



THE CENTER FOR GLOBAL & REGIONAL  
ENVIRONMENTAL RESEARCH



2019 ANNUAL REPORT







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*The names of CGRER members and those affiliated with CGRER are highlighted in boldface throughout this report.*

*Cover photos:*

*Top: View of fire in California from space.*

*(photo by NASA Earth Observatory)*

*Middle: Damage done to homes in the Bahamas by Hurricane Dorian (photo Wikipedia Commons)*

*Bottom: Field of miscanthus grass (photo by Mary Moye-Rowley)*

*This page:*

*Top: The sea (photo by Christian Ferrer)*

*Bottom photo: CGRER is housed in the Iowa Advanced Technology Laboratories on the University of Iowa campus. (photo by Mary Moye-Rowley)*

*Photo page 1: The UI is growing its own energy in the form of miscanthus grass. 2,500 acres are planned and expected to produce 22,500 tons of sustainable and renewable fuel for the campus annually. (photo by Mary Moye-Rowley)*



THE CENTER FOR GLOBAL & REGIONAL ENVIRONMENTAL RESEARCH



## THE CENTER FOR GLOBAL & REGIONAL ENVIRONMENTAL RESEARCH

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 131 members from 16 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.

PROMOTE DIALOGUE AMONG SPECIALISTS AND AGENCIES

EDUCATE STUDENTS AND THE GENERAL PUBLIC

FOSTER AND SUPPORT RELEVANT RESEARCH PROJECTS





**W**e remember 2019 for record-setting weather events in Iowa, the nation, and the world. Nonetheless, students, staff, and faculty at CGRER endeavored to make an impact with sterling environmental research, education, and outreach.

This past year, CGRER funded four Seed Grants for faculty research and awarded travel grants to two dozen students for field research and conference presentations. The Center received \$785,642 in funding from the ratepayers of Iowa utilities, and we leveraged those funds to raise \$17 million in new external research grants. CGRER faculty collaborated on the ninth-annual Iowa Climate Statement and contributed to numerous conferences such as the Iowa City Climate Expo, the Iowa Ideas Conference, and The



*In early March a "bomb cyclone" and spring rains on frozen ground caused record flooding that closed Interstate-29.*

agonizing six-month period resulting in billions of dollars in damages.

**M**eanwhile on the other side of the state, Davenport, Iowa, the largest city on the Mississippi River without a permanent flood wall, faced its own problems. The Mississippi reached a record peak stage at Rock Island and was in flood stage for the longest period on record—51 days—from March 23

through May 12. Alas, on April 30, Davenport's temporary flood wall failed and the downtown flooded. Ditto for Burlington, Iowa, just 100 river miles downstream, where HESCO barriers failed on June 1 after 79 days in flood stage.

All told, Iowa experienced the wettest 12-month period since 1895 when record-keeping began. 50.73 inches of precipitation fell from June 2018 through May 2019. That is about 16 inches greater than the average precipitation of 34.42 inches for baseline years 1980-2010.

Globally, climate extremes were even more horrendous. Precedence was shattered when

a Category-5 storm with 185 mph winds, Hurricane Dorian, parked for more than 40 hours over Abaco and Grand Bahama Island. Can you imagine the terror while hunkering down for two days of 150+ mph winds and a 20 foot storm surge drowning your home?

That's the nature of climate change these days... unprecedented. We all experience it in different ways. In Iowa, it manifests as flooding. In California, wildfires. In Florida as blue sky (King tide) flooding, and in coastal and island nations as storm surge. Nonetheless, it is

*In September 2019, Hurricane Dorian caused extreme damage on Grand Bahama Island.*



**C**limate change is here; it is vicious and it will get worse if we don't stop our greenhouse gas emissions.

Extreme Weather in Iowa panel discussion held in Des Moines. Against this backdrop of business as usual, 2019 was marred by intense weather events and failed policy development at the United Nations' 25th Conference of the Parties in Madrid.

Let's begin by talking about the weird weather. Following a cold winter with heavy snowpack, we witnessed a "bomb cyclone" in early March and spring rains on frozen ground causing record flooding on the Missouri River in Hamburg, Iowa. Levees broke damaging towns, farms and businesses, including Interstate-29. With no rest and continued rainfall, many residents were flooded three times this year during an



*Matthew Dannenberg was awarded a CGRER Seed Grant for his research on the response of forests to recent climate change. (photo by Angelica Gomez)*

all part of the same story. Climate change is here; it is vicious and it will get worse if we don't stop our greenhouse gas emissions.

**I**n October of 2018, the Intergovernmental Panel on Climate Change issued a special report that climate is, if anything, changing faster



*Climate change activist Greta Thunberg in Iowa City. (photo by Jerry Schnoor)*

than models and scientists projected. It was a warning that our opportunity to keep average global warming to less than 1.5 °C (2.7 °F) is rapidly slipping away. Drastic emission cuts must begin soon and reach a level of 45% reduction by 2030 and net zero by 2050 to avoid dire consequences and interference in our climate system. Serious emission reductions require time; time to install wind turbines and solar panels, time to replant forests and sequester carbon in agricultural soils, time to develop a new grid and battery storage technologies, time to research

safe modular nuclear power, and time to transition to electric vehicles and charging stations. Such actions can save the planet while creating good jobs and economic opportunity for the future and our children.

Sometimes it takes a child. On October 4, 16-year-old Greta Thunberg came to Iowa City to strike for climate action. Frustrated by the slow response that the U.S. and the world are making to combat climate change, she challenged us "to be the adults in the room."

It is a crisis. In 2019, we hope that CGRER made a small difference in our state to lay the research foundation for informed climate policy and action. We are grateful for the opportunity.

**Jerald L. Schnoor**  
**Gregory R. Carmichael**  
CGRER Co-Directors



*Greg Carmichael and Jerry Schnoor*

EXECUTIVE COMMITTEE

**Kelly Baker**  
Occupational & Environmental Health,  
University of Iowa

**Rhawn Denniston**  
Geology,  
Cornell College

**Emily Finzel**  
Earth & Environmental Sciences  
University of Iowa

**Gregory LeFevre**  
Civil & Environmental Engineering  
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**Lou Licht**  
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**Corey Markfort**  
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**Heather Sander**  
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University of Iowa

**Silvia Secchi**  
Geographical & Sustainability Sciences  
University of Iowa

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University of Iowa

**Elizabeth Stone**  
Chemistry  
University of Iowa

**H.S. Udaykumar**  
Mechanical & Industrial Engineering  
University of Iowa



*Hurricane Dorian (photo by NASA)*



**MESSAGE FROM  
THE CGRER ADVISORY BOARD**

While last year's Advisory Board Message focused on Cities and Iowa City in particular, this year's message, due to my background, will take a much wider and even global perspective. While now retired, I worked for more than 40 years as a research scientist in the areas of global air pollution, climate change and their mutual interactions. I have been on the Advisory Board since 2007, and I have seen the Board's advice

**T**he actions of Iowa residents have environmental influences far beyond the borders of Iowa.

focus on suggestions for making CGRER more Midwestern and specifically Iowa-centric. This has led to CGRER expanding their local and regional public outreach and participating in numerous conferences focused on Iowa's environmental issues such as those listed in this year's report from the CGRER co-Directors.



*CGRER member Greg LeFevre tests stormwater for contaminants. (photo IHHR staff)*

However, as the Director's report discusses, there is a significant global component to the local and regional environmental issues faced by Iowa and the Midwest in general. First this means that the actions of Iowa residents have environmental influences far beyond the borders of Iowa; for example the nitrate pollution carried down the Mississippi into the Gulf of Mexico where a giant dead zone forms. Even more importantly, the actions of millions and millions of people from all over the world will significantly affect the future environment for all Iowans.

First, we consider water. The relatively good news is that sea-level rise, which is driven by global warming and will continue for many centuries, is not a direct problem for the upper Midwest. On the other hand, its future impact on the Gulf ports at the mouth of the Mississippi as well as the petrochemical industry in the Gulf will have a major impact on the export of agricultural products and the production of fuel and fertilizer. More directly affecting agribusiness in Iowa, as well as life in general, is the expected warming of the Midwestern climate throughout the 21st Century. Associated with that is the predicted increase in severity, if not frequency, of storms and flooding. While far from the ocean, Iowa is bounded by the Missouri and Mississippi Rivers and is fed by numerous smaller Iowa rivers, all of which are susceptible to flooding.

