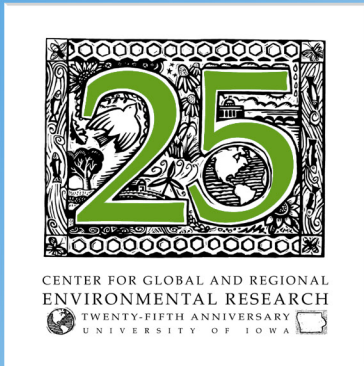


THE CENTER FOR GLOBAL & REGIONAL
ENVIRONMENTAL RESEARCH



2015 ANNUAL REPORT





CGRER

WWW.CGRER.UIOWA.EDU

- 1 CGRER MISSION
- 2 EXECUTIVE SUMMARY
- 4 MESSAGE FROM ADVISORY BOARD
- 6 OUTREACH
- 12 EDUCATION
- 16 RESEARCH
- 20 INTERNATIONAL EFFORTS
- 22 ADMINISTRATION AND NEW MEMBERS
- 24 BUDGET, FUNDING AND CGRER MEMBERS



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

Cover photos:

At top, a view of earth from NASA Earth Observatory.

Main photo: Iowa farm scene (Copyright: 2011 MidAmerican Energy Holdings Company)

CGRER 25th Anniversary artwork by Claudia McGehee.

Photos this page:

At top, Iowa's Turkey River (photo by Iowa Flood Center)

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

Photo at right by Kathryn Rathbun, who received a CGRER travel grant for her research in the Atacama Desert in Chile.



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 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 120 members from 44 departments at 11 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

The Center for Global and Regional Environmental Research (CGRER) celebrated its 25th anniversary in 2015, making this a landmark year. CGRER was established by the State of Iowa and authorized by the Iowa State Board of Regents in 1990. A quarter century later, we continue to foster interdisciplinary research, educate students and the public, and promote dialogue in the state on issues relating to environmental change.

First and foremost, CGRER is a research center. Our members seek to generate new knowledge through careful experimentation and investigation of observable phenomena. This annual report

needed to confirm their hypothesis, but evidence indicates that dense smoke from Central America contributed to the severe tornado outbreak and deaths on April 27, 2011 in the southern U.S.

Let me tell you about several other research projects of significant importance during the year. Rhawn Denniston collaborated with Gabriele Villarini to interpret flooding over geologic time in a tropical cave in Australia. It turns out that the layers recorded in stalagmites track El Niño events as measured by rainfall records at a weather station near the cave. Now, for the first time, they have established a good proxy

First and foremost, CGRER is a research center. Our members seek to generate new knowledge through careful experimentation and investigation of observable phenomena.

presents a sampling of the wide-ranging work done both regionally and globally by our members. You'll read about how Pablo Saide, Scott Spak and Greg Carmichael generated new knowledge and international interest through their analysis linking Central American biomass burning with increased tornado severity in the U.S., a study that was published in the leading journal *Geophysical Research Letters*. More work will be

Rhawn Denniston installing research equipment in a cave in Australia.

for the frequency of El Niño climate events over a 2000-year period, simply by reading the carbonate layers on stalagmites in the cave. This study was published in the *Proceedings of the National Academy of Science*.

Another study involving CGRER member Tori Forbes looked at the potential risks of hydraulic fracturing and directional drilling. While these have been a boon to natural gas production, the radioactivity from the water used in the process can pose significant health risks to people. Forbes collaborated with scientists in the UI Interdisciplinary Program in Human Toxicology, the State Hygienic Laboratory, and Michael Schultz of the Free Radical and Radiation Biology Program at the UI. Their project, which focused on the production of radionuclides from fracking operations in the Marcellus Shale formation of central Pennsylvania,



CENTER FOR GLOBAL AND REGIONAL
ENVIRONMENTAL RESEARCH
TWENTY-FIFTH ANNIVERSARY
UNIVERSITY OF IOWA

Claudia McGehee created a design to commemorate CGRER's 25th anniversary.

was published in the top journal *Environmental Health Perspectives*. Hopefully, this new understanding will lead to remedies for these risks.

Another project resulted in a more immediate contribution to solving an environmental issue. H.S. Udaykumar and colleagues showed how a simple \$1 burner-insertion into common three-stone hearths in the Mewar region of Rajasthan, India, can achieve similar efficiencies as expensive cook stoves, while at the same time reducing toxic soot exposures to residents, lowering greenhouse gas emissions, and reducing the need for forest-clearing and firewood gathering by 60%. Their work was published, appropriately, in the prestigious journal *Solutions – For a Sustainable and Desirable Future*.

When it comes to educating students and the public, our activities have only become richer through time. We have 120 faculty and staff members to thank for that. Much of our educational effort is done through mentoring, the most important job of a professor. Our dedicated staff members help create the welcoming environment within which that magic of education happens.





A woman holds the burner-insertion used in H.S. Udaykumar's cook stove research.

Translating the research of faculty, staff and students for the public is a vital part of our mission as well, which brings me to our last focus area: promoting dialogue throughout the state. You can read about our efforts at dialogue in this annual report, including CGRER participation in the Paris climate talks, the Iowa Climate Science Educators Forum, our annual Legislative Breakfast, the Iowa Climate Statement, and various forms of media outreach.

Engaging with the public is the primary job of CGRER Outreach and Community Education Director Joe Bolkcom, who does an incredible job, ably assisted by journalism interns and graduate students KC McGinnis and Nick Fetty. We're grateful to Elizabeth Stone, the new voice of our *Iowa Environmental Focus*, and to our IT Director Jeremie Moen, who does brilliant work on our website and provides invaluable technical assistance

to our faculty and students. In addition, we are blessed with a new Research Support Coordinator, Amy Parker, who has ably assumed the duties of Jane Frank, who retired after 25 years of exemplary service. And we are indebted to Mary Moye-Rowley, our graphic designer, and Lori Erickson, our editor, who expertly produce our publications, including this annual report.

After 25 years as co-directors, Greg and I are grateful to many people: to the members, executive committee, and advisory board of CGRER, to the ratepayers of the State of Iowa's utilities, and to the UI Office of the Vice President for Research and Economic Development for its continuing support. We will continue to foster research, educate students and the public, and promote dialogue to the best of our ability in 2016.

