# THE CENTER FOR GLOBAL & REGIONAL ENVIRONMENTAL RESEARCH

CGRER

## 2017 ANNUAL REPORT

# CGRER

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

*Cover photos:*
*Top: Wild fires in California*
*Middle: Hurricane Matthew (photo by NASA)*
*Bottom: A farm pond built by the Iowa Watershed Approach, a statewide watershed improvement program that slows the movement of water through the landscape using conservation practices such as strategically building farm ponds and wetlands. (photo by David Herwaldt, Iowa Flood Center)*

*This page:*
*Top photo by NASA*
*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: Soap Creek Watershed pond construction. (photo provided by Iowa Watershed Approach)*

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 136 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.

**PROMOTE DIALOGUE AMONG SPECIALISTS AND AGENCIES**

**EDUCATE STUDENTS AND THE GENERAL PUBLIC**

**FOSTER AND SUPPORT RELEVANT RESEARCH PROJECTS**

# EXECUTIVE SUMMARY

**CGRER** had a busy, productive year in 2017 as the contents of this annual report suggest. In 1990, we began as an interdisciplinary research Center at the behest of the State Legislature and the Board of Regents. In the Iowa Energy Act of 1990, we were named the "global warming center" for the State during intense scientific debate over whether man-made greenhouse gases were beginning to warm the earth and change our climate. For 27 years, CGRER has pursued that question and, more broadly, environmental change of all kinds at the Midwest, regional, and global scales.

temperature and acidity, sea level rise, melting of Arctic and Antarctic ice, water quality and harmful algal blooms, drought cycles, wildfires, species biodiversity and more.

We, at CGRER, have learned much during those intervening years. Most of all, we have built a special interdisciplinary cadre of faculty and students who collaborate on everything from flood forecasting to sustainable water development; from hand-held sensing of air pollution in Dubuque to remote sensing of the Asian Brown Cloud; and from agricultural landscapes (as critical zones) to the Iowa Watershed Approach for rural

**After 27 years, the debate on climate change is over and the verdict is in. "Global warming" is changing everything...**

After 27 years, the debate on climate change is over and the verdict is in. "Global warming" is changing everything: the frequency and magnitude of intense storm events, ocean

community resiliency. We gratefully leverage precious funds from the electric utility rate-payers in Iowa to attract more than 20-fold in research dollars from outside agencies to Iowa for this effort.

CGRER provides services unique to Iowa including our annual Iowa Climate Statement composed and signed by nearly all the science teachers in higher education throughout Iowa. This past year, it emphasized, "It's not just the heat, it's the humidity!"

*Gene Takle, Elizabeth Stone and Dave Courard-Hauri at the release of the seventh annual Iowa Climate Statement at the Iowa State Capitol.*

Together with our CGRER blog, Iowa Environmental Focus, the Iowa Climate Festival, Legislative Breakfast, special symposia, seed grant program, and multitude of research projects by CGRER faculty, it makes for an attractive portfolio.

However, in 2017, we face a new challenge that came in the form of the State Legislature and Governor sun-setting CGRER funding after 2022. We made a strong case through the Board of Regents that CGRER's research and outreach makes a critical contribution to the State on a crucial topic of environmental change, but it was to no avail. Other Centers lost some annual funding, like the Iowa Flood Center. The ISU Leopold Center

*A dense blanket of polluted air hovers over eastern China. (photo by NASA)*

for Sustainable Agriculture had its funding transferred completely to the Iowa Nutrient Reduction Center, although the Leopold Center still exists, but without its original funding stream. The ISU Iowa Energy Center, established in the same legislation as CGRER, was folded into the Iowa Economic Development Authority in Des Moines and is no longer a part of Iowa State University. Its funds are also sun-setted after 2022 like CGRER.

In light of this challenge, CGRER is not giving up. We intend to keep the Center functioning well past 2022 by competing for other large research grants, seeking foundation and private support, exploring new partnerships with other centers and institutes, and persuading the Iowa Legislature to reconsider its decision. We remain optimistic about the future and the critical need for productive research to understand and protect Iowa and the Midwest from pervasive environmental change.

**Jerald L. Schnoor**

**Gregory R. Carmichael**

CGRER Co-Directors

*The Iowa Watershed Approach will work with Watershed Management Authorities to select locations to construct and implement projects directed toward mitigating flood damage, improving water quality, and building community flood resilience.*


## EXECUTIVE COMMITTEE



*At top, harmful algal blooms in the Gulf of Mexico. (photo by NOAA)*

# MESSAGE FROM THE CGRER ADVISORY BOARD

How can Dubuque reduce our greenhouse gas emissions 50% by 2030? Who are the most vulnerable individuals in our community, and how does poor air quality affect them? As Dubuque—and most of Iowa, for that matter—experience more frequent and severe rain events, how do we protect our residents, businesses and infrastructure?

As public servants, we do our best to make decisions that will provide the most beneficial outcomes for our residents and businesses.

These are all questions that, as the Sustainable Community Coordinator for the City of Dubuque, I have been tasked with addressing, along with my colleagues and partners. They are also questions that cannot be answered without sound science. Which is why, in 2017, I was honored to be asked to join the advisory board for the University of Iowa Center for Global & Regional Environmental Research. At the end of 2017, I can almost recite what CGRER stands for without sneaking a peek at my notes, but I can definitely tell you why the work they're doing is so important to communities across the state.

Urban and rural communities across Iowa continue to work hard to provide places where people of all demographics want to live, work and play. We are doing that amid interesting political times, constrained resources, and changing environment conditions. As public servants, we do our best to make decisions that will provide the most beneficial outcomes for our residents and businesses.

So, when the City Council directed staff to develop a plan to improve air quality and reduce particulate matter (PM 2.5) in 2014, I knew that I could develop a community engagement and education plan, and develop policies that could lead to improved air quality, and ultimately improved public health. But, I was going to need sound scientific research to help me with the content of the public education campaign, and tell me where the most impactful policy changes could be made. Through a partnership called CLE4R, the EPA, UI, City of Dubuque, and Dubuque-area partners are developing a citizen science program that helps residents understand the causes of localized air quality problems, and opportunities to improve those problems.

*University of Dubuque Professor David Koch tests the air quality from atop a parking ramp using a particle counter (see page 7).*

In 2016, the City of Dubuque was part of the successful state of Iowa HUD National Disaster Resiliency Competition application. Now, through the Bee Branch Healthy Homes Resiliency Program, we are making infrastructure improvements that will protect some of our most at-risk neighborhoods from recurring flooding, and spending $8.4 million to improve 320 housing units, making them and the families that live in them more resilient. One of many partners in this work is the Iowa Flood Center, a close collaborating Center to CGRER, who has been providing us with the most accurate and up-to-date flood modeling data available, and also helping us as we determine what socially resilient neighborhoods look like.

*The City of Dubuque Bee Branch Creek dedication ceremony. City officials, state dignitaries, local celebrities, and families gather for the dedication of a project to remove homes damaged by annual flooding, and build a detention project to slow flooding to downtown.*



*Iowa Flood Center researchers can create detailed maps of river corridors to illustrate where floodwaters will go under different upstream flow conditions. Iowa Flood Center has made this information available to the public online via an interactive Google Maps-based application.*

The 2017 Iowa Climate Statement identifies extreme rain events and humidity as local effects of climate change, and the resulting changes to Iowa's agricultural growing season and potential public health impacts we should consider. CGRER research is playing an important role in work to mitigate and adapt to that climate change.

In my short time as part of the CGRER Advisory Board, their value has become increasingly clear to me as a local government official and a resident of this great state. CGRER is helping Iowa companies and researchers develop technologies that are necessary for us to remain economically competitive and environmentally responsible. They are providing data that is critical for local governments and others to protect our communities. And I can't forget the presentation at our last Advisory Board meeting, when I learned about outstanding content being developed by CGRER members to integrate climate science into middle school curriculum and train culturally-competent engineers that can provide water to the most at-risk populations around the world. They are helping to create our future leaders.