The next issue, which is critical to agribusiness, is the question of local climate. Almost one third of the finest farm land in the US is found in Iowa and that land will not move, even as the climate



*Picnic Area in Bayside, Maryland after Hurricane Sandy (photo Wikipedia Commons)*

changes. Right now, Iowa has an excellent climate for growing its major cash crops with the help of adequate moisture and an appropriate growing season. Current global and regional climate models are not yet good enough to provide realistic predictions of local rain and snow amounts for the rest of the 21st Century. We do know that the wet climates will get wetter and that the dry climates will get dryer. However a detailed

*Megan Lindmark, a graduate student in UI's Civil & Environmental Engineering, studies safe drinking water. (photo by Craig Just)*



*NASA photo showing pollution over the east China Sea.*

prediction for the Midwest is not yet possible. Current global climate predictions are clear that the Iowa climate will warm, though whether it will be warmer and wetter and or warmer and dryer we can not say.

Clearly climate change is going to be a critical issue for the State of Iowa. Unfortunately neither Iowa nor even the US as a whole have much control over climate change anymore. China is the number one emitter

of greenhouse gases and, while we are still number two, we will soon be passed by India. It is unfortunate that the issue has become one of partisan politics in the US, since our only mechanism for minimizing the impact is to convince other countries to follow us. My cynical/realistic advice is to forget about prevention, since I doubt we have the political will to lead, and instead focus on adaptation. Iowa still has all that beautiful farmland. It had better invest in genetic research to modify crops for the coming warmer climate and start to negotiate with Northern neighbors about irrigation water, just in case we are in the group of the dry getting dryer.

**Hiram "Chip" Levy**

*Retired from Geophysical Fluid Dynamics Laboratory, NOAA*

*(At left) CGRER member Steven Hall, ISU, studies a flooded soybean field near Ames in 2018. (At right) UI Sustainability Science students in the field.*



**ADVISORY BOARD MEMBERS**

**Cori Burbach**  
Sustainable Community Coordinator  
City of Dubuque

**Stratis Giannakouros**  
Director of the Office of  
Sustainability and Environment  
University of Iowa

**Tim Harden**  
Alliant Energy

**Kris Kilibarda**  
State Science Consultant for  
the Iowa Department of Education

**Scott Koepke**  
Grow Johnson County  
Hunger Relief Farm

**Jesse Leckband**  
MidAmerican Energy

**Hiram "Chip" Levy**  
Retired from Geophysical  
Fluid Dynamics Laboratory, NOAA

**Brenda Nations**  
Sustainability Coordinator  
City of Iowa City

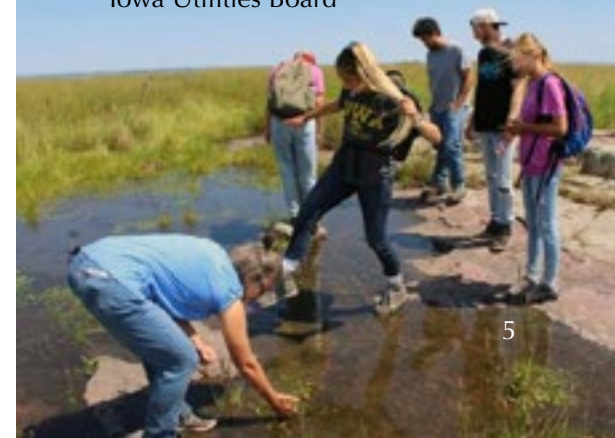
**David Osterberg**  
Occupational and  
Environmental Health  
University of Iowa

**Peter Rolnick**  
Emeritus Professor of Physics  
Truman State University

**Mary Skopec**  
Iowa Lakeside Laboratory  
Regents Resource Center

**Marnie Stein**  
Iowa DNR

**Nick Wagner**  
Iowa Utilities Board







# O U T R E A C H

CGRER members continue to find relevant and engaging ways to communicate the most up-to-date and necessary information regarding research, technological advancements, and educational opportunities to the citizens of Iowa and beyond.

## IOWA CLIMATE STATEMENT 2019: DANGEROUS HEAT EVENTS TO BECOME MORE FREQUENT AND SEVERE

Just weeks after July 2019 became the hottest month in 140 years of record keeping, 216 science faculty and researchers from 38 Iowa colleges and universities came together to endorse the ninth-annual *Iowa Climate Statement 2019: Dangerous Heat Events to Become More Frequent and Severe*.

This statement, which was released on September 18, 2019, warns Iowans in particular and Midwesterners as a whole about the sobering extreme heat projections for the region. Based on the most up-to-date scientific sources, the statement makes clear the urgency of preparing for dangerously hot summers in the coming decades.

"It's time to get serious about reducing greenhouse gas emissions within the next 10 to 15 years," said **Jerry Schnoor**, co-Director of CGRER and Professor of Civil and Environmental Engineering at the University of Iowa. "It is our best hope for lessening the impact of these dire predictions for people in Iowa."

"Heat is the leading cause of weather-related deaths in the U.S.," said **Peter S. Thorne**, director of the University of Iowa Environmental Health Sciences Research Center. "Iowans that work outside will need to take special precautions."



"Many homes, particularly in low-income neighborhoods, are not equipped with air-conditioning," said **David Courard-Hauri**, Chair of Environmental Science and Sustainability, Drake University. "More 90 °F days will place a greater burden on low-income families paying higher energy bills to stay cool in the summer."

"Our furry pets are also vulnerable just like people are," said **Peter Levi**, Assistant

Professor, Department of Environmental Science and Sustainability, Drake University. "Pets kept outdoors or in homes without climate control will be negatively affected, and pets left in vehicles will succumb to the heat more rapidly."

CGRER has released annual climate statements since 2011. These statements, vetted by Iowa's top experts, place pivotal climate change research into an Iowa specific context, encouraging preparedness and resilience in the face of a climate crisis.



Peter Thorne and Jerry Schnoor (photo by Joe Bolkcom)

### Iowa Climate Statement Highlights

- By midcentury, temperatures in Iowa will exceed 90 °F 67 days per year. This is compared to a 23 day average highs in recent decades.
- By midcentury, the average daily high temperature for each year's hottest five day period will be 98 °F, compared to 92° F in recent decades.
- Once per decade, five day average high temperature will be 105 °F.
- Extreme heat is the leading weather-related cause of death in the United States. Low-income neighborhoods, the elderly, outdoor workers (especially construction and farm laborers), and domestic animals are especially vulnerable.
- Confined livestock are at increased risk for death and widespread productivity losses. Producers will need to adjust their operations to deal with extreme heat events.
- Adaptations to increasing heat waves will require expanded disaster preparedness, increased energy use, and curtailment of outdoor work and recreation during times of extreme heat.



## EXTREME WEATHER IN IOWA: PATHS TO EQUITABLE RESPONSE, RECOVERY, AND RESILIENCE



Eric Tate

This past October, CGRER, the UI Center for the Health Effects of Environmental Contamination, and the UI Public Policy Center hosted a symposium on Extreme Weather in Iowa.

The symposium brought together 120 participants from a variety of fields of research and policy work. The goal of this effort was to gather constituencies affected by extreme weather events in Iowa in order to share information regarding prevention, response, monitoring, and long-term recovery from extreme weather related events.

This event was co-sponsored by IHR Hydroscience and Engineering, the Iowa Flood Center, the Iowa Public Health Association, the UI School of Urban and Regional Planning, and the American Planning Association, Iowa Chapter.

The primary focus for the day was on projected climate trends for Iowa that indicate a sobering increase in hot days along with continued extreme precipitation events. An embedded theme throughout the symposium was the issue of addressing equity in ensuring all Iowans are prepared and able to recover from natural disasters. Additional topics of conversation for the day included an overview of weather trends in Iowa, as well as panel discussion on policy making, extreme heat, and flooding.

## MARCELO MENA PRESENTS AT WITCHING HOUR

This past November, CGRER member and University of Iowa Distinguished Alumni recipient Marcelo Mena spoke at Iowa City's historic Englert Theatre as part of the community-wide Witching Hour festival, a free program dedicated to exploring the unknown, discussing creative process, and presenting new work.

Mena completed his doctorate at the UI in Civil and Environmental Engineering. Since that time, he has served as Chile's Minister of the Environment where he led nothing short of an environmental revolution by ratifying some of the world's most progressive environmental policies, and bringing the global south to the forefront of international debate at multiple climate summits from 2014-2018. He currently serves as the World Bank's climate advisor to the CEO, where he recently led the creation of a new Coalition of Finance Ministers for Climate Action that has united 40 countries to mainstream climate change in investment processes.

Mena's Witching Hour talk was titled "From Impossible to Inevitable: How Climate Action is Mainstreamed Globally."

To anchor this point, Mena spoke specifically about his time at Iowa in the early aughts. "I thought it was a good idea to look back at what we presented to be the future when I was at Iowa," Mena said. "We thought the state would be a powerhouse in renewable energy. Using the University of Iowa facilities as an excellent learning opportunity, we were exposed to combined heat, power, and energy efficiency."