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



Jerry Schnoor and Greg Carmichael

Photo at right: Jordan Foye received a CGRER travel grant for his research on debris flow initiation on slopes in southern California.



EXECUTIVE COMMITTEE

David Bennett (term ending)
Geographical & Sustainability
Sciences,
University of Iowa

Art Bettis
Earth and Environmental Sciences,
University of Iowa

Dennis Dahms
Geography,
University of Northern Iowa

Kajsa Dalrymple
Journalism & Mass Communication,
University of Iowa

Barbara Eckstein
English,
University of Iowa

Andrew Forbes
Biology,
University of Iowa

Vicki Grassian (term ending)
Chemistry,
University of Iowa

Sarah Larsen
Chemistry,
University of Iowa

Lou Licht
Ecolotree, Inc.

Charlie Stanier
Chemical and
Biochemical Engineering,
University of Iowa

Elizabeth Stone
Chemistry,
University of Iowa



MESSAGE FROM THE CGRER ADVISORY BOARD

Happy Anniversary! CGRER was created by the Iowa Legislature's Energy Efficiency Act and signed into law by Governor Branstad in 1990, the same year the Intergovernmental Panel on Climate Change released its first Scientific Assessment. The report said that the "emissions resulting from human activities are substantially increasing the atmospheric concentrations of the greenhouse gases... resulting on average in an additional warming of the Earth's surface," and that the disruption of the climate caused by the release of such pollution "will change the composition of ecosystems."

CGRER was created in part to help all Iowans better understand, prepare, and deal with these changes. Since 1990 the scientific consensus has only become clearer that the climate is being disrupted by our activities, with damaging impacts to many people's lives. In the U.S., the

Protection Agency finalized the first national limits on carbon pollution from power plants through the Clean Power Plan. In addition, the U.S. reached an historic accord with 194 other countries to reduce emissions and attempt to avoid the worst impacts of climate disruption. The work of CGRER members and alumni, including that of co-director Jerry Schnoor and Chilean Undersecretary for the Environment Marcelo Mena (a former CGRER graduate student) helped achieve that tremendous progress in Paris.

In Iowa, CGRER's efforts have helped prepare the state for these global changes, with huge benefits for electric customers and all Iowans. CGRER members have been at the forefront of shaping the state's preparation for a changing climate, including initiating and helping develop the Greenhouse Gas Action Plan from 1994-1996, chairing the

variety of efforts. In the aftermath of devastating floods, CGRER members contributed to the book *A Watershed Year: Anatomy of the Iowa Floods of 2008*, organized a symposium on "Preparing for the Future," sponsored an institute for middle and high school teachers in impacted communities,



and commemorated the fifth anniversary of the floods with outreach and educational events. While Iowa was partly spared the worst storms and flooding that devastated parts of the Midwest and Southeast in December of 2015, CGRER's leadership and guidance have undoubtedly better prepared our state to deal with future extreme weather events.

CGRER has provided an amazing return on the small investment Iowa's electric customers have made in it, but the work of its members doesn't stop at the state's borders. Co-director Greg Carmichael, a leading expert on forecasting air quality problems, has done groundbreaking research on the contribution of black carbon such as soot from cooking fires to climate disruption. His research is literally helping save lives around the world. H.S. Udaykumar was inspired to investigate ways to reduce that harmful soot in India, for example. He made headlines in 2015 for his work on a \$1 metal insert that can reduce climate and health-disrupting pollution from cookstoves by up to 90%. And air quality forecasting techniques like

CGRER's critical mission is to help people understand the environmental forces shaping our lives and to provide guidance and assistance in making better-informed decisions about our future in a changing world.

single largest source of such climate-disrupting carbon pollution was and still is the generation of electricity, primarily from power plants burning coal, and thus it makes sense that electric companies and customers in Iowa are asked to partly fund CGRER (albeit with just 0.015% of their electric bills).

This past year has demonstrated the foresight of the Board of Regents in creating CGRER and the wisdom of the Legislature and Governor Branstad in connecting electric ratepayers and utilities with that mission. That's because in 2015 the Environmental

Iowa Climate Change Advisory Council's work from 2007-2009, and organizing the annual Iowa Climate Statements from 2012-2015. Thanks to that guidance, and to investments by Iowa's electric companies, the state is now a leader in renewable energy, with more than 30% of its electricity coming from wind power in 2015. Iowa is on track to meet the Clean Power Plan's targets, and in addition those wind projects have created tens of thousands of new jobs.

CGRER has helped Iowans understand and adapt to increased flooding through a



Mark Kresowik and son meet with U.S. Congressman Dave Loebsack at the Iowa State Capitol.

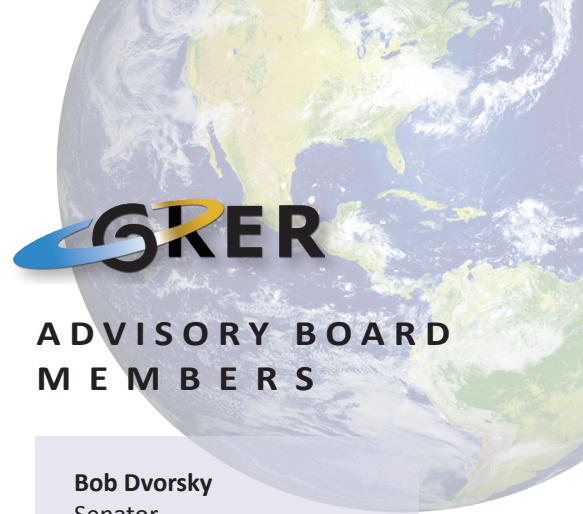
those developed by Carmichael were a critical factor in saving lives during December's multi-day air quality red alert in Beijing, which was caused by dangerous smog pollution formed in part by emissions from coal-fired power plants. China is now moving aggressively to curb that pollution.

As a student at the University of Iowa I had the opportunity to learn from dozens of CGRER members and stakeholders, and their guidance and support still influence my work a decade later. As a result I've been delighted to serve on the Advisory Board for the past eight years. But this year was different as I became a father and welcomed new life into the world. I find myself often

thinking about my son's future and how I can help ensure better opportunities 25 years from now when he's graduated from college (maybe from the University of Iowa!) and embarked on a career.