I have come to rely on the scientific foundations and innovations the CGRER produces, and am looking forward to providing my own contributions that can help improve the lives of Iowa's, and the world's, residents.

**Cori Burbach**

Sustainable Community Coordinator
City of Dubuque

(photo by IFC)

## CGRER ADVISORY BOARD MEMBERS

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

**Bob Dvorsky**
Senator
Iowa State Legislature

**Tim Harden**
Alliant Energy

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

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

**Mark Kresowik**
Beyond Coal Campaign
Sierra Club

**Jesse Leckband**
MidAmerican Energy

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

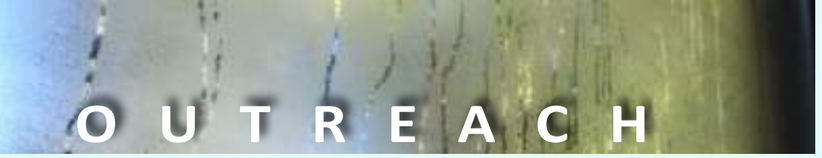
**Brenda Nations**
Sustainability Coordinator
City of Iowa City

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

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

**Marnie Stein**
Iowa DNR

**Nick Wagner**
Iowa Utilities Board



# OUTREACH

In 2017, CGRER members shared their expertise with the larger world through a variety of initiatives. Included were presentations at the Iowa Legislative Breakfast, as well as drafting the seventh annual Iowa Climate Statement.

## IOWA CLIMATE STATEMENT 2017: IT'S NOT JUST THE HEAT, IT'S THE HUMIDITY!

The seventh annual statement, "Iowa Climate Statement 2017: It's not just the heat, it's the humidity!" released in August, was signed by 193 science faculty and researchers from 40 Iowa colleges and universities. The statement describes how significantly higher humidity levels impact Iowa's people, animals, crops, and infrastructure. For the past six years, researchers and educators at nearly every Iowa college and university have produced annual statements on how climate change has impacted Iowans.

*Dave Courard-Hauri, Gene Takle and Elizabeth Stone at the release of the seventh annual Iowa Climate Statement.*

"Absolute humidity, which is typically measured by dew point temperature, has increased statewide from 1971 to 2017. Measurements show Dubuque had the largest increase in humidity, a springtime increase of 23%," said **Gene Takle**, Director, ISU Climate Science Program, Professor of Geological & Atmospheric Sciences, Department of Agronomy.

Iowa's increasing humidity is an important and rarely discussed result of climate change. "Besides making outside activities like visiting the state fair more uncomfortable, increasing humidity creates conditions favorable for increased rainfall, extreme rain events, mold and mosquitoes in Iowa. Significant increases in humidity have been measured across all seasons and at all long-term monitoring stations in Iowa," said UI associate professor of Chemistry, **Elizabeth Stone**.

According to Takle, "increased levels of humidity create hazardous conditions for Iowa workers and sensitive populations through the danger of heat exhaustion and heatstroke. Asthma is worsened by higher levels of allergens in the air. And the cost of air conditioning homes and businesses to maintain comfort levels increases."

Takle continues, saying that "for Iowa's agriculture, increased warm-season humidity leads to water-logged soils during planting season, rising humidity also leads to longer dew periods and higher moisture conditions that elevate costs of drying grain. Increased nighttime temperatures coupled with humidity causes stress to crops, livestock, and pets."

What does this mean for Iowans? What are the next steps to combating these pressing issues? Stone advises "we must all do more to mitigate the effects of climate change, by curtailing emissions of heat-trapping gases, improving energy efficiency, and increasing use of clean and renewable energy."

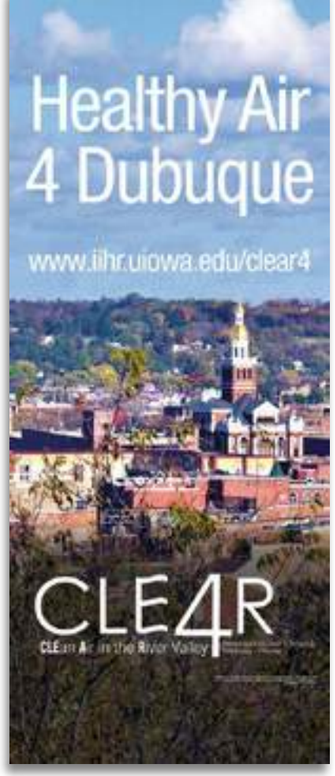
IOWA CITY CLIMATE ACTION TODAY

## IOWA CITY CLIMATE PLAN

**Charles Stanier** and **Eric Tate** represent CGRER as members of the City of Iowa City Climate Action Steering Committee. This committee is appointed by the City Council with the goal of helping to reduce greenhouse gas emissions while simultaneously increasing the resiliency of the community to anticipated climate change impacts.

The City of Iowa City has been working toward climate-related goals for over a decade, and in 2016 the City Council approved ambitious greenhouse gas reduction targets of 26-28% reduction by the year 2025 and 80% by 2050. The Steering Committee works with consultants from Elevate Energy, the community, and City staff to craft recommendations for City Council, in the areas of energy efficiency, renewable energy, transportation, waste, and adaptation. The committee's recommendations were launched in June of 2017 and have taken the form of a Climate Action and Adaptation Plan.

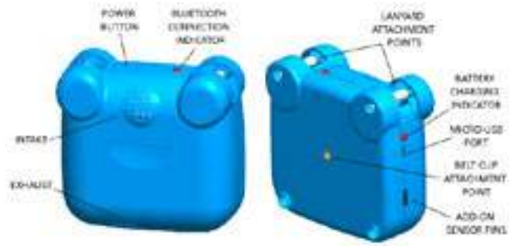


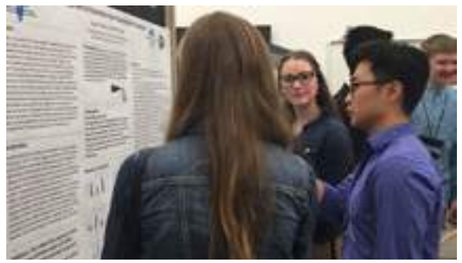



## CLE4R PROGRAM LAUNCHED STATEWIDE

CGRER member **Elizabeth Stone** developed and deployed the Collaborative Learning in Environmental and Aerosol Research (CLE4R) program in Iowa through the Center for Aerosol Impacts on Climate and the Environment. The CLE4R program equips high school students with a particle counter that enables them to explore atmospheric particle levels and sources in their environment. The guided-inquiry program leads them through developing an original research hypothesis, designing an experiment to test their hypothesis, data analysis, and presenting their results. Students shared their results through oral and poster presentations at the Iowa Academy of Science meeting in April. UI graduate students Thilina Jayarathne, Hansol Lee, and Elias Hasenecz were mentors to the high school students and served as judges at the Iowa Academy of Science meeting. In 2017, this program worked with students at Osage High School, Center Point Urbana High School, and Iowa City West High School.

*In an effort to educate Iowans about particulate air pollution, CLE4R has made Air Beam air quality monitors (shown here) available for check out at the Dubuque Public Library, Dubuque Community School Districts, and at the UI.*



*Students attend a poster session. (photo by Hansol Lee)*

*Students from Osage High School were among those who participated in the Iowa Academy of Science. Osage High students included were, Eric Dralle, Ben Grimm, Matthew Huisman, Matthew Klaes, Alexa Maakestad and Garrett Maakestad. (photo by Elias Hasenecz)*

## CGRER MEMBER FEATURE : LARRY WEBER

After 13 years, **Larry Weber** resigned from the IIHR—Hydroscience & Engineering Directorship to serve as the Executive Associate Dean, College of Engineering. Weber remains an IIHR faculty affiliate, a participant in the Iowa Flood Center and Iowa Nutrient Research Center, and an advocate for the research and service programs of the Iowa Geologic Survey. Additionally, Weber continues to serve as the principle investigator of the HUD-funded Iowa Watershed Approach research program and other research projects.