Mena compared this vision of the future with what has over the course of a decade, for good and for bad, come to pass. "In time, renewable energy from wind has been a substantial part of what Iowa has to offer on power generation."



Greg Carmichael, Marcelo Mena, Rich Valentine and Jerry Schnoor

Mena went on to draw comparisons between Iowa and Chile. "In my home country, solar energy and electromobility have had substantial progress," Mena said. "The sustainable future we thought impossible today is inevitable."

Mena spoke about how the financial markets are reacting to climate demands and he concluded his talk with a strong call to shut down the UI's coal fired power plant.

On this call to action, Mena said, "it served its purpose but it is not aligned to the Paris Agreement. We should declare a climate emergency and should move to a 100% renewable, net zero emissions future based on evidence, economics, and without any ideology except the ideology of believing that kids should aspire to a safe climate future. It is therefore great for the Climate Strikers to pick up on our Coal or Classes Campaign from 2005. It was very inspirational for me to see what they have done, and I am proud that they introduced me."





An interactive map of Iowa's counties on The Peoples' Weather Map website.

## PEOPLES' WEATHER MAP

**Barbara Eckstein**, Professor of English at the UI, alongside Jim Giglierano, Mark NeuCollins, **Eric Tate**, Kevin Ripka, and Steve Gottschalk, have created *The Peoples' Weather Map* website.

This site offers historical and recent severe weather stories for all of Iowa's 99 counties, interviews with Iowa climate scientists, and information about the major weather hazards

affecting Iowa. It also provides opportunities for the public to engage with and expand the sites stories.

The project has benefited from the support of CGRER as well as ICRU, Humanities Iowa, the Digital Bridges Project, and, most of all, the Iowa State Historical Society. To add your story visit [www.peoplesweathermap.org](http://www.peoplesweathermap.org).

## CITY OF IOWA CITY CLIMATE ACTION AND ADAPTATION PLAN



The Iowa City Council established a community-wide greenhouse gas emissions target and has created its first **Climate**

**Action and Adaptation Plan** to develop strategies to achieve its emissions target.

In September of 2018, the Council approved a resolution setting community-wide greenhouse gas reduction goals of 26-28% for the year 2025 and 80% by 2050. The baseline year for these reductions was 2005. At the time the reduction goals were set, they were in

alignment with the U.S. targets set by the Paris Agreement and agreed upon for the United States by President Obama in 2016. These recommendations were set forth by the 11-member Climate Action Council which includes CGRER members **Stratis Giannakouros** (UI representative) and **Jesse Leckband** (MidAmerican representative), and was overseen by **Brenda Nations** (City of Iowa City Sustainability Coordinator).

Then in August of 2019, the Council approved new emissions goals in accordance with updated goals from the Intergovernmental Panel on Climate Change (IPCC): reduce

carbon emissions by 45% from 2010 levels by 2030, then net zero carbon emissions by 2050.

The Climate Action toolkit was created as a resource guide to provide residents, businesses, schools and community-based organizations with information to take steps in reducing the City's community-wide greenhouse gas emissions.

On November 15, 2019, the Council released a 100 Day Report on Accelerating Climate Actions. The full report, along with the Iowa City Climate Action Pledge and checklist for homes and businesses, can be read on the City of Iowa City website.

## IOWA CITY RESPONDS

- Iowa City Gateway Project was completed, raising Dubuque Street and replacing the Park Road bridge.

- The City's curbside recycling program expanded significantly with a 27% increase in recyclables.

- Electric vehicle charging stations were added to City parking ramps.

- 11 Community Climate Action grants were awarded.

- Bike lanes were added and enhanced.

- An Equity-Diversity-Inclusion fellow joined the City for a 12-week fellowship and compiled a report on local equity and climate change issues.

- Iowa City joined Coralville and UI in launching a local transit study.



- Iowa City, taking the lead among its eastern Iowa community partners, received an Electric Vehicle Readiness grant.



Top left; IHR director Gabriele Villarini and Rep. Cindy Winkler.



Top right; IHR Director Gabriele Villarini and Senator Liz Mathis.



Above; Iowa Flood Center Director Witold Krawjewski and Senator Jackie Smith.



## LEGISLATIVE BREAKFAST RECEPTION

This past March, the Iowa Flood Center hosted its annual Legislative Reception at the Iowa Statehouse. Each year, this reception provides a unique opportunity to update policy makers about the Iowa Flood Center's work to make Iowa communities and farms more resilient to extreme rain events and flooding and share new initiatives.



## GRETA THUNBERG IN IOWA CITY

On October 4, 16-year-old Greta Thunberg came to Iowa City to strike for climate action. Frustrated by the slow response that the U.S. and the world are making to combat climate change, she challenged us "to be the adults in the room."







## IOWA ENVIRONMENTAL FOCUS

CGRER's blog, *Iowa Environmental Focus*, features daily environmental news, reports on faculty research, and analysis of leading environmental issues impacting Iowa and the world. The blog is compiled and written by the team of CGRER communication Interns who capture photos and video pertaining to relevant environmental topics. In addition to the Iowa Environmental Focus, CGRER engages Iowans through Facebook and Twitter.

A recent post on the blog was "Researchers call for 'peak meat' to limit emissions by 2030," an article that explores an effort made by a group of scientists to stabilize or decline global meat production by 2030 in order to reduce global carbon emissions.

Subscribe to receive notifications about the most recent posts at [www.iowaenvironmentalfocus.org](http://www.iowaenvironmentalfocus.org).



Kasey Dresser, Julia Poska, Julia Shanahan, Tyler Chalfant and Joe Bolkum, Director of Outreach and Community Education.

## CGRER 2019 INTERNS

Kasey Dresser is a senior at the UI pursuing an honors BA in Political Science, a certificate in Writing, and minors in International Relations and Cinema. Dresser is from San Diego, CA, and is an active member on campus through her involvement in multiple student organizations. After graduation, she hopes to move to Washington D.C. to work in government and continue to increase public knowledge about the importance of issues like climate change.

Julia Poska is from Woodridge, IL and is a senior Journalism and Geography student at the UI. Poska has published work in the Daily Iowan, Civil Eats, and the Dubuque Telegraph Herald. After graduation, she hopes to fully enter the news media and eventually cover science, environment, and food systems news exclusively.

Julia Shanahan is a third-year student at the UI pursuing a double-major in Journalism and Political Science with a

minor in International Relations. Shanahan is the assistant politics editor at The Daily Iowan and along with the agriculture beat, she coordinates coverage of presidential candidates visiting the state ahead of the 2020 Iowa caucuses. Shanahan has worked on multiple in-depth stories about the difficulties Iowa farmers face, including changing weather patterns and public scrutiny amid climate change reports. After graduation, she hopes to continue with political reporting.

Tyler Chalfant is a fourth-year student at the UI where he studies English and Creative Writing with a minor in Cinema. Chalfant works with the Center for Worker Justice of Eastern Iowa, and is an active member of several student organizations. His coursework has provided him with an understanding of the complexity and significance of environmental issues. After graduation, he plans to study law and pursue a career as an advocate of social and environmental justice.

Sara E. Mason, UI Associate Professor of Chemistry (at left), is the voice of CGRER's weekly *On The Radio* environmental news segment. These short one-to-two minute segments highlight the work of CGRER members as well as current Iowa environmental news and issues. The weekly radio segment is shared with nearly 80 Iowa radio stations and is available on the *Iowa Environmental Focus* blog.

Recent segments included "Ohio's bug invasion," "Drinking water and your health," and "Chimpanzees feel anxiety, too." Episodes are available for download and are all transcribed. To receive weekly updates or to submit story suggestions, contact [cgrerresearchfocus@gmail.com](mailto:cgrerresearchfocus@gmail.com).



## A SAMPLING OF AWARDS, ACHIEVEMENTS & APPOINTMENTS



Ibrahim Demir

**Ibrahim Demir** received the *Preparedness, Technology and Innovation Award* presented by South Dakota Emergency Management Association for his project "Big Sioux River Flood Information System."



Gregory LeFevre

**Gregory H. LeFevre** received the 2019 National Science Foundation *CAREER Award*. He also received the Royal Society of Chemistry *Best Paper in Environmental Sciences for Critical Review*, and was an invited speaker at the American Chemical Society's Great Achievements in Environmental Science & Technology Ceremony.



Ulrike Passe

**Ulrike Passe** received a National Science Foundation Award for "Developing a Convergence Sustainable Urban Systems (SUS) Agenda for Redesigning the Urban-Rural Interface along the Mississippi River Watershed," a project with the goal of developing a transdisciplinary research agenda to address large-scale problems such as nutrient runoff, erosion, flooding, heat island effects, and urban sprawl at the urban/rural interface.