CGRER's critical mission is to help people understand the environmental forces shaping our lives and to provide guidance and assistance in making better-informed decisions about our future in a changing world. The tireless efforts of CGRER members have improved my own life. They've shaped a stronger and more resilient environment and economy for Iowans. And they've helped create opportunities for people all over the world. On behalf of the Advisory Board I want to thank everyone who has contributed to this positive work, especially the CGRER members and the Iowa ratepayers who have supported the Center for Global and Regional Environmental Research since its creation in 1990. I hope we can all continue to create a more prosperous and stable future for my son, and for your children and grandchildren, over the next 25 years.

Mark Kresowik
Beyond Coal Campaign,
Sierra Club



ADVISORY BOARD MEMBERS

Bob Dvorsky
Senator,
Iowa State Legislature

Tim Harden
Alliant Energy

Mark Kresowik
Beyond Coal Campaign,
Sierra Club

Jesse Leckband
MidAmerican Energy

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

David Osterberg
Occupational and
Environmental Health,
University of Iowa

William Stigliani
Center for Energy and
Environmental Education,
University of Northern Iowa

Sharon Tahtinen
Iowa Department
of Resources

Nick Wagner
Iowa Utilities Board

CGRER @ 25



1981

A team of federal scientists finds evidence of an overall warming of the earth's atmosphere dating back to 1880.

1983

EPA releases a report on greenhouse effect and gives suggestions for mitigating rises in global temperature.

1985

Scientists from 29 nations urge leaders to develop economic and social plans to combat imminent rising temperatures and sea levels.

Source for timeline items in green and red:
The New York Times

The National Academy of Scientists releases a report about the buildup of carbon dioxide in the atmosphere.





In addition to outreach initiatives connected to CGRER's 25th anniversary, the year included a series of forums on climate change held in preparation for the U.N. climate conference in Paris, a project to improve air quality in Dubuque, and the fifth-annual Iowa Climate Statement.

CGRER 25TH ANNIVERSARY EVENTS

Two events in October honored CGRER's 25th anniversary. The first was a reception attended by approximately 30 students, professors, politicians and researchers at the UI. Short speeches were given by **Greg Carmichael** and **Jerry Schnoor**, who co-founded CGRER; **David Osterberg**, who was instrumental in its creation while serving in the Iowa Legislature; and UI Vice President of Research and Economic Development Dan Reed. In commemoration of the event, CGRER distributed a 12-page report that includes profiles of

CGRER members, a message about the center's history written by Carmichael and Schnoor, and a timeline of international and local climate events since the 1980s (see pages 5-23).

The second event was a program hosted by WorldCanvass, a monthly series sponsored by UI International Programs at FilmScene in downtown Iowa City. "The Evolution of Climate Change: 25 Years and Counting" brought together scientists, political leaders and entrepreneurs to discuss how the topic of climate change has evolved in both scientific understanding and public discourse. **Greg Carmichael** and **Jerry Schnoor** were joined by a panel that included U.S. Congressman Dave Loebsack, **Joe Bolkcom**, Des Moines Mayor Frank Cownie, **David Osterberg**, and solar energy entrepreneur Tim Dwight. The program is available on the WorldCanvass channel on YouTube.



CGRER was featured prominently in a WorldCanvass program on climate change.



Press conference for the Iowa Climate Statement 2015

IOWA CLIMATE STATEMENT 2015

In May, the fifth-annual Iowa Climate Statement was released. Signed by 188 science faculty and researchers from 39 Iowa colleges and universities, *Iowa Climate Statement 2015: Time for Action* urged Iowans to ask presidential candidates about climate-related issues in the lead-up to the 2016 Iowa Caucuses. Citizens of the state are encouraged to advocate for policies that will help Iowans—and the nation—adapt to climate change in the short term and avoid unmanageable consequences in the long term. The statement describes the negative effects Iowans are already experiencing from climate change, including heavier rains, increased flooding and negative effects on human health. The statement received state and national press coverage.



UI's Global Group begins to meet, hosts a climate change symposium with ISU, and proposes a formal center devoted to environmental change.



The State Board of Regents establishes CGRER.

1990



1988

James Hansen, UI grad and NASA scientist, testifies to Congress about evidence for climate change.

1989

The Intergovernmental Panel on Climate Change releases a report stating that carbon dioxide and other harmful emissions must be cut by 60% to avoid sharp rise in global temperatures over the next century.



A clean air initiative in Dubuque involves UI researchers and local partners.

CLEAN AIR PROJECT

Charlie Stanier is the project director for *CLE4R: Clean Air in the River Valley Project*, a collaboration between the UI, the City of Dubuque, and Dubuque-area partners. The initiative seeks to improve air quality in Dubuque and the surrounding Upper Mississippi River Valley through environmental education. Funded by the U.S. Environmental Protection Agency's Environmental Education Program, CLE4R includes workshops on effective ways to reduce air pollution. It also makes use of low-cost air quality monitors that help citizens learn about air quality in real time.

FORUMS ON CLIMATE CHANGE

A series of forums on *Iowa, the United Nations, and Climate Change* was held during the year in preparation for the United Nation's climate conference in Paris in December (see page 20). Sponsored by CGRER and the Iowa United Nations Association, each forum included speeches by experts on initiatives to address climate change and the ways in which Iowans can help support these efforts. Forums were held in Iowa City, Pella, Waterloo-Cedar Falls, Cedar Rapids, Dubuque, Ames, Des Moines and Fairfield.



Speakers discuss the upcoming U.N. climate conference in Paris.



Volunteers helping to restore monarch populations.

HELPING MONARCHS

David Osterberg participated in an effort to help restore monarch butterfly populations in Iowa by giving milkweed "seed bombs" to riders in RAGRAI, the annual bike ride across the state. Osterberg helped organize volunteers at the UI College of Public Health, who created about 600 of the seed bombs, which are a mixture of soil, compost and milkweed seeds rolled into a ball. The golf-ball-sized creations were distributed to RAGRAI riders, who were encouraged to toss them in ditches in Linn and Johnson Counties as they rode. The seed bomb effort was originated by Monarchs in Eastern Iowa, a group working to restore monarch populations. Monarch butterflies, which have experienced a 90 percent decline in population over the past two decades, rely on milkweed plants for part of their life cycle.