## LEGISLATIVE BREAKFAST RECEPTION

The Iowa Flood Center and CGRER hosted the annual Legislative Breakfast reception in March at the Iowa State Capitol.

University of Iowa CGRER members **Craig Just**, assistant professor, UI Department of Civil & Environmental Engineering, and **Lou Licht** adjunct associate professor, UI Department of Civil & Environmental Engineering, updated legislators on the Iowa Small Community Wastewater Technology Park and Training Program.

**Ted Neal**, Clinical Associate Professor of Science Education, UI College of Education, along with Susanna Herder Ziemer, MAT Student and Research Assistant, Science Education, worked with members of CGRER to present an update on the CGRER – UI College of Education - Iowa K-12 Climate Science Education Initiative. This project is designed to help implement the Next Generation Science standards in Iowa middle and high schools.

*Ted Neal and Susie Herder Ziemer*

*Larry Weber and State Representative Chuck Holz*


*Lou Licht and Craig Just at the annual CGRER-IFC Legislative Breakfast at the Iowa State Capitol.*

*Craig Just and State Representative Michael Bergan*



## CGRER COMMUNICATIONS

*Joe Bolkcom, CGRER's Outreach and Community Education Director meets with interns Natalia Welzenbach-Marcu, Kasey Dresser, and Jenna Ladd. (photo by Mary Moye-Rowley)*

## CGRER INTERNS

Jenna Ladd is a graduate student pursuing her Master's degree in Rehabilitation and Mental Health Counseling. Receiving her bachelor's degree from the UI, Jenna studied Sociology and Spanish and served as an active member of the UI Environmental Coalition. In addition to working as a Graduate Outreach Assistant with CGRER, she serves as a mental health counseling intern with the UI Women's Resource and Action Center.

Natalia Welzenbach-Marcu is an undergraduate pursuing a BA in Cinema and a BFA in Intermedia at UI. She is studying Chinese and works with the Organization for the Active Support of International Students to help bridge the gap between domestic and international groups on campus. Outside of her communications assistant position at CGRER, she works as a student videographer for the College of Public Health.

Kasey Dresser is an undergraduate student at the UI. She is currently working towards a BA in Global Health, a certificate in non-profit organization, and a minor in Cinema. Kasey is from San Diego, CA and has been a Hawkeye since 2016. She is also a member of the Tau chapter of Delta Gamma on campus.

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.

*Jacob Slobe, CGRER media specialist, discusses elevated nitrate levels in drinking water with Pete Weyer for an EnvIowa podcast. (photo by Jenna Ladd)*

EnvIowa

## CGRER MEDIA OUTREACH

Curated by the communication interns, CGRER's blog, Iowa Environmental Focus, features current news stories of interest, videos, and photographs pertaining to environmental news and research. Recent stories include a critical response to Toyota's clean energy initiative; a response to food waste and its connection to the environment; and a look at how a rise in Bitcoin's value could lead to an energy crisis.

*Elizabeth Stone and Jenna Ladd record a CGRER radio segment.*

**Elizabeth Stone** records and distributes CGRER's weekly news throughout radio stations across the state. These one-to-two-minute segments highlight the work of CGRER members as well as current Iowa environmental issues and efforts toward greater sustainability. Audio recordings are available on Iowa Environmental Focus.

EnvIowa is a podcast hosted by CGRER intern Jenna Ladd. Each month, Ladd invites a guest onto the show to explore current environmental news, research, and initiatives affecting Iowans. The podcast can be downloaded on iTunes and found on the Iowa Environmental Focus website.

CGRER MEMBERS

## A SAMPLING OF AWARDS, ACHIEVEMENTS & APPOINTMENTS

*Greg Carmichael and UI President Bruce Harreld*

*William Gutowski*

*Craig Just*

*Gregory LeFevre*

**Gregory Carmichael** delivered the 34th annual UI Presidential Lecture "What Goes Around, Comes Around: The Global Reach of Air Pollution."

**William Gutowski** was made Honorary Professor in the Department of Environmental and Geographical Sciences at the University of Cape Town, Cape Town, South Africa.

The Institute of Industrial Engineers Sustainable Development Division has awarded **Craig Just** the 2017 Excellence in Teaching Sustainability Award.

ACS Editor's Choice Award was given to **Gregory LeFevre** for the paper *Environmental Science and Technology Letters* for work at the UI studying neonicotinoid pesticides.

Along with several graduate students, **Maurine Neiman** received the 2017 Thomas Henry Huxley Award from the Society for the Study of Evolution.

**Elizabeth Stone** was appointed as faculty in UI's department of Chemical and Biochemical Engineering. Additionally, Stone was awarded the UI College of Liberal Arts and Sciences 2017 Outstanding Outreach and Public Engagement Award.

Water Journal awarded **Gabriele Villarini** with the 2017 Water Young Investigator Award.

**Jun Wang** was appointed by NASA to serve as one of 13 members in its senior review panel for Earth Science. The Senior Review Panel is convened to evaluate the scientific performance of each satellite mission in NASA's Earth Science Portfolio and the continued relevance of each mission to the NASA Science Strategic Plan.

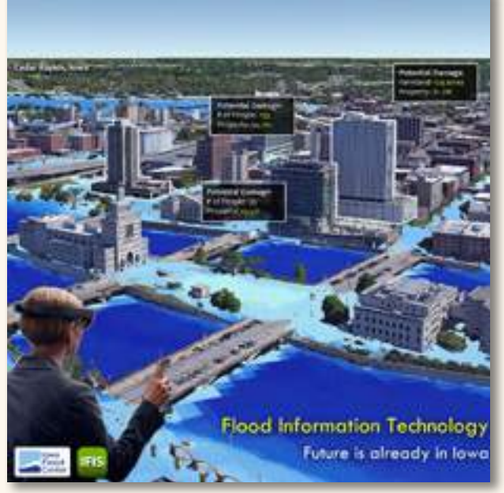
*Maurine Neiman*

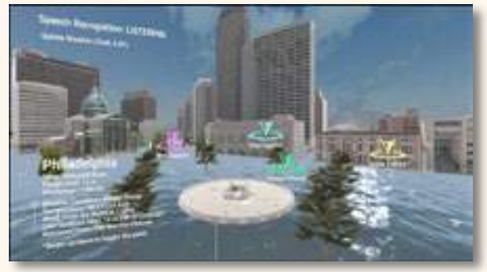
*Elizabeth Stone*

*Gabriele Villarini*

*Jun Wang*





*Ibrahim Demir was PI on three grants (see below). These images show emergency preparedness, response, and recovery applications using virtual and augmented reality, and holographic displays.*

## A SAMPLING OF GRANTS AWARDED TO CGRER MEMBERS

**Chandrashekhar Charavaryamath** (PI) received a $29,999 grant from CDC-NIOSH for *Hydrogen sulfide exposure and impact on swine barn dust induced lung inflammation* (2017).

**Ibrahim Demir** was PI on three grants. From Iowa Homeland Security Demir received two grants: $61,000 for *Data Visualization Project for Homeland Security* (2017); and $68,000 for *Data Visualization of IWA Data and Project Sites* (2017). Demir received a $20,000 grant from AI for Earth, Microsoft & ESRI for *Knowledge Discovery, Integration and Communication for Extreme Weather and Flood Resilience Using Artificial Intelligence* (2017). Additionally, Demir was co-PI on two grants: an $88,714 from the National Science Foundation for EAGER: PPER: *Validation and Utilization of a New Tool for Citizen-Led Water Quality Monitoring in Agricultural Watersheds* (2017); and a $41,626 grant from the US Corps of Engineers for *Decision Support Tool for the Texas Multi-Hazard Tournament* (2017).

**Steven Hall** (PI) was awarded a two-year grant from the EPA for $150,754 titled *Integrated environmental assessment of cropped and restored wetlands in agricultural catchments with varying drainage intensity* (2017-2019). Bill Crumpton and Matt Helmers of ISU are co-PIs.