Beiming Tang, Megan Christiansen, Charles Stainer, Marisol Contreras and Nate Janecek

**Charles Stainer's** students (above) received several awards. Nate Janecek was awarded Second Place Winner of the 2019 AIChE *Environmental Division Graduate Student Paper Award* for his research work "Physical properties of secondary photochemical aerosol from OH oxidation of a cyclic siloxane." Megan Christiansen received the *Arthur Vetter Award for Excellence in Service Award* presented by the UI Department of Chemical and Biochemical Engineering. Beiming Tang received second place in the Student Research Presentation Competition at the Chinese American Chemical Society Great Lakes Chapter Conference. Marisol Contreras received the *Best Poster Award* in the Green Chemical and Energy Technology Category at the UI College of Engineering Research Open House.



**Eugene Takle** (above) was the keynote speaker at the Canada-United States Law Institute 43rd Annual Conference held this past March at Case-Western Reserve University School of Law in Cleveland, OH. Takle delivered a speech titled "Can the United States and Canada cooperate on Climate Change?"



Yi Wang pictured with his PhD committee: Greg Carmichael, Jun Wang, Yi Wang, Charlie Stainer and Marc Linderman. On screen is Daven Henze. (photo by Andrea Flaherty)

**Jun Wang's** student Yi Wang has been granted the first Ph.D. by the University of Iowa's newly formed Geoinformatics program.

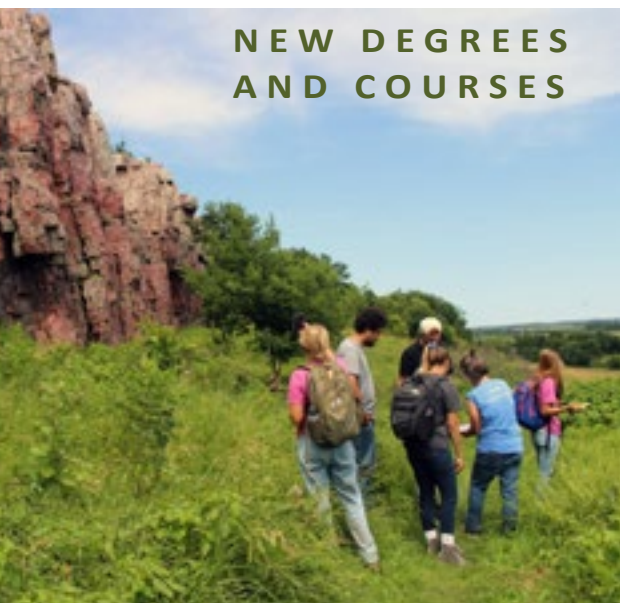




# EDUCATION

The educational efforts made by CGRER members influence the world both in and beyond the walls of academic institutions. This past year, CGRER awarded \$119,916 in Seed Grants to four projects and through numerous travel grants made it possible for graduate students to attend conferences and complete important research.

## NEW DEGREES AND COURSES



(Above) Sustainability Science students in the field.

(At right) Scott Spak teaching the new course Generational Planning: Envisioning Regenerative Cities. (photo by Michael Guhin)

The UI is now offering a new Bachelor of Science degree. The Sustainability Science major is built on an integrative curriculum with course work in the social, natural, and analytical disciplines. The degree is designed to provide students with the knowledge and skills needed to help build a more sustainable future in Iowa, the United States, and around the world. The Sustainability Science program cultivates students who are forward thinking, able to envision a future with equity, high environmental quality, and economic opportunity, and are equipped to work towards that future.

This past spring, **Scott Spak** taught a new course at the UI campus in the Urban and Regional Planning department called Generational Planning: Envisioning Regenerative Cities. This is the world's first undergraduate course on regenerative cities.



## UI STUDENTS IMPLEMENT CLIMATE ACTION PLAN

In the spring of 2019, students in **Scott Spak's** Environmental Policy & Management course developed the initial Implementation Plan for the City of Iowa City Climate Action Plan. To help implement this plan, The City of Iowa City has been awarded \$200,000 REAP grant from the Department of Natural Resources for ecological restoration work at Terry Trueblood Recreation Area. This is the first municipal parks climate adaptation plan to be implemented in the state of Iowa.

The grant funds will be used to remove invasive species and promote woodland restoration in the area of Terry Trueblood between the lake and the Iowa River. Similar REAP grants were received in 2017 and 2018 for ecological restoration work in Hickory Hill Park. The Iowa City 2017 Natural Areas Plan prioritized these sites as unique and important natural areas for Iowa City residents.

At right: Terry Trueblood Recreation Area in Iowa City (photo by John Johnson)



## SCHNOOR RECEIVES ACS AWARD



Jerry Schnoor receives the American Chemical Society Award for Creative Advances in Environmental Science and Technology. (photo by Loris Guzzetta/ACS)

**Jerald Schnoor**, CGRER co-director and UI Professor of Civil and Environmental Engineering, has received the American Chemical Society Award for Creative Advances in Environmental Science and Technology.

At the ACS annual meeting this past spring, Schnoor was honored for his work pioneering the science and practice of phytoremediation, a natural, green, and cost-effective means of using plants to clean hazardous waste sites, contaminated soil and groundwater, and agricultural runoff. The ACS award is given each year to encourage creativity in research and technology or methods of analysis to provide a scientific basis for informed environmental control decision-making processes, or to provide practical technologies that will reduce health risk factors.

## SEED GRANTS

In 2019, CGRER awarded a total of \$119,916 to four projects

*Once and future forests: Exploring divergent responses of Douglas-fir and limber pine to recent climate change in the central Rocky Mountains.*  
**Matthew Dannenberg**, UI Geographical and Sustainability Sciences, \$30,000.

*Extreme Heat Adaptation Strategies for Buildings and Neighborhoods in the Upper Midwest Using Novel Urban Energy Modeling Techniques.*  
**Ulrike Passe**, ISU Department of Architecture, \$29,999.

*Growing the urban forest: Uncovering relationships that shape urban forests and understories in agricultural cities.*  
**Heather Sander**, UI Geography and **Stephen Hendrix**, UI Biology, \$29,997

*Development of a proxy record of El Niño/Southern Oscillation (ENSO) from Colombian Stalagmites during the last 6,000 years.*  
**Alan Wanamaker** and **Juan Carlos Romero Gelvez**, ISU Department of Geological and Atmospheric Sciences, \$29,920.



Alan Wanamaker and Juan Carlos Romero Gelvez, outside the cave containing Colombian Stalagmites.



Heather Sander and students work in the field.



Matthew Dannenberg coring limber pine in Wyoming. (photo by Angelica Gomez)



## A SAMPLING OF GRANTS AWARDED TO CGRER MEMBERS

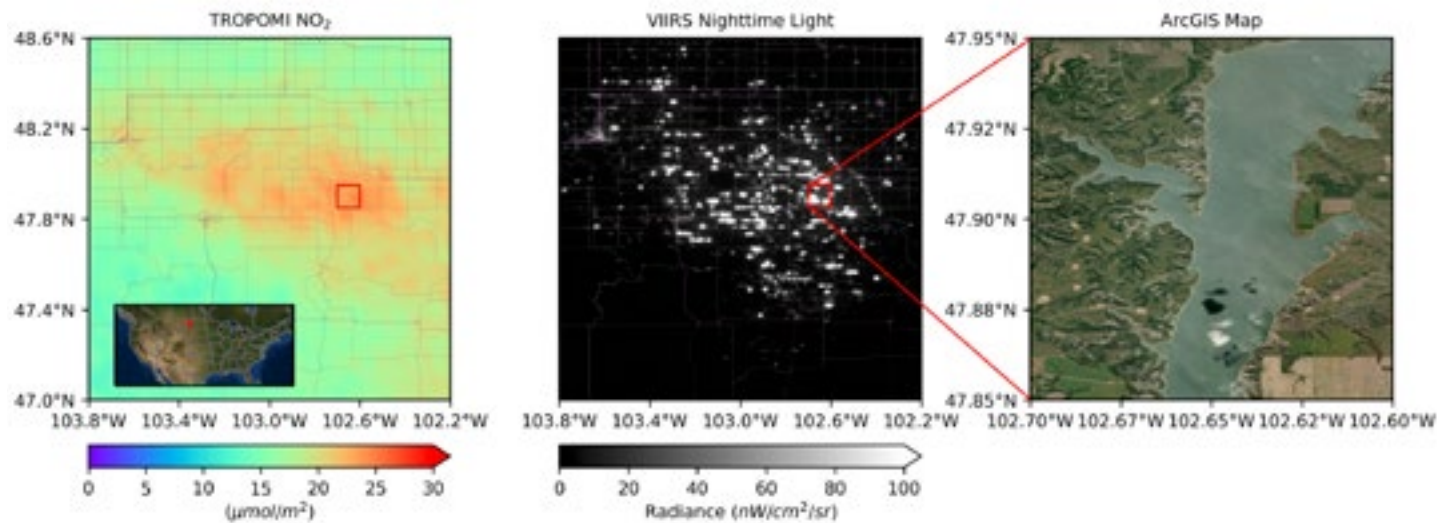
**Ibrahim Demir** was PI on a \$1-million NSF grant for “Framework: Software: Collaborative Research: CyberWater: An open and sustainable framework for diverse data and model integration with provenance and access to HPC.” He was also co-PI on “Connecting Rural and Peri-urban Farmers to Demonstrate and Disseminate Innovative Nutrient and Sediment Reduction Practices,” a \$1-million EPA grant (2019-2022).