SOLAR ENERGY FAIR

Kamyar Enshayan helped organize a Northeast Iowa Solar Energy Fair in June at UNI. Sponsored by the UNI Center for Energy & Environmental Education, it helped educate the public about solar energy and its economic feasibility. The fair also connected businesses and homeowners with local and regional solar installers and raised awareness of the need to move away from fossil energy and invest in renewable sources of energy.

CGRER receives its first grant.

1992

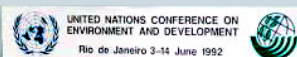
CGRER establishes office, first in Jessup Hall, then at IATL.



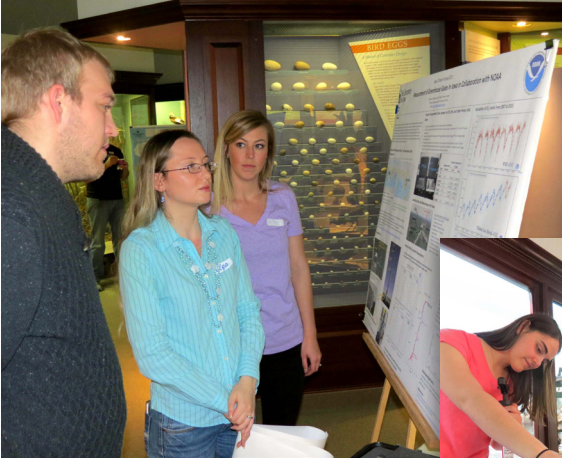
1991

CGRER receives its first state funding.

Representatives from 178 countries gather for the Earth Summit in Rio de Janeiro to confront climate change and other threats to biodiversity. The summit led to the formation of United Nations Framework Convention on Climate Change.



CGRER sponsors students to go to the Earth Summit in Rio de Janeiro in cooperation with the Iowa Division of the United Nations Association.



Scientific information was presented in a variety of forms at the Iowa Climate Festival.



CGRER was a co-sponsor of the 2015 Iowa Climate Festival, which was held in April at the UI Museum of Natural History. **Elizabeth Stone** was the organizer of the event and was one of its speakers. In addition, **Vicki Grassian** and **Scott Spak** gave presentations on recent climate change and the climate effects of greenhouse gases and particles in the air, while **Gene Takle** and **Peter Thorne** addressed the effects climate change has on public health and Iowa agriculture. A Climate Science Fair was held in the afternoon, with hands-on experiments relating to topics such as how clouds are formed, how particles in the air cool the earth, and why oceans are becoming more acidic.



LEGISLATIVE BREAKFAST

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

CGRER members in attendance included **Witold Krajewski**, director of the Iowa Flood Center, and **Larry Weber**, director of IIHR—Hydroscience & Engineering. More than 50 legislators as well as state environmental officials and non-governmental organization representatives attended the reception.



CGRER members visit with legislators at the CGRER-IFC Legislative Breakfast at the Iowa State Capitol.

CGRER@25



1993
CGRER Advisory Board established.

CGRER hosts first Visiting Research Scientist.

1994
First CGRER Seed Grants are awarded.



CGRER initiates work on Iowa Greenhouse Gas Action Plan.

CGRER holds symposium, Global Change II: A Midwest Perspective.

Scientists record the hottest year on record and attribute it to the burning of fossil fuels.





Iowa Environmental Focus, CGRER's blog, plays an important role in outreach efforts.

CGRER MEDIA OUTREACH

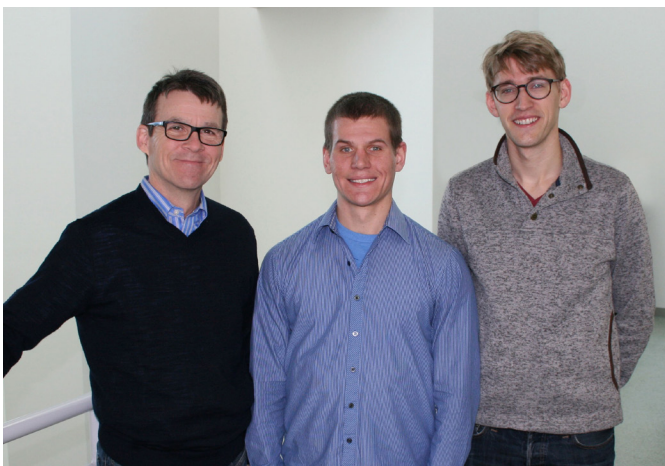
CGRER's blog, Iowa Environmental Focus, continues to be a valuable resource for online engagement and environmental education. Its stories, videos and photos about environmental news and research are created by CGRER's communications interns.

Elizabeth Stone has joined the team that records CGRER's weekly news segments that are distributed to radio stations throughout Iowa. The one-to-two-minute segments highlight the work of CGRER members as well as current Iowa environmental issues and efforts toward greater sustainability. The audio recordings can be accessed at IowaEnvironmentalFocus.org.

CGRER INTERNS

Nick Fetty serves as a media assistant for CGRER while pursuing an MA in journalism at the UI. His CGRER responsibilities include writing blog posts, radio scripts and feature stories as well as managing social media and shooting videos and photos of events. He continues to write freelance articles about environmental issues for the *Iowa City Press-Citizen* as well as *Yale Climate Connections*.

KC McGinnis is a multimedia journalist earning his MA in Journalism & Mass Communication at the UI. In 2015 he helped produce documentaries and video tutorials for CGRER and affiliated departments, provided visual coverage of CGRER events, and joined fellow graduate assistant Nick Fetty in Paris for the COP21 climate summit to report on issues relevant to Iowans (see page 20).



Joe Bolkcom, pictured at left with Nick Fetty and KC McGinnis, directs outreach and community education efforts at CGRER.



Above photos: Elizabeth Stone works with Nick Fetty and KC McGinnis on recording CGRER radio segments.



1996

CGRER website is launched.

Iowa Greenhouse Gas Action Plan is published.