**Gregory LeFevre** is PI on a newly awarded grant from the US Geological Survey National Institutes for Water Resources National Competitive Grant program. This work is in collaboration with researchers from the USGS and the Great Lakes Genomics Center at the School of Freshwater Sciences at the University of Wisconsin-Milwaukee. The $499,524 grant is for *Fate and Ecological Impacts of Pharmaceuticals in a Temperate Stream Dominated by Wastewater Effluent* (2017-2020).

**Maurine Neiman** (PI, with co-PI Stephanie Meirmans) received a $10,325 grant from the American Genetic Association for *Science policies: how should evolutionary biology be funded?* (2017). Neiman (PI, with co-PI graduate student James Woodell) also received the $4,030 Iowa Science Foundation grant *How does genetic and phenotypic diversity influence invasion processes? A case study with the New Zealand mud snail* (2017-2018). The Mid-Atlantic Panel on Aquatic Invasive species awarded co-PI Neiman (PI Ed Levri, Penn State Altoona, co-PI graduate student James Woodell) a $15,000 grant for *Using environmental DNA to detect early stages of the invasion of a destructive freshwater snail* (2017-2018).

**Elizabeth Stone** (co-PI) was awarded a $341,617 grant by The National Science Foundation for Collaborative Research: *New measurements to understand coastal ozone production during the 2017 Lake Michigan Ozone Study* (2017-2020). Co-Pi's **Charles Stanier**, Iowa; Tim Bertram, University of Wisconsin-Madison; Dylan Millet, University of Minnesota).

**Eugene S. Takle** was awarded a $690,206 National Science Foundation grant for *Forced and Natural Turbulence Allowing Studies of Turbulent anIsotropic Conditions* (2017-2020).

# EDUCATION

CGRER members work to educate the next generation of researchers and scientists who will help address the many environmental issues facing the world. Educational efforts this past year included a safe drinking water symposium, a K-12 Climate Science Education Initiative, as well as several new and engaging courses.

## CGRER AND THE UI COLLEGE OF EDUCATION IOWA K-12 CLIMATE SCIENCE EDUCATION INITIATIVE

CGRER and the UI College of Education (COE) continued to make strides in a project to help eighth grade Iowa science teachers adapt to new science education standards. The Next Generation Science Standards (NGSS) emphasize investigative learning rather than rote memorization. Approved by the Iowa Board of Education in 2015, the bulk of the eighth grade NGSS curriculum will be implemented in Iowa schools next year.

This year, the project took on the task of surveying teachers in Iowa to better understand the needs of the classroom. This allowed the surveying team to determine what must be provided in order to most readily accelerate and enhance the ability of schools to not just meet the new standards but to help bring a transformative set of ideas into classrooms.

Based on these survey results, the CGRER-COE Iowa K-12 Climate Science Education Initiative team has developed a free and public online Pressbook where Iowa teachers can access course-related climate science data from CGRER researchers, as well as lesson plans and suggestions from other Iowa teachers.

**Ted Neal**, clinical associate professor in the UI College of Education and project lead, explained that eighth grade NGSS curriculum requires education about the natural systems and climate science.

Neal explained, "This whole curriculum is free. Use it how you want, where you want; we're just trying to compile this together for school districts in a time when budgeting is so tight and learning can be so innovative."

CGRER members **Scott Spak**, UI assistant professor of Urban and Regional Planning and **Charlie Stanier**, UI associate professor of Chemical and Biochemical Engineering, have also helped lead the project and have developed content to connect Iowa educators with local climate science data in real-time.

*Teachers work in small groups to develop curriculum plans that align with Iowa's new science standards. (Left to right: Taylor Schlicher, Southeast Junior High; Zach Miller, UI MAT Science Education; Susanna Herder, UI MAT Science Education; Ted Neal, Clinical Instructor, UI; Courtney Van Wyk, Pella Christian Grade School; Stacey DeCoster; Grinnell Middle School.)*

The initiative has been made possible with the help of graduate research assistants Susanna Herder Ziemer, Andrea Malekis, Zach Miller, and Nathan Quarderer (profiled on page 13).

*The Iowa K-12 Climate Science Education Initiative project members Zach Miller, Charlie Stanier, Scott Spak, Ted Neal, Nathan Quarderer, Andrea Malek and Susanna Herder Ziemer.*




## SAFE DRINKING WATER SYMPOSIUM

Assessing risks and developing strategies to ensure the safety of Iowa's drinking water was the central focus for leading state and national water quality experts gathered at a UI sponsored event at Drake University in September.

Water quality in the state of Iowa has been an increasing public health concern in recent years, primarily due to nitrate levels that exceed U.S. EPA standards. As this and other contaminants continue to pose public health threats via our waterways, drinking water treatment, contaminant surveillance, and regulation continue to be at the forefront of health concerns in the Midwest.

The symposium, "Challenges to Providing Safe Drinking Water in the Midwest," was a collaborative effort co-sponsored by several Iowa-based institutions and organizations, including a number of Centers at the UI, Drake University, the University of Northern Iowa, the Iowa Association of Water Agencies, and the Central Iowa Drinking Water Commission.

This symposium featured Iowa based and nationally recognized speakers and discussion panels on a variety of drinking water issues facing Iowa, the Midwest, and the nation. Some of the topics addressed were the Health Impacts of Nitrate in Drinking Water, Drinking Water Treatment Concerns, New and Emerging Drinking Water Threats, and Communicating with the Public on Drinking Water Issues.

University of Iowa sponsors included the Environmental Health Sciences Research Center, the Center for Health Effects of Environmental Contamination, the Public Policy Center, and CGRER. Additional symposium co-sponsors include the Iowa Public Health Association, Iowa League of Cities, and the Iowa Environmental Council.

*Photo at top: Safe Drinking Water Symposium discussion panelists Caroline Davis, Emily Holley, Shelli Lovell and Kathie Obradovich. At left; speaker Jerry Schnoor, below; speaker Peter Thorne addresses attendees. (photos by Joe Bolkcom)*

## IOWA K-12 CLIMATE SCIENCE EDUCATION INITIATIVE ASSISTANTS

Andrea Malek is a research assistant pursuing an MS in Science, Technology, Engineering, and Mathematics (STEM) Education at UI. She enjoys working with fellow teachers to ultimately make climate science more accessible as part of Next Generation Science Standards (NGSS) curricula. Malek teaches in the Home School Assistance Program of the Cedar Rapids School District. In the classroom, she enjoys working with students to investigate and develop ideas.

Zach Miller is pursuing an MAT in Science Education at UI and is currently student teaching at North Scott High School in Eldridge, IA. Zach wants to help students interact with science concepts in a relatable and meaningful way. He believes that it is crucial for students to learn the earth and climate science standards in order to spread awareness of issues facing the climate of our planet. Zach enjoys working with students to provide an educational environment where they can learn at high levels.

Nathan Quarderer is a teaching and research assistant, currently working on a PhD in science education at UI. His research interests include designing effective environments for professional development, the use of multiple representations as a learning tool, and how the topic of climate change is being taught in middle school science classrooms. Nathan is also a faculty member at Northeast Iowa Community College (Calmar) teaching physics, math, and environmental science.

Susanna Herder Ziemer is pursuing an MA in Teaching in Science Eduation and is a research assistant with the UI College of Education and CGRER. While working as a research assistant she hopes to gain wisdom from in-service teachers, collaborate to develop real solutions to their problems, and work to apply this knowledge herself when she graduates. Ziemer is proud to help Iowa lead as energy innovators and promote environmental consciousness alongside her students and coworkers.

## NEW DEGREES ON THE UI CAMPUS

### Environmental Engineering Degree

This fall, the UI will offer Iowa's first Bachelor of Science in Engineering (BSE) degree in Environmental Engineering. The major will prepare students to address the complex food, energy, and water issues of the 21st century. The U.S. Bureau of Labor Statistics estimates significantly higher-than-average job growth in environmental engineering until 2024. According to Forbes Magazine, environmental engineering is the fifth most valuable college major.