**Steven Hall** was PI on a \$476,381 grant from the Iowa Nutrient Research and Education Council for “Environmental and agronomic assessment of microbial nitrogen fertilization technologies in corn cropping systems” (2019-2022).

**Gregory H. LeFevre** received a \$500,000 NSF Career Award. It is the most prestigious NSF honor for early-career faculty who demonstrate the potential to serve as role models in research and education. LeFevre is PI on “Toward Resilient Stormwater Quality Practices: Biotransformation for Sustained Removal of Emerging Contaminants” (2019-2024).

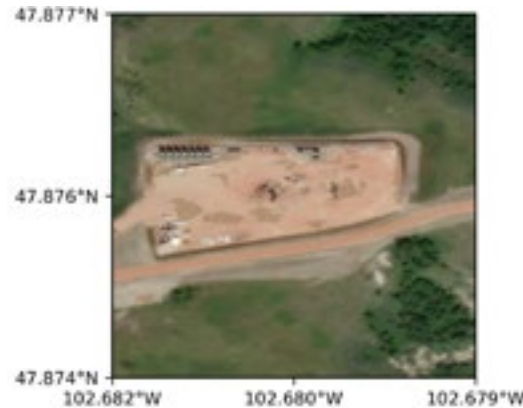


Greg LeFevre takes water quality measurements to test pharmaceutical dynamics in an Iowa stream and their impacts to fish.



**Jun Wang** was PI on two grants. A \$560,000 NASA ACOMAP grant for “Multi-sensor (OMI, OMPS, VIIRS, and TROPOMI) constraints and downscaling of NOx emissions in the continental U.S. during 2005-2018 and beyond” (2019-2022); as well as a \$1.65-million USDA National Institute of Food and Agriculture grant for “SCC: An integrated and smart system for irrigation management in rural communities” (2019-2023).

The left and center figures above show NO<sub>2</sub> air pollution observed by TROPOMI and nighttime light observed by VIIRS over North Dakota during March to May, 2019, respectively. The NO<sub>2</sub> air pollution is caused by oil fracking activities which emit NO<sub>x</sub>. Changes of surface type due to oil fracking activities are shown by the right figure above. The right figure shows oil fracking facilities.



## CONFERENCE TRAVEL GRANTS FOR GRADUATE STUDENTS

In 2019, \$24,305. was awarded to graduate students advised by CGRER members who traveled to professional conferences to make oral or poster presentations.



Seven students from the UI Urban & Regional Planning Department received CGRER travel grants to attend the National Planning Conference in San Francisco in April. They are Jocelyn Borjas, Zhi Chen, Michael Delp, Jasmine Frias, Reuben Grandon, Fernando Oliveira, and Seth Thomas.

The American Geophysical Union held their Centennial meeting in San Francisco. UI Civil & Environmental Engineering students Jessica Ayers, Ganesh Raj Ghimire, Navid Jadidoleslam, and Zhiqi Yang received CGRER travel grants to attend the meeting. Also attending was Meng Zhou of UI's Informatics Initiative.

CGRER Travel Grants were also awarded to:

Bako, Christian  
Civil & Environmental  
Engineering, UI  
*Association for Environmental  
Engineering and Science  
Professors Research and  
Education Conference*

Bilenky, Moriah  
Horticulture, ISU  
*American Society for  
Horticultural Science  
Conference*

DeYoung, Jessica  
Chemistry, UI  
*American Chemical Society  
Meeting*

Dolle, Christopher  
English, UI  
*The Association for the Study of  
Literature and Environment*

Ewald, Jessica  
Civil & Environmental  
Engineering, UI  
*Association for Environmental  
Engineering & Science Professors  
Research and Education  
Conference*

Keehner, Steven  
Anthropology, UI  
*Society for American  
Archaeology Annual Meeting*

Kauten, Rebecca  
Geographical & Sustainability  
Science, UI  
*TRIECA Annual Stormwater  
Conference*

Li, Yanlin  
Civil & Environmental  
Engineering, UI  
*American Chemical  
Society Meeting*

Lindmark, Megan  
Sustainable Water  
Development, UI  
*Colorado Wash Symposium*

Luna, Javier  
Chemistry, UI  
*American Chemical  
Society Meeting*

Mahadev Bhat, Sanjana  
Biomedical Sciences, ISU  
*American Thoracic Society*

McFadden, Monica  
Civil & Environmental  
Engineering, UI; *American  
Chemical Society Meeting*

Nada, Majid  
Chemistry, UI  
*American Chemical  
Society Meeting*

Nagorzanski, Matthew  
Civil & Environmental  
Engineering, UI; *American  
Chemical Society Meeting*

Rahman, Md Asif  
Geographical & Sustainability  
Sciences, UI  
*AAG Annual Meeting*

Shrestha, Denusha  
Biomedical Sciences, ISU  
*American Thoracic Society*

Simmer, Reid  
Civil & Environmental  
Engineering, UI; *American  
Chemical Society Meeting*

Wiener, Erica  
Civil & Environmental  
Engineering, UI; *Association for  
Environmental Engineering and  
Science Professors Research and  
Education Conference*

Sermet, Yusuf  
Electrical & Computer  
Engineering, UI;  
*Special Interest Group on  
Computer Graphics and  
Interactive Techniques  
Conference*

Teng, Jian  
Mechanical Engineering, UI  
*North American Wind Energy  
Academy Conference*

Thines, Jennifer  
Earth & Environmental Sciences,  
UI; *Goldschmidt Conference*



# RESEARCH

CGRER is committed to advancing research efforts to more fully understand the impacts of environmental change. This valuable research provides real-life solutions to local, regional, and global environmental problems.



Marty Scholtz

## NEWLY APPOINTED UI VP OF RESEARCH

Marty Scholtz is the newly appointed Vice President of Research at the University of Iowa. Prior to joining the UI in June of 2019, Scholtz served as the Executive Associate Vice President for Research at Texas A&M University, where he held faculty appointments in the departments of Biochemistry & Biophysics, Molecular & Cellular Medicine, and Medical Biochemistry and Genetics.

In his time at Iowa, Scholtz has been quick to recognize the importance of the interdisciplinary work done by CGRER members. "CGRER is a model for the way the University of Iowa and our

partners are tackling one of the societal grand challenges: changes in the environment, climate and weather," Scholtz said. "The interdisciplinary nature of the center with over 100 members across the university, state, and beyond in all fields is exactly the type of approach and team needed to address this type of complicated and multifaceted problem."

One such way these complicated problems are addressed by CGRER members is that they can have a real impact on the larger community. We need faculty that is doing cutting edge research, but we also need to be able to convey that research to the general public," Scholtz said.



University of Iowa (photo by Amy Parker)

## FLYING THROUGH A FIRE CLOUD

Two UI professors recently participated in Fire Influence on Regional to Global Environments and Air Quality (FIREX-AQ), a joint venture led by NOAA and NASA designed to investigate the impact on air quality and climate from wildfires and agricultural fires across the continental United States.

For two weeks this past summer, **Jun Wang**, Professor of Chemical and Biochemical Engineering, traveled with UI graduate student Tyler Van to Boise, Idaho, while **Gregory Carmichael**, also a Professor of Chemical and Biochemical Engineering and CGRER co-Director, traveled to Salina, Kansas. Assistance for the project was provided by former

CGRER student and current UCLA professor, Paolo Saide, as well as CGRER PhD student Gonzalo Ferrada, who spent one month in the field providing forecast support of the experiment.

Through the FIREX-AQ campaign, scientists work to understand the composition and chemistry of smoke in order to better understand its impact on air quality and global climate. "We were there to forecast fire weather and predict where fires will occur," said Wang. "As well as to learn whether or not fires can be intensive enough to generate convective clouds."