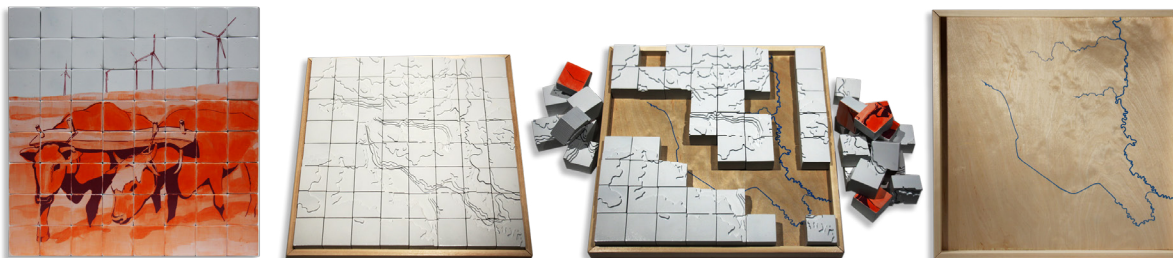
1997

CGRER provides mapping-quality GPS equipment to Office of the State Archaeologist.

CGRER funds workshops on greenhouse gas issues for Iowa public school teachers, farmers, and citizens.

The Kyoto Protocol, which calls for industrialized nations to reduce greenhouse gas emissions, is signed at a UN meeting in Japan.

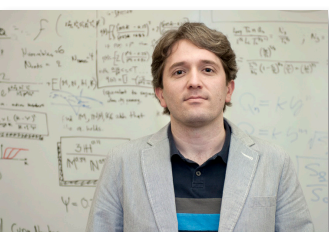
A SAMPLING OF AWARDS, ACHIEVEMENTS & APPOINTMENTS



Above photos: Artwork by Erica Damman was featured in an exhibition on environmental themes at a German museum.

David Cwiertyny was appointed editor-in-chief of *Environmental Science: Water Research & Technology*.

Erica Damman, a UI PhD student in Environmental Humanities working with **Barbara Eckstein**, had a work of art chosen to be part of an exhibition on “Welcome to the Anthropocene: Our responsibility for the future of the earth” at the Deutsches Museum in Munich, Germany. Damman was also the recipient of the UI’s Graduate College Post-Comps Research Fellowship.



Ibrahim Demir (at left) received an Excellence Award for Staff Research from the UI College of Engineering.

Andrew Forbes received a UI College of Liberal Arts and Sciences Collegiate Teaching Award.

Liza Minor, a student of **Scott Spak**, received the University of Iowa American Institute of Certified Planners Outstanding Student Award, which is given to one student from each accredited graduate planning school.

Jacob Odgaard received the Karl Emil Hilgard Hydraulic Prize from the American Society of Civil Engineers. The award is given for an outstanding paper on hydraulic engineering.

Gene Parkin was given the Charles R. O’Melia Distinguished Educator Award by the Association of Environmental Engineering and Science Professors (AEESP). The award recognizes excellence in teaching, significant research achievements, and an outstanding record of influence through mentoring of colleagues and former students.



Jerry Schnoor (above) received several honors during the year, including the Perry L. McCarty/Founders’ Award for excellence in environmental engineering education, research and practice from the Association of Environmental Engineering and Science Professors (AEESP). In addition, Yale University presented him with a career achievement award at the annual meeting of AEESP, and he received the teaching and mentorship award from the graduating class of UI Civil and Environmental Engineering.

Elizabeth Stone (at right) was named the UI Early Career Scholar of the Year.



CGRER @ 25

1998

CGRER performs some of first research in heterogeneous atmospheric chemistry, studying interactions of aerosolized mineral surfaces and organic molecules.



Iowa DNR gives CGRER the *Iowa Energy Leadership Award* for contributions to Iowa’s energy efficiency and renewable energy.

1999

CGRER Seed Grants help establish Iowa Atmospheric Measurement Station and Atmospheric Reaction Chamber at UI.

CGRER’s Fulbright-Hays grant takes 12 UI faculty and students to Nepal for a month to study water issues.



A SAMPLING OF GRANTS AWARDED TO CGRER MEMBERS



Diane Debinski presents her research.

Diane Debinski (co-PI) received a National Conservation Innovation Grant for \$760,897 for *Enhancing Monarch Butterfly Conservation in Iowa* (2016-19).

Rhawn Denniston is PI for two grants. The first is a \$21,531 NSF grant for *Assessing the Viability of Pristine Fossil Corals from the Dominican Republic as Indicators of ENSO at the Miocene/Pliocene Boundary* (2015-2016). The second is a \$149,601 NSF grant for *Assessing the Influence of Extreme Rainfall Events on Australian Stalagmite Reconstructions of Tropical Cyclone Landfalls and the Indo-Australian Summer Monsoon* (2015-2019).

Australian cave photo by Rhawn Denniston



Andrew Forbes (PI) received a \$441,225 NSF Dimensions of Diversity grant for *Diversification Dynamics of Multitrophic Interactions in Tropical Communities* (2015-2020).

Sara Mason is PI for a \$240,000 NSF grant *Interfacial Water Restructuring: An Unrecognized Contribution to Mineral Surface Reactivity* (2015-18) and is co-PI for a \$20,000,000 NSF grant for *Center for Sustainable Nanotechnology* (2015-20). Mason is also PI and **Vicki Grassian** is co-PI for a \$299,878 NSF grant *Insights into Chemical Looping Combustion Through a Combined Theory and Experimental Approach* (2015-18).

Marian Muste (PI) and **Ibrahim Demir** (co-PI) received a \$180,865 grant from the U.S. Army Corps of Engineers Institute for Water Resources for *Prototype Multi-jurisdictional Decision-Making Web Platform for Integrated Water Resources Management* (2015-2016).

Amy Toth (PI) received a \$103,626 grant from the Leopold Center for Sustainable Agriculture for *Impacts of Landscape and On-farm Diversity on the Abundance and Health of Bee Pollinators* (2015-2018). She also is co-PI for a \$10,000 grant from the North American Pollinator Protection Campaign for *Viral Hijackers: Do Viruses Manipulate Honey Bee Behavior to Increase Their Transmission?* (2015-16).



Tropical plant with *Blepharoneura* fruit fly (photo by Andrew Forbes' grad student Marty Condon)

Gabriele Villarini (PI) received a \$69,999 grant from the National Oceanic and Atmospheric Administration for *NMME Precipitation and Temperature Forecasts for the Continental United States and Europe: Diagnostic Evaluation and Development of Multi Model Applications Award* (2015 - 2016).