"Both myself and the CEE faculty are quite proud that we will be the first to offer an undergraduate environmental engineering degree in Iowa," says **Michelle Scherer**, UI professor of Civil and Environmental Engineering.

Environmental engineers apply engineering principles to design systems that control pollution and protect public health, as well as restore air, soil, and water quality at sites that have already been contaminated as well as work at the front lines of the clean energy economy by developing systems that convert waste into energy.

"The environmental engineering degree program will produce students with a solid background in basic chemistry, physics, mathematics, and environmental sciences as well as quantitative problem solving skills necessary for designing complex solutions to environmental problems," says Scherer. "The students will be well positioned and marketable for obtaining employment in the growing field of environmental engineering both in Iowa and around the nation."

### Sustainable Water Development Graduate Program

A new graduate program at the UI works to teach students how best to establish sustainable water solutions for communities most in need. The work of the Sustainable Water Development graduate program addresses social justice issues like food, energy, and water for all. In this program, students have the ability to tailor the course of study to attain specific career goals through individualized coursework ranging from chemistry to microbiology, informatics to entrepreneurship. The program attracts highly motivated and engaged students from all STEM disciplines, backgrounds, and life experiences. Students in this program prepare to work with water-quality professionals in industry, government, research, and NGOs across the world.

## WHERE ARE THEY NOW?

J. Elliot Campbell, associate professor of Environmental Studies and Stephen R. Gliessman Presidential Chair in Water Resources and Food System Sustainability in the Environmental Studies Department at UC Santa Cruz, received a 2017 Global Environmental Change Early Career Award from the American Geophysical Union during its December meeting in New Orleans.

The award, recognizes interdisciplinary scientists for "outstanding contributions in research, educational, or societal impacts in the area of global environmental change." It includes a $1,000 prize.

Campbell received his BS and MS from Stanford University and his PhD from the UI where he was advised by **Jerry Schnoor** and **Charles Stanier**; and worked alongside **Greg Carmichael**. He completed a postdoctoral fellowship at the Carnegie Institute for Science.

Campbell's research emphasizes the use of regional and global models to extrapolate from small-scale field measurements to policy-relevant spatial scales, particularly within the context of agroecology and global biogeochemical cycles. This work has led to his CAREER award from the National Science Foundation, appearances in media ranging from NPR to *The Economist*, and consultations to the U.S. EPA and other government agencies. He serves on the Association Editorial Board at *Frontiers in Ecology and the Environment* and the faculty advisory committee at the University of California President's Postdoctoral Fellowship program.



## CONFERENCE TRAVEL GRANTS FOR GRADUATE STUDENTS

In 2017, $22,689 was awarded to graduate students advised by CGRER members who traveled to professional conferences to make oral or poster presentations.

The 2017 *American Planning Association National Planning Conference* was held in New York City in May. Angela Glover Blackwell (above), was a keynote speaker at the conference. She co-authored *Uncommon Common Ground: Race and America's Future*, and is considered an authority on race and equality issues in America.

Ten students from UI's Department of Urban & Regional Planning attended the meeting: Todd Bagby, Jay Fieser, Sarah Gardner, Shiqin Liu, Samuel Odeyem, Priyanka Rayamajhi, Emily Seiple, Akanksha Tiwari, Francis Waisath, and Martina Wolf Battistone.

The American Geophysical Union's 2017 meeting took place in New Orleans, Louisiana in December. It is the largest earth and space science meeting in the world. Veteran journalist Dan Rather (above) was a keynote speaker.

Nate Lawrence, an ISU student in Ecology, Evoloution, & Organismal Biology attended as well as three students from UI's Department of Chemical & Biochemical Engineering: Gonzalo Ferrada, Munsung Keem, and Elizabeth Lennartson.

Meghana Akella
Mechanical Engineering, ISU
*American Institute of Chemical Engineers Annual Conference*

Toby Avalos
Anthropology, UI
*American Association of Physical Anthropologists Conference*

Ellen Black
Civil & Environmental Engineering, UI
*Association of Environmental Engineering and Science Professors*

Chad Drake
Civil & Environmental Engineering, UI
*American Society of Agricultural and Biological Engineers Annual International Meeting*

Jacob S. Grant
Chemistry, UI
*Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy*

Lauren Grimley
Engineering, UI
*Consortium of Universities for the Advancement of Hydrologic Science, Inc. Conference on Hydroinformatics*

Jacob Jahnke
Civil & Environmental Engineering, UI
*Society of Environmental Toxicology and Chemistry*

Braden Krien
English, UI
*Association for the Study of Literature and the Environment*

Kangsan Lee
Geographical & Sustainability Science, UI
*American Association of Geographers Annual Meeting*

Nicholas Lyon
Ecology, Evolution & Organismal Biology, ISU
*Iowa Climate Science Educators Forum* and *Ecological Society of America*

Nyzil Massey
Biomedical Sciences, College of Veterinary Medicine, ISU
*Experimental Biology*

Danielle Medgyesi
Occupational & Environmental Health, UI
*University of North Carolina Water & Health Conference*

Claire Muerdter
Civil & Environmental Engineering, UI
*Society of Environmental Toxicology and Chemistry North America Annual Meeting*

Kristine Neu Lang
Horticulture in College of Agriculture & Life Sciences, ISU
*American Society for Horticulture Science*

Shivendra Prakash
Civil & Environmental Engineering, UI
*North American Wind Energy Academy 2017 Symposium*

Jiajie Qian
Chemical & Biochemical Engineering, UI
*American Chemical Society National Meeting & Exposition*

Jeremy Skeens
Anthropology, UI
*Society for American Archaeology*

Jennifer Thines
Earth & Environmental Sciences, UI
*International Association of Volcanology & Chemistry of the Earth's Interior*

Haowen Xu
Iowa Institute of Hydraulic Research, UI
*University Consortium on Geographic Information Science Summer School 2017*

Hui Zhi
Civil & Environmental Engineering, UI
*Society of Environmental Toxicology and Chemistry North America Annual Meeting*

# RESEARCH

CGRER supports research that deepens the understanding of environmental change and provides solutions to local, regional and global problems. In 2017, this work included a $1.3 million grant awarded to Plant Microbiome research, and a cross-cultural initiative to develop web scraping tools to highlight the level of research conducted in India.

## BIOAUGMENTATION GRANT AWARDED TO SCHNOOR

In September, a $1.3 million new Strategic Environmental Research and Development Program (SERDP) Grant was awarded to **Jerald Schnoor,** professor of Civil and Environmental Engineering at the UI and co-director of CGRER. According to Schnoor, a persistent and common problem at military bases and some industrial sites is the contamination of groundwater with 1,4-dioxane and co-occurring chlorinated solvents such as trichloroethene (TCE), dichloroehene (DCE), and trichloroethene (TCA). These chemicals are toxic, long-lived, and difficult to biodegrade or treat. They are frequently found at relatively high concentrations in groundwater and yet the Environmental Protection Agency has set very stringent clean-up goals based on their toxicity and the risk to drinking water supplies.

The objective of Schnoor's work will be to discover novel strains of microorganisms that help to rapidly degrade 1,4-dioxane and co-contaminants to innocuous end-products. This will be accomplished by accessing the microbiome of plants, where there is reason to believe that microorganisms can be found that will biodegrade 1,4-dioxane and co-contaminants better than those reported in the past. With successful isolation, culturing, testing, optimization and scale-up, this effort will produce and stabilize kg-quantities of the best microbe for bioaugmentation at the contaminated sites.

## IOWA WATERSHED APPROACH

*Upper Cedar River Watershed wetland project (photo by Iowa Flood Center).*

The Iowa Watershed Approach (IWA) is a statewide watershed improvement program that slows the movement of water through the landscape using conservation practices such as strategically building farm ponds and wetlands. The IWA will restore some of Iowa's natural resiliency to heavy rainfall while also improving water quality, creating wildlife habitat, and protecting vulnerable populations and infrastructure.

