.

MANAGEMENT OF RESERVOIR RESOURCES

Research at California’s Hydrologic Research Center, which is directed by Konstantine Georgakakos, is being used by the state of California to better manage water resources. Over the past ten years, Georgakakos and colleagues have conducted the Integrated Forecast and Reservoir Management (INFORM) demonstration project, which gives forecasts for inflow into the major reservoirs of Northern California. The success of the project has led California’s Department of Water Resources to use INFORM in its operations. With lead times between six hours and nine months, INFORM helps reservoir managers balance trade-offs between objectives that include water conservation, hydroelectric energy generation, ecosystem health, and flood control. INFORM is also being used by other California agencies to examine potential impacts of climatic changes in reservoir operations.

DUST LINKED TO ASTHMA PREVENTION

Peter Thorne was one of the lead researchers on a study showing a protective effect of agricultural exposures early in life on the development of asthma. The research, which was published in the New England Journal of Medicine, compared the Amish of Indiana and the Hutterites of South Dakota. Even though the two groups share comparable genetic backgrounds, diets, and lifestyles, about 21% of Hutterite children aged 6-14 have asthma while only 5% of Amish children do, which is about half the national average. The study suggests that the farming practices of the two groups help account for the difference. Hutterite communities operate large, industrialized farms while the Amish children often play in dairy farms that are located near the family home. Researchers found that Amish house dust was much richer in microbial products derived from farm animals, which triggers an immune response that helps protect the children from asthma.

Municipal water pipes can become filled with corrosion. (photo by Tang and Poor of Flintwaterstudy.org)

In the aftermath of the water crisis in Flint, Michigan, Jerry Schnoor offered valuable expertise on a national level. In an editorial in the Journal of Chemical Education, he described the ways in which aging water infrastructure, particularly lead pipes and faucets, represent a significant community health hazard in thousands of communities. Old water infrastructure needs maintenance, repair, and replacement, and funds should be established to accomplish this task. In an article in Science, Schnoor and four co-authors wrote that a key concern in tap water is microbial contamination. The U.S. uses residual disinfectant to address this issue, but this process can lead to the formation of potentially carcinogenic by-products, issues with corrosion, and poor taste. They concluded that the drinking water infrastructure in the U.S. is in serious need of investment.
In addition, two Gifu College students, Isao Murase and Masanori Miwa (at right) visited the National Advanced Driving Simulator at the UI’s Research Park. (photo by Iowa Flood Center)

SEED GRANTS

In 2016, CGRER awarded a total of $243,664 in Seed Grants to seven projects.


The Changing Aerosols in the Midwestern U.S. Advanced Tools to Relate Sources, Composition, Climate, and Land Use; Charles Stanier, UI Chemical and Biochemical Engineering, $35,000.

Enhanced Plant Uptake of Contaminants of Emerging Concern under Simulated Global Change Conditions; Gregory LeFevre, UI Civil and Environmental Engineering, $15,000.

An Integrated Photoelectrochemical/Supercritical System for CO2 and Wastewater Utilization, and Fuel Production; Syed Muheen, UI Chemical and Biochemical Engineering, $14,561.

The Argon Computing Cluster on the UI campus is utilized by many CGRER members. (photo by Ben Rogers)

A SAMPLING OF PUBLICATIONS BY CGRER MEMBERS


A tropical cyclone in Australia (photo: Wikimedia Commons)

CGRER AIDS TO RESEARCHERS

CGRER provides high-performance computing and visualization resources to support the interdisciplinary research done by its members and their students. CGRER research is done primarily on shared computing clusters capable of delivering the CPU power and storage needed for high-end parallel computing environments. Two computing clusters, Neon and Argon (which will be fully functional in January, 2017), are located at the UI Research Park at the Olddale campus. CGRER has invested financially in both clusters, which provides our researchers priority when conducting research and analysis.

In addition, the UI has an unlimited site-wide license for all Environmental Systems Research Institute products (ESRI). Jeremie Moen is on the campus GIS Technical Advisory Committee and facilitates campus requests for support.

Isao Murase (second from left) and Masanori Miwa (at right) visited the National Advanced Driving Simulator at the UI’s Research Park.

Toshihiro Kitada, president of the National Institute of Technology, Gifu College traveled from Japan to Iowa to meet with UI President Bruce Harreld to renew a student exchange program between the UI and Gifu College. Kitada also visited CGRER to meet with students to discuss research in environmental modeling. In addition, two Gifu College students, Isao Murase and Masanori Miwa, visited CGRER to learn about U.S. engi- neering education as part of the exchange program.
CGRER members work both regionally and around the globe to address problems relating to environmental change. In 2016, international efforts included combating air pollution in India, South Korea, Africa and China and helping establish global standards for sustainable urban development.