Larry Weber (PI) and **Ibrahim Demir** (co-PI) received a \$453,263 grant from the Carver Foundation for *Iowa Water-Quality Information System* (2015-17).



Amy Toth does research on bees.

CGRER members attend UN's World Summit for Sustainable Development in Johannesburg, South Africa.

2000

CGRER establishes Graduate Student Travel Award grant program.



2002

2001

CGRER initiates research-oriented Iowa Weather Forecasting System website.



CGRER helps to facilitate trial burns of waste oat hulls by UI power plant.

CGRER helps World Bank create online course, *Urban Air Quality Management*, for worldwide use.

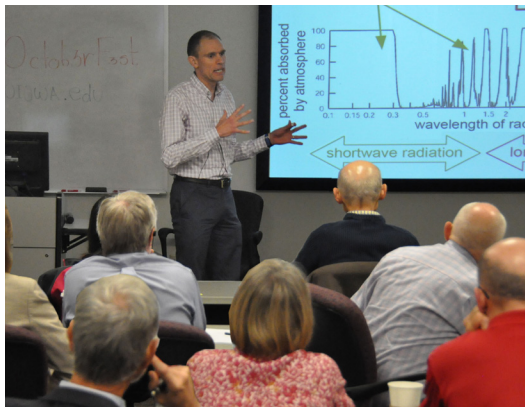




E D U C A T I O N

CGRER helps prepare the next generation of researchers and scientists to address the environmental problems facing the world. Educational efforts in 2015 included a symposium on water quality and agriculture, a seminar on the ethics of energy production, and a mobile museum exhibit relating to water in Iowa.

IOWA CLIMATE SCIENCE EDUCATORS FORUM



The third-annual Iowa Climate Science Educators Forum attracted more than 30 scientists, students and teachers from eight Iowa colleges and universities to Des Moines University in October. The event was hosted by **Yogi Shah**, who presented an update on the Iowa Climate Statement 2015. Other speakers included **Diane Debinski**, who spoke about climate-induced changes in the range of butterflies; **Brian Hornbuckle**,

(at left) who discussed ways to teach about the effects of greenhouse gas; and **Charlie Stanier**, who gave information about his undergraduate course on Green Chemical and Energy Technologies. Additional speakers explored the intersection of science, economics, politics and social issues in regard to climate and the obstacles for implementing policies to address climate change.

IMPROVING MIDWESTERN LAND, WATER AND AIR QUALITY



In July, approximately 30 students, professors and researchers from six institutions met at the UI's Lucille A. Carver Mississippi Riverside Environmental Research Station (LACMRERS) in Muscatine for a discussion of a collaborative research project aimed at improving land, water and

air quality in the Midwest by better managing farmland and watersheds. Their efforts are part of a nationwide project known as the Critical Zone Observatory, which is funded by the National Science Foundation. LACMRERS director **Doug Schnoebelen** helped host the event and is a contributor to the project.



FEEDING THE WORLD SYMPOSIUM

The UI Water Sustainability Initiative helped sponsor "Food for Thought," a semester-long schedule of activities relating to food as a vital field of study in many academic disciplines. In April, the symposium *Feeding the World: Challenges for*

Water Quality and Quantity explored the interface of food production, agriculture and water quality. Speakers included **David Cwiertny, Eric Tate, Kajsa Dalrymple, Kelly Baker, Craig Just, Jerry Schnoor, Larry Weber, Liz Christiansen** and **Rick Cruse**.



2003

CGRER co-sponsors *The Green Awakening—Redefining Prosperity* symposium at UI.

The UI is only the second public university to join the Chicago Climate Exchange, pledging to reduce greenhouse gas emissions each year for 3 years.

UI Power Plant implements burning of waste oat hulls.

CGRER co-sponsors Alliant Energy's *Energy Policy and Global Climate Change: A Path Forward* conference.

Scientists find sea levels to be rising faster than previously predicted based on a rapidly warming part of Antarctica.





PEOPLES WEATHER MAP PROJECT

With CGRER support, the Peoples Weather Map project has acquired the help of research assistant **Christina Zinkgraf** (at left) during the 2015-16 academic year. An MA student in Science Education, Christina has assisted **Barbara Eckstein**, **Eric Tate** and Mark NeuCollins in developing the project's website, a digital, county-searchable map of Iowa devoted to severe weather stories, both historical and recent. The site will also feature weather hazards information, interviews with weather and climate researchers in Iowa, and climate information from other sites.

ETHICS OF ENERGY SEMINAR

David Osterberg was a speaker at Ethics of Energy Production, a UNI event examining the economic effects, environmental impacts, legal aspects, agricultural viewpoints and employment prospects in regard to how energy is produced in Iowa and abroad. **Kamyar Enshayan** was also a speaker and helped plan the day-long seminar.

MOBILE MUSEUM WATER EXHIBIT



The UI Mobile Museum featured the exhibit "Water Underground: The Science of Iowa's Most Essential Resource," which was developed in association with the UI Water Sustainability Initiative. The exhibit explored the chemistry of water, Iowa's bedrock aquifer systems, and arsenic pollution in drinking water. **Tori Forbes** assisted with the creation of a display of magnetic water molecules that allowed

visitors to build different water structures, as well as a digital display of water chemistry and research. The Mobile Museum is a customized RV that travels the state visiting community events, elementary schools and the Iowa State Fair.



CLIMATE NARRATIVE PROJECT

The Climate Narrative Project is an interdisciplinary media arts initiative in the UI's Office of Sustainability. During the spring, **Nick Fetty** served as a project fellow. For the semester's theme of Soil and Education, he produced a 20-minute documentary: *Soil Mate: It takes a Teacher*, which focuses on Iowa City soil expert Scott Koepke (at left) and his efforts to share his passion for soil with students in the Iowa City area. Koepke teaches about the importance of good soil health, best gardening techniques, and proper composting practices.