The U.S. Department of Housing and Urban Development (HUD) awarded Iowa $96.9M for the IWA, which is a collaboration of many organizations and agencies statewide, including the Iowa Flood Center (IFC). The IWA is working in eight rural watersheds to voluntarily engage watershed stakeholders and move toward a more resilient state.

In 2017, project coordinators were hired for each of the participating IWA watersheds. Watershed planning efforts are underway and will set priority goals and objectives in each watershed to guide strategic decision-making going forward. The IWA program goals are being delivered through watershed management authority quarterly meetings, landowner meetings, a new program website, and outreach events. Nine water-quality stations and ten hydrologic network stations have been deployed. Analysis of existing and potential agricultural best management practices in each watershed will help guide practice implementation efforts that will begin in 2018.

*Oxbow restoration project (photo by Iowa Flood Center)*



## FIELD RESEARCH TRAVEL GRANTS FOR GRADUATE STUDENTS

*In 2017, $12,362 was awarded to graduate students advised by CGRER members who traveled to sites to complete field research for their thesis or dissertation.*

Abdioskouei, Maryam
Environmental Engineering, UI
*Improving the Methane and VOC Emission Estimates from Natural Gas Activities Using Inverse Modeling Techniques*

Auguado, William
World Languages, ISU
*Seed Dispersal of an Economically Important Plant, Saba senegalensis, by Western Chimpanzees at Fongoli, Senegal*

Lyon, Nicholas (*above*)
Ecology, Evolution and Organismal Biology, ISU
*Adaptive Management for Pollinators and Prairie Plants in Midwestern Working Landscapes*

*Below: Alex Maruszczak's photo of Iceland.*

Maruszczak, Alex D
Earth & Environmental Sciences, UI
*Sampling volcanic glasses to determine spatial variations in melt generation and the depths of magma chambers along the Snæfellsnes Peninsula, Iceland*

Piatscheck, Finn
Ecology, Evolution, and Organismal Biology, ISU
*Spatial and temporal variation of costs and benefits in an obligate mutualistic symbiosis*

Quinteros, Kevin
Ecology, Evolution, and Organismal Biology, ISU
*Phylogeography of an Obligate Mutualistic Symbiosis*

Siebach, Jacob A.
Earth & Environmental Sciences, UI
*Investigating why recent volcanism is occurring far from the plate boundary on Iceland*

Ward, Anna
Biology, UI
*Documenting massive unreported animal diversity associated with North American oak galls*

*Jacob Siebach in Iceland*

*Kevin Quinteros and Finn Piatscheck collecting leaf samples.*

*Anna Ward studies oak galls.*

## CGRER VISITING SCIENTISTS

*(Photo by TEDxHitechCity)*

Sarath Guttikunda, a UI alumnus, visited CGRER in April of 2017. During his time at Iowa, Guttikunda, who currently serves as an affiliate associate professor at the Desert Research Institute in Reno, sparked pioneering discussions that prompted practical solutions to real-time problems. By leading a group of students to work alongside CGRER members at the Informatics Initiative, Guttikunda and his team were able to develop innovative web scraping tools that will modernize a process once accomplished through manual screening.

The development of web scraping tools such as this serves as a tremendous advancement for Guttikunda's area of work. Technology of this nature, specifically machine learning and web scraping tools, are beneficial because they help automate the research that leads to streamlined efficiencies and ultimately allows for greater innovation. With the help provided by students from Iowa, Guttikunda developed a script for this particular type of research. Following the analysis report of this script, Guttikunda will be able to highlight the level of research conducted both in and outside of India.

## 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, are located at the Information Technology Facility on the UI Oakdale 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.

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



## SEED GRANTS

*In 2017, CGRER awarded a seed grant total of $227,983 to eight projects.*

*Ambient Air Pollution and Reproductive Health among Women in Wuhan, China;* **Wei Bao**, UI Epidemiology; $35,000.

*The El Niño-Southern Oscillation in a Warming World: Developing Coral Records of Ocean Variability from Past Greenhouse Periods;* **Rhawn Denniston**, Cornell College, Geology; $26,550.

*Surface Scanner Upgrade for Satellite Soil Moisture Applications;* **William Eichinger**, UI Civil & Environmental Engineering; $14,000.

*Impacts of iron biogeochemical cycling on soil carbon stabilization in Iowa agroecosystems*; **Steven Hall**, ISU Department of Ecology, Evolution and Organismal Biology; $34,978.

*Prairie Strips as a Sustainable Mitigation Strategy to Retain Antimicrobial Resistant Organisms;* **Adina Howe,** ISU Department of Agricultural and Biosystems Engineering; $35,000.

*Optimization of Wind Energy Projects Using Experimental and Computational Fluid Dynamics;* **Corey Markfort**, UI College of Engineering; $35,000.

*Coupled Climatic and Human Impacts on the Sycomore Fig, a Culturally and Ecologically Significant Tree;* **John Nason**, ISU Ecology, Evolution, and Organismal Biology; $16,590.

*Trace element records of Pacific Ocean tropical corals as a proxy for multi-millennial record of ocean acidification*; **Ingrid Ukstins Peate**, UI Earth & Environmental Sciences; $30,865.

*2008 flooding in Iowa City (photo by M. Moye-Rowley)*

## RETIRING FOUNDING MEMBER GEORGE MALANSON

CGRER was founded in 1990 to address global warming and since that time has made significant contributions to increasing understanding of climate change and the need for climate action. **George Malanson**, a founding member of CGRER, reflects on the impact of this program.

"I think that CGRER's role in spurring interdisciplinary work has been a great accomplishment. This has been necessary to push boundaries, not only in research but also in teaching and outreach. I give CGRER credit for raising awareness of other's work across campus and across the state, and I personally see this benefiting students at all levels–from classroom visits to doctoral committees," Malanson said. "I think an interdisciplinary approach has led to the success of outreach initiatives such as the annual Iowa Climate Statement.

Although I have gained some personal recognition for my research while working here for 32 years, I am most proud of helping others along the way–but maybe it is that they helped me. I have coauthored papers with 44 students, 28 of those students here at UI. I am also proud to be part of an academic genealogy in environmental research covering 10 generations (-6, +3)."

## A SAMPLING OF PUBLICATIONS BY CGRER MEMBERS


Buyun, L., H. Lehmler, Y. Sun, G. Xu, Y. Liu, G. Zong, Q. Sun, F.B. Hu, R.B. Wallace, **W. Bao**. 2017. Bisphenol A substitutes and obesity in US adults: analysis of a population-based, cross-sectional study. *Lancet Planet Health,* doi: 10.1016/S2542-5196(17)30049-9.

Sethi, R.S., D. Schneberger, **C. Charavaryamath**, B. Singh. 2017. Pulmonary innate inflammatory responses to agricultural occupational containments. *Cell and Tissue Research*, doi: 10.1007/s00441-017-2573-4.

Klarich, K.L., N.C. Pflug, E.M. DeWald, M.L. Hladik, D.W. Kolpin, **D.M. Cwiertny**, **G.H LeFevre**. 2017. Occurrence of Neonicotinoid Insecticides in Finished Drinking Water and Fate during Drinking Water Treatment. *Environment Science and Technology*, doi: 10.1021/acs.estlett.7b00081.

Tesfatsion, L., Y. Jie, C. R. Rehmann, **W. J. Gutowski**. 2017. An agent-based platform for the study of watersheds as coupled natural and human systems. *Environmental Modeling & Software*, doi: 10.1016/j.envsoft.2016.11.021.

**Hall, S.** 2017. Elevated moisture stimulates carbon loss from mineral soils by releasing protected organic matter. *Nature Communications*, doi:10.1038/s41467-017-01998.

Bril, J.S., K.L. Langenfeld, **C.L. Just**, **S.N. Spak,** T.J. Newton. 2017. Simulated mussel mortality thresholds as a function of biomass and nutrient loading. *PeerJ*, doi:107717/peerj.2838.