INDIA SMART CITIES PROJECT
Jeremie Moen traveled with a UI team to India as part of a Geospatial Consortium held in association with the India Smart Cities Project. Jeremie showcased CGRER-related research at four Indian cities over a two-week period: Delhi, Ahmedabad, Puducherry and Madurai. His presentations focused on the genesis of CGRER, the work being done by its members in a wide range of fields, and the research it supports. In Delhi, he was joined by former CGRER researcher Sarath Guttikunda, who researches air pollution in India, in a talk at the Sehgal Foundation. During the trip, the team laid the foundation for future collaborations with Indian scientists, who will be taking part in Geospatial Consortium workshops hosted by the UI in 2017.

Sarath Guttikunda and Jeremie Moen in India

HABITAT III’S NEW URBAN AGENDA
In October, Greg Carmichael was a member of the UN World Meteorological Organization (WMO) delegation to the 3rd UN Conference on Housing and Sustainable Urban Development (Habitat III) in Quito, Ecuador. Attended by more than 45,000 people, Habitat III adopted a New UN Urban Agenda for the next 20 years. The document sets global standards for how cities should be planned and managed to promote sustainable urbanization. Carmichael gave a talk on “Climate Change and Urban Disaster Resilience: Current and Future Challenges.”

COMBATING AIR POLLUTION IN INDIA
Greg Carmichael is part of a team of scientists helping to draw attention to air quality issues in India, which has some of the most polluted cities in the world. Until relatively recently, the Indian government has not paid much attention to air quality. The scientists have studied pollution sources in India, both in- and outside of cities. In November, they issued a report outlining 10 steps the Indian government can take to reduce toxic pollutants, including preventing agricultural burning of crop residue and the institution of a new street cleaning program to minimize dust and sand. In addition to having severe health and economic effects, air pollution has significant negative effects on climate. Carmichael’s research group developed the first air quality forecasting system in India, which is now being used in three cities, with a fourth to be added in 2017. In addition, scientists from India spent time in Carmichael’s lab to learn more about forecasting. The project is sponsored by the UN World Meteorological Organization (WMO) Global Atmospheric Watch program.

WINTER HAZE RESEARCH IN CHINA
Greg Carmichael and Meng Gao, a former CGRER PhD student who is now a postdoctoral fellow at Harvard University, have discovered a chemical mechanism that helps explain severe winter haze events in China. Their research, which was published in Science Advances, greatly improves the forecasting of haze events and will help guide more effective control measures. The fine-particle pollution associated with winter haze threatens the health of more than 400 million people on the North China Plain.

VOLCANIC ACTIVITY IN ICELAND
David Peate receieved a $250,479 NSF grant to study volcanic activity in Iceland. Most volcanoes in Iceland are concentrated in a NE-SW rift that traverses the center of the island. This rift marks where two tectonic plates are moving apart, which causes the underlying mantle rocks to rise and melt, forming magma that creates volcanic eruptions at the surface. The reasons are less clear, however, why some volcanoes are found in the Snaefellsnes Peninsula in the western part of Iceland. This project aims to understand why and how the mantle melts in this region by analyzing the chemical composition of the lavas.
NEW MEMBER SPOTLIGHT: JUN WANG

Jun Wang’s broad background serves him well in his new position as a professor in the UI Department of Chemical and Biochemical Engineering with a joint appointment with CGRER and the Iowa Informatics Initiative. His research focuses on the integration of satellite remote sensing and chemistry transport models to study air quality, wildfires, and aerosol-cloud interaction. He has done extensive work with NASA, including serving as a science team member on several of its satellite missions. In addition, he enjoys interdisciplinary work in areas related to public health, agriculture, climate change, renewable energy, supercomputing, scientific visualization, data mining, and education in Earth Science.

NEW MEMBERS

Wei Bao is an assistant professor of Epidemiology in the UI College of Public Health. He has a broad background in biology, medicine, nutrition and epidemiology. He research primarily focuses on nutrition and physical activity in relation to diabetes and obesity across the lifespan. He has a particular interest in identifying biomarkers and mechanisms for diabetes and obesity, with emphasis on gestational diabetes and women’s health. Recently, he has developed a research interest in elucidating the interplay of food and environmental chemicals in human health.