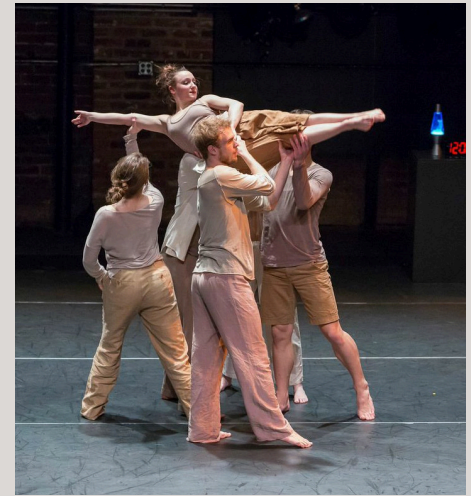


photo by Derek Blackman

ENERGY CULTURES SYMPOSIUM

Barbara Eckstein partnered with **Tyler Priest** and Brad Cramer to host the 2015 *Obermann Symposium: Energy Cultures in the Age of the Anthropocene*. A three-day meeting of historians, geologists, literary scholars, writers, dancers, anthropologists, artists and more, the symposium explored questions of where our energy comes from and the risks and complexities of its use.



A deadly summer heat wave, which is attributed to climate change, kills tens of thousands in Europe.



2004

CGRER joins Iowa DNR in organizing new UI engineering course, *Sustainable Systems*.



CGRER co-sponsors *Teacher at Sea* internship, training high-school teachers about atmospheric research.

CGRER develops air pollution models for assessing regional air quality in Brazil.



CONFERENCE TRAVEL GRANTS FOR GRADUATE STUDENTS

In 2015, \$18,887 was awarded to graduate students advised by CGRER members who were traveling to professional conferences to make oral or poster presentations.

Emily Altrichter
Natural Resource Ecology
& Management, ISU
*Society for Ecological Restoration
World Conference*

Zhengyang Cheng
Civil & Environmental
Engineering, UI
*International Association for Hydro-
Environment Engineering and
Research World Congress*

Shani Egodawatte
Chemistry, UI
Gordon Research Conference

Junchuan Fan
Geographical & Sustainability
Sciences, UI
*International Workshop on
Spatiotemporal Computing*

Meng Gao
Chemical & Biochemical
Engineering, UI
*American Association for Aerosol
Research Annual Conference*

Anusha Priyadarshani Hettiyadura
Chemistry, UI
*11th International Conference
on Carbonaceous Particles
in the Atmosphere*

Nathan Janechek
Chemical and Biochemical
Engineering, UI
*Society of Environmental
Toxicology and Chemistry
North America*

Andrew Knight
Chemistry, UI
*Safety of Actinide
Separation Processes*

Wen Xin Koh
Interdisciplinary Graduate
Program in Human Toxicology, UI
*Society of Toxicology
Annual Meeting*

Joanna Krajewski
School of Journalism and Mass
Communication, UI
*Conference on Communication
and the Environment*

Sean Lehman
Chemistry, UI
*National American Chemistry
Society Meeting*

Ruben A. Llamas
Electrical & Computer
Engineering, UI
IEEE Radio & Wireless Week

Theodore Marks
Anthropology, UI
*Society for American Archaeology
Annual Meeting*

James McGrath
Anthropology, UI
*Society for American Archaeology
Annual Meeting*

Holly Morris
Chemistry, UI
*Fall National American
Chemical Society Conference*

Cristina Munoz
Geographical and
Sustainability Sciences, UI
*Association of American
Geographers Annual Meeting*

Andrew Nelson
Interdisciplinary
Human Toxicology, UI
*American Industrial Hygiene
Conference and Expo*

Renu Pariyadath
Communications Studies, UI
*Western States Communication
Association Meeting*

Chathurika M. Rathnayake
Chemistry, UI
*American Chemical
Society National Meeting*

Stefan Schoeberlein
English, UI
*Southern Atlantic Modern
Language Association
Conference and Conference of
Association for the Study of
Literature and the Environment*

Amirhossein Tayyebi
Geographical and
Sustainability Sciences, UI
*Association of American
Geographers Annual Meeting*

Jonathan Trueblood
Chemistry, UI
*American Chemical Society
National Conference*

Meredith Wismer-Lanoe
Anthropology, UI
*Society for American
Archaeology Annual Meeting*

Haowen Xu
Civil & Environmental
Engineering, UI
*International Association
for Hydro-Environment
Engineering and Research
World Congress*

Sean Young
Geographical &
Sustainability Sciences, UI
*International Medical
Geography Symposium*

Chang Zhao
Geographical and
Sustainability Sciences, UI
*Association of American
Geographers Annual Meeting*



2005

CGRER helps fund
greenhouse-
gas-monitoring tower.

Hurricane Katrina
slams the Gulf Coast
of the United States,
killing nearly 2,000 and
spurring debate about the
effects of climate change.

2006

CGRER members meet in
Mexico City with
300+ international
researchers to discuss air
quality modeling.



FIELD RESEARCH TRAVEL GRANTS FOR GRADUATE STUDENTS

In 2015, \$15,220 was awarded to graduate students advised by CGRER members who were traveling to sites to complete field research for their thesis or dissertation.



Emily Altrichter

Ibrahim Al Neghemah
Chemistry, UI
Source Apportionment of Anthropogenic Secondary Organic Aerosol

Emily Altrichter
Natural Resource Ecology and Management, ISU
Woodland Herbaceous Layer Restoration in Urban Forests: Assessing Key Species

Jordan Foye
Earth and Environmental Sciences, UI
Investigating Shallow Debris Flow Initiation on Natural and Artificial Unburned Slopes in Southern California

Nathan Janecek,
Chemical and Biochemical Engineering, UI
Experimental Investigation of Photochemically-Produced Organosilicon Aerosols

Thilina Jayarathne
Chemistry, UI
Sampling and Analysis of Peat Burning Smoke in Kalimantan, Indonesia

Kayley Lain
Mechanical Engineering, UI
Reducing Emissions and Wood Usage in Three Stone Hearth

Kayley Lain



photo by Jordan Foye



Thilina Jayarathne



photo by James McGrath

James McGrath
Anthropology, UI
Archaeological Investigations of Late Pleistocene Symbolic Behavior in Southern Africa



Victoria Pocius

Victoria Pocius
Ecology, Evolution, and Organismal Biology, ISU
Milkweed and Monarchs in the Agricultural Landscape: An Examination of Milkweed Persistence and Monarch Use

Kathryn Rathbun
Earth and Environmental Sciences, UI
Mapping Ejecta Distribution and Thickness at Monturaui Crater, Chile: An Independent Method for Estimating the Environmental Effects of Small Meteorite Impact Events

photo by Kathryn Rathbun



CGRER helps organize weeklong course on air quality forecasting for 50 scientists from Latin American megacities.