**Khandelwal, M.**, **M.E. Hill Jr., P. Greenough**, J. Anthony, M. Quill, **M. Linderman**, **H.S. Udaykumar.** 2017. Why Have Improved Cook-Stove Initiatives in India Failed? *World Development*, doi: 10.1016/jworlddev.2016.11.006.G.

**Krajewski, W.F.**, D. Ceynar, **I. Demir**, R. Goska, A. Kruger, C. Langel, R. Mantilla, F. Niemeier, F. Quintero, B.C. Seo, S. Small, **L. Weber**, N. Young. 2017. Real-Time Flood Forecasting and Information System for the State of Iowa. *Bulletin of the American Meteorological Society*, doi: 10.1175/BAMS-D-15-00243.

Al-Naiema, I., and **E.A. Stone**. 2017. Evaluation of Anthropogenic Secondary Organic Aerosol Tracers from Aromatic Hydrocarbons. *Atmospheric Chemistry and Physics*, doi: 10.5194/acp-17-2053-2017.

Jahn, D.E., **E.S. Takle**, W.A. Gallus. 2017. Improving wind-ramp forecasts in the stable boundary layer. *Boundary-Layer Meteorology*, doi:10.1007/s10546-017-0237-2.

Slater, L.J., and **G. Villarini**. 2017. Evaluating the drivers of seasonal streamflow in the U.S. Midwest. *Water*, doi:10.3390/w9090695.

Xu, X., **J. Wang**, Y. Wang, J. Zeng, O. Torres, Y. Yang, A. Marshak, J. Reid, S. Miller. 2017. Passive remote sensing of altitude and optical depth of dust plumes using the oxygen A and B bands: First results from EPIC/DSCOVR at Lagrange-1 point. *Geophysical Research Letters*, doi:10.1002/2017GL073939.

**Zimmerman, D.L.**, and J.M. Ver Hoef. 2017. The Torgegram for fluvial variography: Characterizing spatial dependence on stream networks. *Journal of Computational and Graphical Statistics*, doi: 10.1080/10618600.2016.1247006.

# INTERNATIONAL EFFORTS

CGRER members are committed to addressing both regional and global problems relating to environmental change. In 2017, international efforts included traveling to China as part of the Thousand Talent Program and a seminar regarding air quality management by Sarath K. Guttikunda.

## CGRER SEMINAR WITH SARATH K. GUTTIKUNDA

Sarath K. Guttikunda delivered a seminar titled *"Air Quality (Data) Landscape in India to Support Short- and Long- Term Decisions"* in April. Guttikunda is a TED Fellow, founder of Urban-Emissions.Info (India), and an affiliate associate professor at the Desert Research Institute in Reno.

According to Guttikunda, traditionally air quality management has been based on a "top-down approach" with data coming from a wide network of reliable, representative, and continuous monitoring stations. In India, continuous monitoring activities and information dissemination platforms are limited and under development, and are in need of a complete overhaul in order to reach the level of transparency and accuracy required for implementing an air quality and health alert system.

Guttikunda notes that even while waiting for the top-down capacity to develop, the monitoring data trends present a deteriorating picture of air quality and public health. For example, recent comparative studies have highlighted Delhi as the city with the worst air quality in the world and the number of districts not complying with the national annual ambient standard for PM2.5 went up from 40% to 60% between 1998 and 2014. The comparisons are not justified because of the lack of reliable and available monitoring data from cities other than Delhi. That is to say that there are cities in India with the potentially equal risks as Delhi and yet this comparison remains unknown. For Guttikunda, this translates to an urgent need to collate and disseminate air quality information in some form, for regions with limited or no monitoring.

*Sarath K. Guttikunda delivers a seminar on air quality. (photo by Jeremie Moen)*

## CARMICHAEL PRESENTS TO IOWA CITY FOREIGN RELATIONS COUNCIL


*Gregory Carmichael at the Iowa City Foreign Relations Council meeting in September.*

**Gregory Carmichael**, UI professor of Chemical and Biochemical Engineering and co-Director of CGRER, spoke at the Iowa City Foreign Relations Council meeting in September. Carmichael began his talk with a summary explanation of the Paris Climate Agreement. The aim of this agreement is to strengthen the global response to the threat of climate change by maintaining a global temperature rise below 2 degrees Celsius. The agreement works to strengthen the ability of countries to respond to the impacts of climate change. Carmichael acknowledged the Paris Agreement was a small but significant step in the right direction towards curbing the effects of global climate change.

These specific effects have increased in intensity over the last few years. The global scientific community is now able to confidently relate recent extreme weather events such as the heat waves in California, hurricanes Irma and Harvey, wildfires, and massive flooding across India, Bangladesh, and Nepal, to climate change. Even though the U.S. has expressed its plan to withdraw from the Paris Agreement, there remain many efforts at local, regional, and global scales to address climate and environmental change. 38 states have drafted action plans to address the Paris Accord. Carmichael noted that Iowa City is an example of a specific community that has adopted the same plans as the U.S. in response to the Paris Accord. Furthermore, Carmichael noted the work of **Joe Bolkcom** and CGRER in taking the lead to develop the Iowa Climate Statement as a means of connecting the knowledge of the scientific community to public understanding and action.

What are other ways to respond to this unfolding crisis?

One way forward is to integrate new technology that will assist communities in implementing change as part of the Post-Paris efforts. Carmichael presented the Integrated Global Greenhouse Gas Information System (IG3IS), a tool created and distributed by the World Meteorological Organization that provides techniques to verify the success of efforts to reduce greenhouse gas emissions.

Wong Wei, a visiting scholar from China's Ministry of Environmental Protection, joined Carmichael on stage where he spoke about the National Center for Environmental Quality Forecasting and the massive efforts China is taking to curb greenhouse gas emissions.


*Wong Wei, a visiting scholar from China's Ministry of Environmental Protection.*

## SCHNOOR PRESENTS: CHINA THOUSAND TALENT PROGRAM

In November, **Jerald Schnoor**, professor of Civil and Environmental Engineering at UI and co-director of CGRER, presented a lecture at the China Thousand Talents Program in Dalian, China. Schnoor holds the honor of being one of the 1000 Talents named by the Chinese Academy of Sciences as part of this international program.

Schnoor's lecture advocated multiple barriers of protection as the key to producing safe drinking water, citing how much of northern Europe has already adopted this particular paradigm. For surface water sources, northern Europe insists on watershed protection, infiltration of source water through river bank or groundwater, disinfection with ozone and ultraviolet light, biologically-extended activated carbon, reverse osmosis, and a clean distribution system.

Schnoor noted how the U.S. has a good record of producing safe drinking water while using mostly chlorine, chlorine dioxide, or chloramines to maintain a residual.

*Dalian, China*

However, he made clear that the difference in philosophies between the two approaches is certainly worthy of consideration. The age of the distribution systems in many cities of the U.S. is deplorable and in need of investment. Additionally, Schnoor called for action to address the community health hazard that exists from lead pipes, solder, and faucets throughout the nation.

The greatest number of disease outbreaks in the U.S. from drinking water is from Legionella, an airborne disease from inhalation of water aerosols. The second is intermittent groundwater sources that are not chlorinated. Schnoor advocated that improvements to water infrastructure can be made while addressing multiple barriers for the production of safe drinking water. The Environmental Protection Agency will not be able to keep up with all the new and emerging chemicals, so it is incumbent on water professionals to continuously improve overall treatment standards. Schnnor advises that a common sense approach to this issue is not chemical-by-chemical, but rather the adoption of high treatment standards, pollution prevention, and infrastructure renewal.

## NEW MEMBERS

**Peter Berendzen** is an associate professor of Biology at UNI. The major theme of Berendzen's research is examining phylogeographic patterns and diversification of North American and East African freshwater fishes, using both molecular and morphological approaches. The focus of his recent work is understanding the role of historical and contemporary processes in shaping the observed spatial genetic variation of individuals and populations of native non-game fishes distributed in the upper Mississippi River basin.