David Courard-Hauri is director of the Environmental Science and Policy Program at Drake University. He has co-authored a series of three environmental science textbooks, and has published modeling work in fields that include carbon sequestration, butterfly movement, cell-signaling, and the psychological drivers of overconsumption. His current research is in the field of ecological economics, where he has challenged conventional metrics in benefit-cost analysis using agent-based modeling, monte carlo simulations and survey instruments.

Steven J. Hall is an assistant professor of Biology at ISU. His research focuses on understanding greenhouse gas production, decomposition, and nutrient cycling across terrestrial and aquatic ecosystems. His study systems include tropical forests, cities, and Corn Belt agriculture. His work includes solutions-oriented sustainability science in addition to basic research.

Aileen Keating is an associate professor of Animal Science at ISU. Her research focuses on reproductive physiology and toxicology. She studies the impact of chemical exposure on female reproduction, including how chemicals can detrimentally affect gamete quality, the ability of the follicle structure housing the oocyte to grow and produce hormones, and DNA damage and repair processes in the ovary. She also studies how the ovary can biotransform chemicals to make them less or more toxic.

Caglar Koylu is an assistant professor of Geographical and Sustainability Sciences and a member of the UI’s Informatics Initiative cluster faculty. His research interests include the development and evaluation of computational and visual methodologies for analyzing spatially embedded networks such as migration, the flow of commodities and information. Analysis of flows using a computational-visualization framework is crucial for understanding and communicating patterns in a variety of areas including disaster management, public health and security, climate, and environmental conservation.

Gregory LeFevre is a UI assistant professor of Civil & Environmental Engineering. His primary research area is non-point source pollutants, which are the leading cause of water quality degradation. He studies the biotransformation mechanisms (e.g., plants, bacteria, fungi) of trace organic contaminants and how to create low-energy, engineered natural treatment technologies that improve water quality.

Ted Neal is a clinical instructor of Science Education at the UI. He serves on the state’s science leadership team, which helped bring the Next Generation Science Standards (NGSS) to Iowa. He is working with CGRER to develop professional development programs and materials for climate science geared to middle and high school teachers, and he serves on the Recreational Services guidance board, helping to introduce the outdoors to students through School of the Wild and Wildlife Camps.

Behrouz Shafei is an assistant professor of Civil, Construction and Environmental Engineering at ISU. His research interests include the vulnerability assessment of structures under mechanical and environmental stressors, the evaluation of uncertainties in aging mechanisms, and the mitigation of disasters in civil infrastructure components.

Gregory Carmichael is a professor of Chemistry at the UI. He is the director of the Environmental Research Laboratory (ERL) and serves on the Recreational Services guidance board. As a UI research faculty, Carmichael works with CGRER to develop professional development programs and materials for climate science geared to middle and high school teachers, and he serves on the Recreational Services guidance board, helping to introduce the outdoors to students through School of the Wild and Wildlife Camps.

Jerald Schnoor is a professor of Civil and Environmental Engineering. His research focuses on the flow of commodities such as migration, the flow of commodities and information. Analysis of flows using a computational-visualization framework is crucial for understanding and communicating patterns in a variety of areas including disaster management, public health and security, climate, and environmental conservation.

Sponsorship: CGRER is directed by University of Iowa professors Gregory Carmichael (Department of Chemical and Biochemical Engineering) and Jerald Schnoor (Department of Civil and Environmental Engineering). Center activities are guided by an elected Executive Committee that consists of twelve members (listed on page 3) plus two co-directors. The Executive Committee meets monthly as needed to plan initiatives and chart CGRER’s course. An Advisory Board of nine members (listed on page 5) from outside the academic community meets annually to lend oversight to CGRER’s activities.

ADMINISTRATION

CGRER employs two full-time staff members. Amy Parker is CGRER’s Research Support Coordinator. Jeremie Moen manages CGRER’s computer facilities with the support of Engineering Computer Services (ECS). In addition, Joe Bolkcom serves as half-time Director of Outreach and Community Education. CGRER reports directly to the UI’s Vice President for Research.
In 2016, CGRER received $729,322 in revenue from investor-owned utilities as mandated by the State of Iowa's Energy Efficiency Act. These funds helped CGRER assist its members in a wide variety of initiatives.

This funding was magnified many times in the research money awarded to CGRER members from other sources. In 2016, CGRER members brought in $20,982,550 in new external research funding.

In 2016, CGRER received $729,322 in revenue from utilities.