Fire clouds, or what are known to atmospheric scientists as

## CURRENT MEMBER FEATURE: JUN WANG DEVELOPS SMARTER SUSTAINABLE FARMING

**Jun Wang**, professor of Chemical and Biochemical Engineering at the UI and Assistant Director for the Center for Computer-Aided Design, has been awarded funding to design and implement smart technology to maximize crop yields and use water more efficiently in rural agriculture.

The four-year, \$1.6-million grant from the U.S. Department of Agriculture will allow a team of UI engineers to design and build smart sensors that measure soil moisture and temperature, air temperature, and humidity levels. Once collected, this data will be transmitted to a cloud

computing storage system. Using a customized app, farmers will be able to access this collected information.

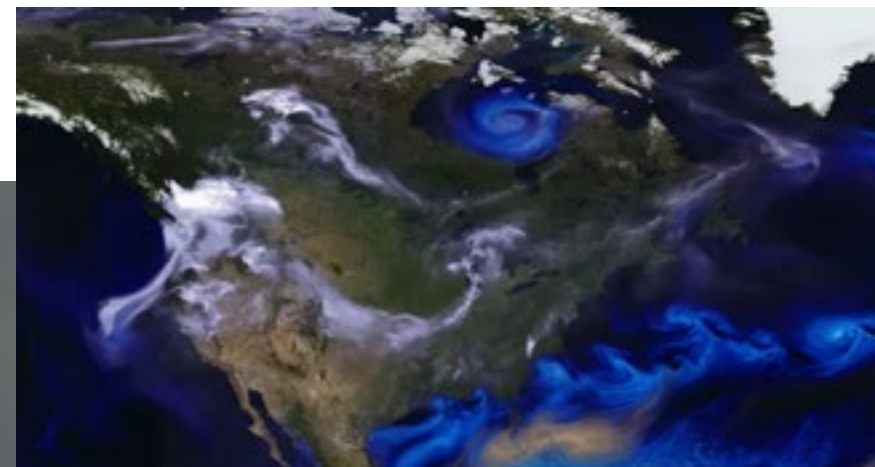
The data gathered from the sensors and models will be used to monitor weather, crop growth, and the economy in order to help decide the most efficient, sustainable use of water to maximize crop yields in areas where mostly groundwater is used. This practice is known as irrigation scheduling.

The project will take place in rural western Nebraska where farmers have relied on drawing water from the Ogallala Aquifer as an irrigation source.



Jun Wang

As part of the Iowa Informatics Initiative, Wang worked with Information Technology Services at the UI and Protostudios Iowa City to develop the proposal. Wang's team will partner with researchers at the University of Nebraska-Lincoln and the University of Illinois-Champaign-Urbana.



(Above) The FIREX-AQ DC-8 plane in Boise, Idaho preparing for take off. (photo by S. Hall)

(At left) Satellite image of smoke plumes across the United States. (photo by NASA)

(Below) Interior of the DC-8 research plane. (photo by NASA)

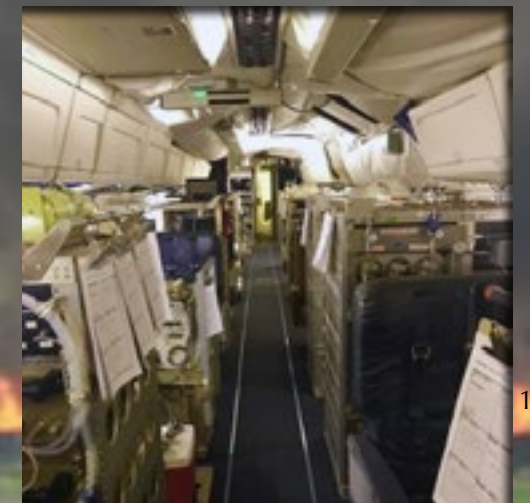
(Background) Fire line. (photo by NASA)

pyrocumulonimbus (pyroCb) or cumulonimbus flammagenitus, are caused when fires generate enough heat and moisture into the atmosphere to produce thunderstorms. As part of the FIREX-AQ campaign, the team was able to board NASA's DC-8 flying laboratory as it passed directly through a pyroCb as it rose from a fire in eastern Washington.

"Wildfires and agricultural fires are major sources of smoke and adversely impact air quality,"

Carmichael said. "CGRER was heavily involved in this whole process. Our groups were able to provide daily forecasts of smoke plumes which were used to assist in the daily planning of where to fly the aircraft to obtain the desired data regarding fire evolution and smoke dispersion."

As members of this team, Wang and Carmichael were present for the most detailed sampling of pyroCb that has, to this point, taken place.





## FIELD RESEARCH TRAVEL GRANTS FOR GRADUATE STUDENTS

In 2019, \$9,522 was awarded to graduate students advised by CGRER members who traveled to sites to complete field research for their thesis or dissertation.



Oak Galls  
(photo by Sofia Sheikh)

Aline Blasizzo, Earth & Environmental Sciences, UI  
*A textural analysis of the 1961 lava flow in Askja, Iceland for martian analog studies.*

Braden Krien, English, UI  
*Magazine Ecology: Environmental Knowledge Infrastructures in 19th and 20th Century Periodicals.*

Megan Lindmark, Civil & Environmental Engineering, UI  
*Evaluating a semi-autonomous Smart Chlorinator design to optimize system uptime and safe drinking water in rural Nicaragua.*

Jose Lopez, Ecology, Evolution, and Organismal Biology, ISU  
*Phylogeography of a Mutualistic Symbiosis host species and its parasite.*

Sofia Sheikh, Biology, UI  
*Revealing drivers of diversity in North American oak galls wasps and their natural enemies.*

Jennifer Thines, Earth & Environmental Sciences, UI  
*Mechanisms of the formation and eruption of large-volume silicic magma revealed by experimental petrology and shock tube experiments.*

## IN HER WORDS: UI GRADUATE STUDENT ALINE BLASIZZO

Aline Blasizzo is a second year graduate student at UI pursuing a masters degree in Geoscience. This past July, she traveled with a team from Iowa under the guidance of Ingrid Ukstins to Askja, Iceland to conduct field work.

The CGRER Field Research Travel Grant has assisted me in obtaining data necessary for my master's thesis project. The goal of my research is to characterize the large and small-scale textures of the 1961 lava flow in Askja, Iceland and apply it to martian lavas.

Aline Blasizzo



Along with five other research colleagues, I completed a two-week field campaign to collect samples and topographic profiles that would create an encompassing data set of the different textures found in blocky a'a lava and ropey smooth pahoehoe lava.

The crisp, bright mornings in Askja created a mystifying aspect of the already natural atmosphere, optimistically setting



Megan Lindmark works with a semi-autonomous Smart Chlorinator. (photo by Craig Just)



Jennifer Thines conducts research in large volume silicic magma.

us up to complete traverses over an unsuspectingly intense one-mile swath over the lava flow. During these traverses, we took note of a variety of textures with respect to their relative elevation and overall position in the entire eruption sequence.

With great thanks to CGRER, I was able to collect the necessary data to present a poster of my research at the American Geophysical Union conference, the largest scientific meeting pertaining to earth and space sciences in the United States. I reconnected with old colleagues and acquainted myself with new people and research that will help me progress in my analysis of the 1961 lava flow.

The easternmost edge of the 1961 lava flow in Askja, Iceland. To the left is where the lava flow terminated at the end of the eruption. (photo by Aline Blasizzo)

## A SAMPLING OF PUBLICATIONS BY CGRER MEMBERS

**Bao, W.,** B. Liu, D.W. Simonsen, and H.J. Lehmler. Association between exposure to pyrethroid insecticides and risk of all-cause and cause-specific mortality in the general US adult population. *JAMA Internal Medicine*, doi:10.1001/jamainternmed.2019.6019.

**Dannenberg, M.P.,** E.K. Wise, and W.K. Smith. Reduced tree growth in the semiarid United States due to asymmetric responses to intensifying precipitation extremes. *Science Advances*, doi:10.1126/sciadv.aaw0667.

Yildirim, E. and **I. Demir.** An integrated web framework for HAZUS-MH flood loss estimation analysis. *Natural Hazards*, doi:10.1007/s11069-019-03738.



**Hall, S.J.** and C. Ye. Mechanisms underlying limited soil carbon gains in perennial and cover-cropped bioenergy systems revealed by stable isotopes. *Global Change Biology-Bioenergy*, doi:10.1111/gcbb.12657.

Muerdter, C.P. and **G.H. LeFevre.** Synergistic Lemna Duckweed and Microbial Transformation of Imidacloprid and Thiacloprid Neonicotinoids. *Environmental Science and Technology Letters*, doi:10.1021/acs.estlett.9b00638.