**Jaime Juárez** is an assistant professor of Mechanical Engineering at ISU. Juarez's research focuses on the development of complex fluids for additive manufacturing. Complex fluids are materials that involve two or more phases of matter. Additive manufacturing of complex fluids is limited by the fact that most processes can only handle one type of material at a time. Juarez addresses this issue by using externally directed fields during the additive manufacturing process to form composites for use as cosmetics, pharmaceuticals, food-based emulsions, and construction materials.

**Chaoqun (Crystal) Lu** is an assistant professor of Ecology, Evolution, & Organismal Biology at ISU. Her research focuses on understanding and quantifying the complex ecosystem processes in response to climate change, land use and cover change, and human management across scales. Lu's primary area of interest includes estimation of terrestrial carbon sequestration, land-to-atmosphere greenhouse gas emissions, and land-to-aquatic nutrient movements by using land surface models, and data-model assimilation approach.

**Corey Markfort** is an assistant professor of Environmental Fluid Mechanics and Renewable Energy with a secondary appointment in Mechanical and Industrial Engineering at the UI. He is also faculty in Research Engineering and head of the Environmental Fluid Mechanics and Renewable Energy Laboratory at IIHR – Hydroscience & Engineering. Markfort's research focus is on improving measurement and prediction of environmental boundary layers, with application to air and water resource sustainability, land-atmosphere and air-water interactions, and renewable energy.

**Ajay Nair**, is associate professor and Vegetable Extension Specialist at ISU. The primary goal of Nair's research and the extension program is to develop resilient, sustainable, and productive vegetable production systems. Nair's current research endeavors include projects that focus on cover cropping, nutrient management, season extension, soil amendments, and conservation tillage in vegetable cropping system.

**Keith Schilling** is an associate State Geologist with the Iowa Geological Survey at the UI. Schilling's work focuses on watershed hydrology and water quality. His current projects include investigating total and dissolved phosphorus transport, assessing spatial and temporal patterns of groundwater recharge, quantifying tile contributions to streamflow and nutrient loads, and evaluating new best management practices for nutrient reductions at the watershed scale.

**Carl L. Thurman** is a professor of Biology at UNI. Thurman's area of research includes tropical marine ecology, evolution, and ecological physiology. Specifically, Thurman's research interest embraces topics such as cellular and ecological physiology as well as ecology and biogeography. More recently collaborations have expanded his research into ecological genetics. Thurman's research model species are intertidal decapod crustaceans know as fiddler crabs (at left) inhabiting the coastal regions of most tropical and temperate oceans.



## CGRER NEW MEMBER SPOTLIGHT

**Silvia Secchi** is an associate professor of Geographical and Sustainability Sciences and Public Policy at the UI. Secchi is trained as a natural resource economist. Her research focuses on the use of interdisciplinary approaches and integrated modeling to assess the environmental impacts of agriculture, particularly on water quality and carbon sequestration. Her work centers on Iowa and Corn Belt landscapes. She has studied agricultural conservation, Asian Carp control, the impact of climate change in the Corn Belt, floodplain management and biofuel issues. She is currently investigating the effect of the ethanol mandate on land use change, and the effectiveness of state-level nutrient reduction strategies. In addition, she is interested in interdisciplinary learning pedagogy, for both undergraduate and graduate students.

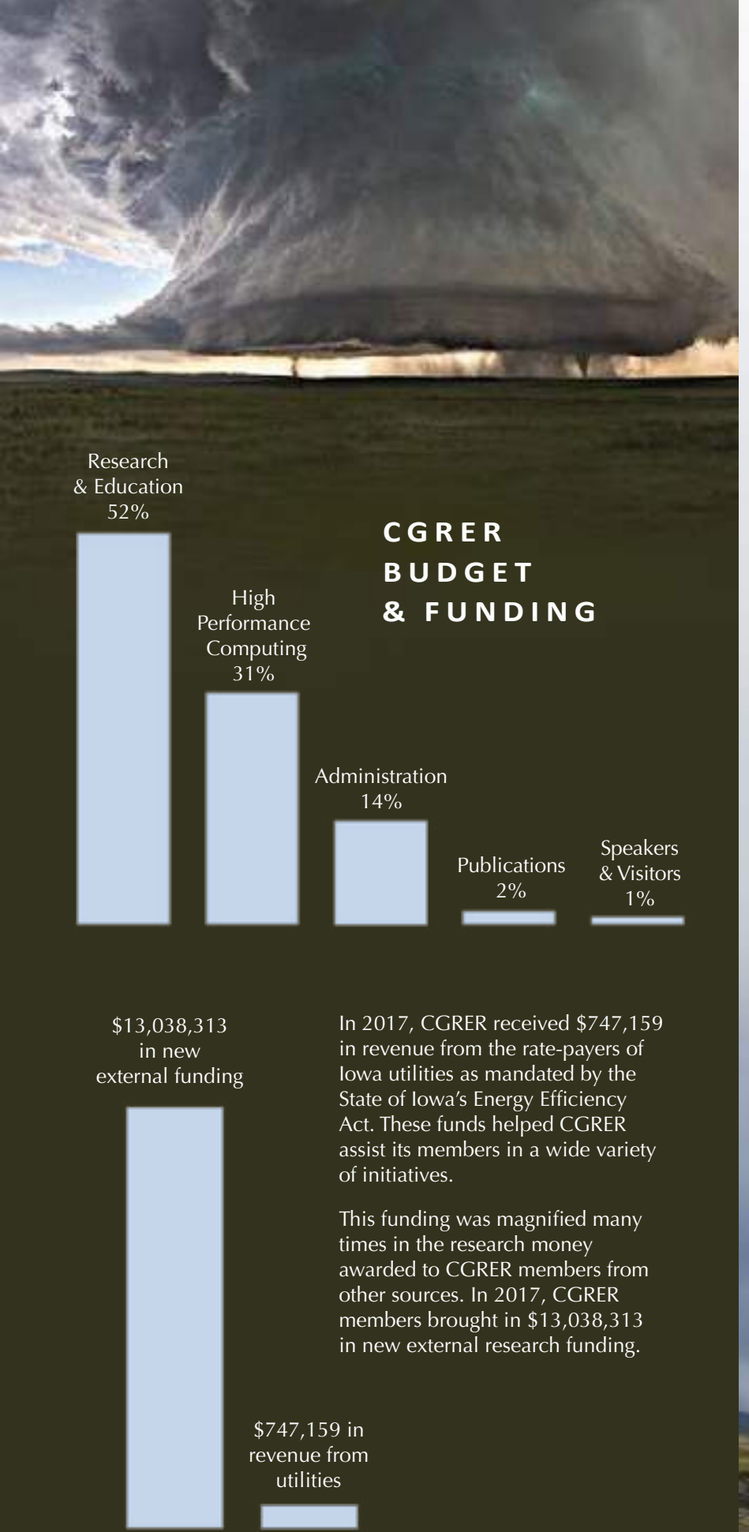
## CGRER ADMINISTRATION

*Jerry Schnoor and Greg Carmichael.*

CGRER is directed by UI 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 the 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.

*Joe Bolkcom, Amy Parker and Jeremie Moen*

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.




## CGRER BUDGET & FUNDING

$13,038,313 in new external funding

$747,159 in revenue from utilities

In 2017, CGRER received $747,159 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 2017, CGRER members brought in $13,038,313 in new external research funding.



# CGRER MEMBERS

## UNIVERSITY OF IOWA

**Anthropology**
*Margaret E. Beck*
*Michael S. Chibnik*
*Russell L. Ciochon*
*James G. Enloe*
*Matthew E. Hill, Jr.*
*Meena Khandelwal*

**Biological Sciences**
*Andrew A. Forbes*
*Stephen D. Hendrix, Emeritus*
*Diana G. Horton, Emeritus*
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