Xu, H., M. Windsor, **M. Muste,** and **I. Demir.** A Web-Based Decision Support System for Collaborative Mitigation of Multiple Water-related Hazards using Serious Gaming. *Journal of Environmental Management*, doi.org/10.1016/j.jenvman.2019.109887.

Tao, Y.X., Y. Zhu, and **U. Passe.** Modeling and Data Infrastructure for Human-Centric Design and Operation of Sustainable, Healthy Buildings through a Case Study. *Building and Environment*, doi.org/10.1016/j.buildenv.2019.106518.

Yoder, L., A.S. Ward, **K.E. Dalrymple, S.N. Spak,** and R. Lave. An analysis of conservation practice adoption studies in agricultural human-natural systems. *Journal of Environmental Management*, doi: 10.1016/j.jenvman.2019.02.009.

Vermeuel, M.P., G.A. Novak, H.D. Alwe, D.D. Hughes, R.

Kaleel, A.F. Dickens, D. Kenski, A. Czarnetzki, **E.A. Stone, C.O. Stanier,** R.B. Pierce, D.B. Millet, and T.H. Bertram. Sensitivity of Ozone Production to NOx and VOC along the Lake Michigan Coastline. *Journal of Geophysical Research Atmospheres*, doi:10.1029/2019JD030842.



**Takle, E. S.,** D.A. Rajewski, and S.I. Purdy. The Iowa Atmospheric Observatory: Revealing the unique boundary-layer characteristics of a wind farm. *Earth Interactions*, doi:10.1175/EI-D-17-0024.1.

Zhu, J., X. Xia, H. Che, **J. Wang,** Z. Cong, T. Zhao, S. Kang, X. Zhang, X. Yu, and Y. Zhang. Spatiotemporal variation of aerosol and potential long-range transport impact over Tibetan Plateau, China. *Atmospheric Chemistry and Physics*, doi.org/10.5194/acp-19-14637-2019.

Tibetan Plateau, China



## CGRER'S HIGH PERFORMANCE COMPUTING ENVIRONMENT

CGRER provides high-performance computing resources to support the interdisciplinary research done by its members and their students.

CGRER research is conducted primarily on a shared computing cluster capable of delivering the CPU power and storage in a high-end parallel computing environment. This computing cluster known as Argon is located at the Information Technology Facility on the UI Oakdale campus. CGRER

has invested in the Argon cluster in order to provide researchers necessary priority when conducting research and analysis. The Argon cluster is continually evolving and because of this has the ability to keep researchers on the cutting edge with machine learning and artificial intelligence capabilities.

Additionally, the UI has an unlimited site-wide license for all Environmental Systems Research Institute products. **Jeremie Moen** is on the campus GIS Technical Advisory Committee



The Argon Computing Cluster on the UI campus. (photo by Ben Rogers)

and facilitates campus requests for support. Jeremie also provides Business Intelligence guidance for resources available to CGRER.



# INTERNATIONAL EFFORTS

Central to the work of CGRER is the goal of promoting dialogue among specialists and agencies on both local and global platforms. In service of this effort, this past year CGRER members traveled across the world to foster collaborative and interdisciplinary dialogues, research, and educational opportunities.

## AIR POLLUTION TRAINING PROGRAM IN NAIROBI

**Gregory Carmichael**, UI Professor of Chemical and Biochemical Engineering and CGRER co-Director, co-organized and lectured at a workshop and training activity on behalf of the World Meteorological Organization (WMO) in Nairobi, Kenya this past October. More than 40 students from eight African countries participated in this event.

The Workshop on Air Quality Prediction and Forecasting Improvement for Africa (PREFIA) was paired with a training course

titled “Seamless Prediction of Air Pollution for Africa.” Organized by the WMO Global Atmosphere Watch Programme, the Education and Training Programme, and the Kenya Meteorological Department, PREFIA is an international collaborative project on air quality and meteorological Prediction and Forecasting Improvement for Africa.

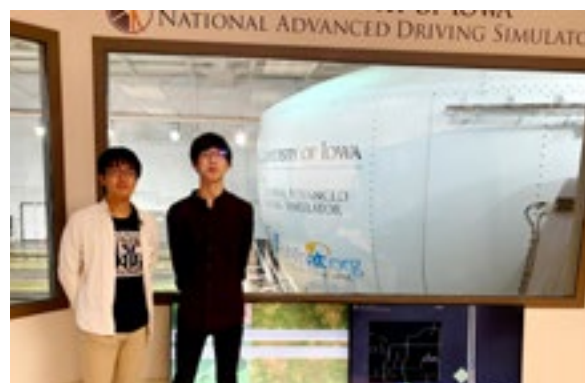
The aim of PREFIA is to develop and implement a seamless prediction and forecasting framework operating on higher resolutions for local, urban and regional scales. The overarching motivation for the project is to enable local and regional forecasts to help African countries and decision makers to improve air quality and public health, mitigate the occurrence of acute air pollution episodes, particularly in urban areas, and reduce the associated impacts on agriculture, ecosystems, and climate.



*The Workshop on Air Quality Prediction and Forecasting Improvement for Africa (PREFIA). (photos by Greg Carmichael)*

In addition to scientific developments, PREFIA also undertakes training of local scientists to enhance local skills in prediction and forecasting in combination with air quality observations bringing together stakeholders from a number of disciplines including air quality and weather modeling for prediction and forecasting, monitoring and observations, data science, digital technologies and information technology.

## INTERNATIONAL STUDENTS VISIT UI



*Takumi Niwa and Taiga Mori from the National Institute of Technology, Gifu College, Japan, tour the National Advanced Driving Simulator at UI.*



## WHERE ARE THEY NOW?

### KONSTANTINE P. GEORGAKAKOS



Konstantine P. Georgakakos currently serves as the Director of the Hydrologic Research Center (HRC), a non-profit research corporation in San Diego, CA.

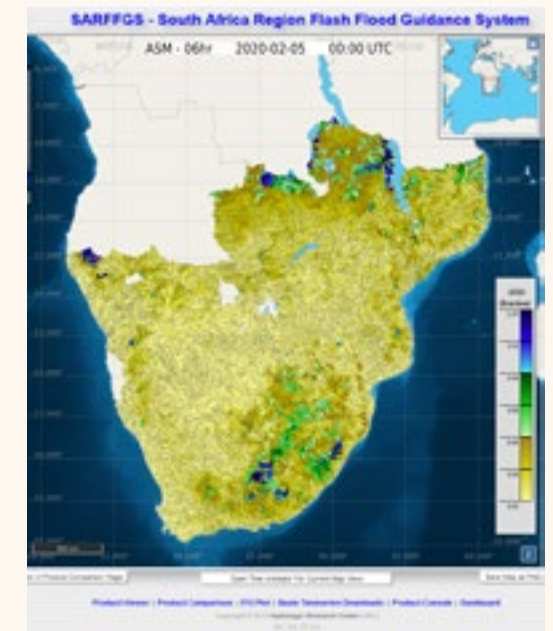
He is an Adjunct Professor with the Scripps Institution of Oceanography at the University of California, San Diego, and at the UI in the Department of Civil and Environmental Engineering. Since 1993, the HRC has been the nation’s leading source of applied research expertise for the development of sustainable solutions to global water issues. HRC was established as a non-profit corporation to bridge the gap between scientific research in hydrology and real-world applications for the solution of important societal problems that involve water. Since its founding, HRC’s research, education initiatives, climate change adaptation and mitigation solutions have influenced the water resource interests of many people in several countries. These initiatives include disaster preparedness and response, the management of water resources, and the development of vitally important early warning systems for weather-related hazards, especially floods, flash floods and droughts.

As of November 2019, the Flash Flood Guidance System (FFGS) developed by HRC, covers 67 countries serving nearly 3 billion people, with additional implementations planned. Since 2007, such implementations have been completed under the auspices of a quad-part agreement between the World Meteorological

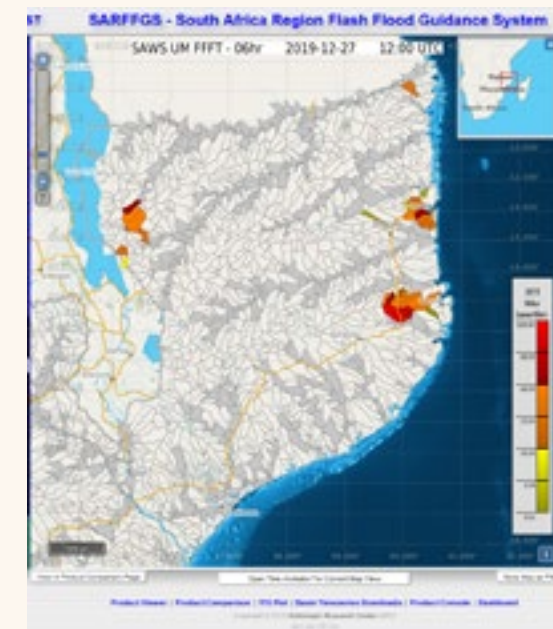
Organization, the US Agency for International Development, Office of Foreign Disaster Assistance, the US National Oceanic and Atmospheric Administration, and the Hydrologic Research Center. This operational system brings together components developed and fine-tuned by HRC engineers and scientists over several decades and in diverse application environments. Its purposes are to quality control and integrate data from diverse observational sensors and real-time numerical weather prediction model forecasts through various system components while using such information as input to numerical models of the land surface and subsurface. This work is done in order to produce products that are immediately relevant for forecasters during their real time assessment of the potential occurrence of flash flooding.

System interactive interfaces facilitate spatial and temporal analyses by the forecaster of the factors that contribute to flash flood occurrence. Options exist for forecaster adjustments to basic products based on last minute information or on forecaster experience with the application regions or with the forecasts of the operational numerical weather prediction models.

The seeds for the design of the present day FFGS were sowed in the late 1980s and early 1990s when lead FFGS designers and implementers Georgakakos, Theresa Modrick-Hansen and Jason Sperlslage led pioneering research at the UI in the Department of Civil and Environmental Engineering as well as at the Iowa Institute of Hydraulic Research.



*The main display of the Southern Africa Flash Flood Guidance System (SARFFGS) interactive interface. In this case it shows the upper soil saturation fraction for the entire region with high resolution for the time indicated.*



*The forecast flash flood threat with a 6-hour lead time over small basins in Mozambique for the date shown. SAWS stands for South Africa Weather Service. They have been trained and serve as the regional center for this system that covers 9 countries in Southern Africa.*



**GRER**  
NEW MEMBERS



**Ulrike Passe** is an Associate Professor of Architecture and the Director of the Center for Building Energy Research (CBER) at Iowa State University. In addition to teaching sustainable design and environmental technologies, Passe oversees CBER which focuses on strategies to

reduce energy consumption in buildings using effective building design, as well as efficient and renewable energy sources and technologies. CBER supports interdisciplinary and collaborative research between disciplines such as architecture, agriculture, geological and atmospheric sciences, business, mechanical, construction and electrical engineering, material science and engineering, interior design, environmental psychology and behavioral science. Passe was a practicing architect in Berlin, Germany in the 1990s. As the author of "Designing Spaces for Natural Ventilation: an Architect's Guide," she lectures and publishes widely internationally and has won multiple research awards. Currently, she integrates human-building-microclimate interactions into urban energy models for resilience.



**Linda Shenk** is an Associate Professor in the English department at Iowa State University where she teaches Shakespeare, early modern literature, and communication courses. In recent years, she has taken her background in storytelling and performance

and applied it to incorporating computer simulation models, such as agent-based models, into community engagement. Working with stakeholders, particularly with underrepresented populations, she approaches simulation models as fellow storytellers, using the models' "what if" scenarios as well as their narrative gaps to support researchers and community members co-producing knowledge and action.



**Yuyu Zhou** is an Associate Professor in the department of Geological & Atmospheric Sciences at Iowa State University. The primary focus of Zhou's work is the application of remote sensing, GIS, geo-visualization, spatial analysis, and Integrated Assessment Modeling in ecosystem, environmental,

and social sciences. Zhou is currently working on two NSF projects: "Collaborative Research PREEVENTS Track 2: Land-atmosphere feedbacks over urban terrain under heat waves" and "Water Sustainability at the Food-Energy-Water Nexus under Urbanization and Climate Change."

**INDIA WINTERIM EXPERIENCE**

UI's India Winterim program, available to both undergraduate and graduate students, takes place during the university's winter break and is a three-week study-abroad program. It is comprised of three field-based courses: Water Poverty in Rural India: A Freshwater Crisis Case Study, Pain and Palliative Care, and Sustainable Development. Students from various disciplines, such as civil and environmental engineering, biology, education, health care, and social sciences, participate in these concurrent courses. **Marian Muste**, UI Professor and Research Engineer at IIHR Hydrosience and Engineering, leads the course on Water Poverty. Since the program began in 2011, 75 university students have participated in the course.



Participants in the India Winterim Experience. (photo by Marian Muste)

**NEW MEMBER SPOTLIGHT: SARATH GUTTIKUNDA**

Sarath Guttikunda is the founder and atmospheric scientist for India's Urban Emissions, a repository of information, research, and analysis related to air pollution.

Through his work at Urban Emissions, Guttikunda's research centers on air quality analysis at the urban, regional, and global levels while simultaneously working to find ways to bridge the gap between science and policy. This particular skill of bridging disciplines is one that dates back to his time as a CGRER PhD candidate at the UI from 1997-2002.

Guttikunda is the developer of the SIM-air family of tools which are capable of assessing air quality in a multi-pollutant environment. The air pollution knowledge assessments (APnA) is



Sarath Guttikunda leading an air quality workshop.

a program that utilizes these tools and currently hosts information for more than 60 airsheds across Asia, Africa, and Eastern Europe. In 2016, Guttikunda was part of the team that launched the only dissemination platform for modeled air quality forecasts for all of India.

Guttikunda is a NASA Earth and Space Science Fellow as well as a TED fellow. He is a member

of the Air Quality Guidelines Development Group of the World Health Organization, and a special advisor to the Steering Committee on Air Pollution and Health Related Issues in India. Guttikunda also advises the Development of Uniform Air Quality Index for Indian Cities as part of The Ministry of Environment Forests and Climate Change.

**GRER ADMINISTRATION**

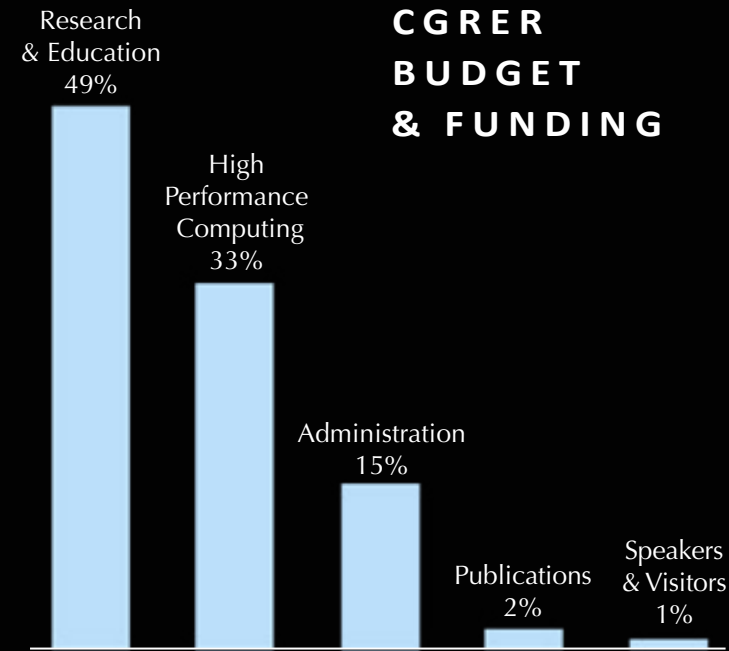


Joe Bolkcom, Jerry Schnoor, Jeremie Moen, Amy Parker and Greg Carmichael (photo by Mary Moye-Rowley)

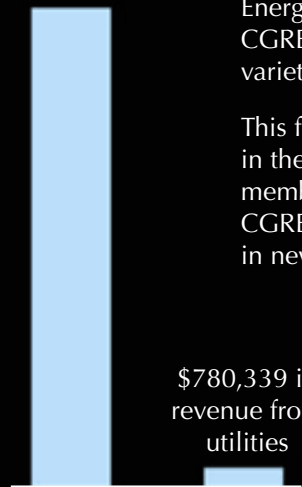
CGRER is directed by UI professors **Gregory Carmichael**, Department of Chemical and Biochemical Engineering and **Jerry Schnoor**, Department of Civil and Environmental Engineering. Center activities are guided by an elected Executive Committee that consists of 11 members (listed on page 3) plus the two co-directors. The Executive Committee meets monthly as needed to plan initiatives and chart CGRER's course. An Advisory Board of 13 members (listed on page 5) from outside the academic community meets annually to lend oversight to CGRER's activities.

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. 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.





\$18,467,289  
in new  
external funding



In 2019, CGRER received \$780,339 in revenue from the rate-payers of Iowa 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 2019, CGRER members brought in \$18,467,289 in new external research funding.



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