Environmental Science and Technology, American Chemical Society (a journal edited by Jerry Schnoor) opens Beijing office.

The National Academy of Sciences reports that the earth has seen its highest temperatures in 12,000 years and that the earth has been warming at a rate of 0.36 degrees Fahrenheit per decade for the past 30 years.



CGRER supports research that deepens our understanding of environmental change and helps provide solutions to environmental problems from the local to global levels. During 2015, projects included research on Midwestern flooding patterns, the danger of environmental contamination from hormones used in beef production, and how PCBs can be removed by a type of prairie grass.

CONTAMINATION FROM BEEF HORMONES



Research by **Adam Ward** and **David Cwiertny** found that hormones commonly used to promote growth in cattle may remain in the environment at higher concentrations and for longer durations than was previously thought. Their findings suggest limitations in the current regulatory system for the pollutants, which does not take into account the chemical changes that occur after pollutants are released into the environment. The study, which was published in *Nature Communications*, coupled transport modeling by Ward with laboratory experiments by Cwiertny to produce better estimates for how long growth promoters used in beef production, many of which are suspected endocrine disrupting compounds, persist in the environment.



OAT HULL RESEARCH

Research by **Elizabeth Stone** examined the efficiency of burning oat hulls along with coal to produce electricity at the UI power plant. Her team found that, when compared to burning just coal, a 50-50 oat hull-coal mix produced 40 percent fewer fossil carbon emissions and significantly reduced the release of particulate matter, hazardous substances and heavy metals into the atmosphere. The UI partnered with Quaker Oats in Cedar Rapids to purchase discarded oat hulls in 2003 and equipment at the power plant was retrofitted to burn the oat hulls in the most efficient way possible. The UI now burns about 40,000 tons of the cereal byproduct annually. Stone's research confirms the environmental benefits of the practice.

TURKEY RIVER FLOOD PROTECTION



A team led by **Larry Weber** and **Witold Krajewski** at the Iowa Flood Center (IFC) assisted the Turkey River Watershed Management Authority with the development of a 20-year, \$32.8 million flood protection plan. The project seeks to address poor soil infiltration of rainfall, which is one of the primary causes of flooding. Rather than building floodwalls and levees that simply send the water downstream, the plan

seeks to improve the soil infiltration of rainfall by restoring wetlands, expanding conservation practices such as cover crops and prairie strips, and establishing riparian buffers along waterways. The plan also includes the construction of approximately 300 ponds and detention basins that will store the floodwaters for gradual release. The IFC performed much of the modeling upon which the plan is based and estimates that its implementation could save the watershed millions of dollars in flood losses.

CGRER @ 25



2007

Jerry Schnoor appointed by Governor Culver to chair the Iowa Climate Change Advisory Council.



2008

CGRER editor Connie Mutel publishes *The Emerald Horizon: The History of Nature in Iowa*.

Historic floods ravage Iowa.



CGRER members awarded eight NSF grants to study the aftermath of the 2008 floods.

MIDWESTERN FLOOD RESEARCH

A study by **Gabriele Villarini** and his PhD student **Iman Mallakpour** found that flooding events in the Midwest have increased in frequency over the past 50 years. Using stream gauge measurements collected by the U.S. Geological Survey at 774 sites in 14 states across the central U.S. from 1962-2011, they found that 34 percent had an increase in frequency in flood events, as opposed to 9 percent with a decrease. The study, which was published in *Nature Climate Change*, linked the increasing number of flood events to changes in rainfall and temperature, as warmer air can hold more moisture.



NUCLEAR WASTE RESEARCH



Tori Forbes was one of 44 scientists—just 27 of them from U.S. universities—selected for a U.S. Department of Energy Office of Science 2015 Early Career Research Program award.

She will receive \$150,000 annually for five years to cover summer salary and research expenses for a project trying to discover effective ways to deal with neptunium, which is a problematic element in the long-term storage of nuclear waste. Forbes is a member of the UI Water Sustainability Initiative. The Early Career Research Program supports the research programs of outstanding scientists early in their careers.



LOCAL FOOD MARKETS STUDY

Ion Vasi led a study that found that American consumers are shopping more at local food markets than ever before. Vasi found that consumers are supporting local food producers not just because they think the food tastes better but also because they like knowing who grows their food. Communities with a strong commitment to civic

participation, health and the environment were more likely to be supportive of local food markets, which include farmers markets, food cooperatives and community-supported agriculture providers (CSAs). Producers and consumers in local food markets in Iowa were interviewed for the study, which was presented at the annual meeting of the American Sociology Association.



PCBs REMOVAL BY SWITCHGRASS

Jerry Schnoor and **Tim Mattes** led a study that found that a type of prairie grass can remove up to 40 percent of highly toxic PCBs from contaminated soils within six months. When switchgrass is paired with a microorganism that also removes PCBs from the

soil, the rate rises to 47 percent. PCBs, which were once widely used in industrial manufacturing, were banned in 1979 but still contaminate many areas. The research was published in *Ecological Engineering*.



WINTER SALT APPLICATION

Research by **Wilfrid Nixon** is helping transportation departments in several states apply salt more efficiently to icy and snowy roads. Using less salt saves money and causes less damage to the environment. Nixon's research has shown that in extreme cold, salt does not melt snow or ice on pavement. He is collaborating with the transportation departments to develop a best-practices manual for the most efficient use of salt on winter roads.



CGRER hosts first annual legislative breakfast reception at the State Capitol.

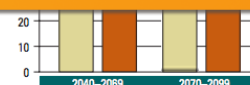


Representatives from 192 nations meet during the United Nations Climate Change Conference in Copenhagen to discuss an international strategy for addressing the threats of climate change.

Iowa Climate Change Advisory Council report and emissions database for Iowa is published.

2009

Iowa Flood Center established at the University of Iowa's IIHR—Hydroscience & Engineering.



A SAMPLING OF PUBLICATIONS BY CGRER MEMBERS

Jokela, K., **D.M. Debinski** and R. McCulley. 2015. Effects of tall fescue and its fungal endophyte on the development and survival of Tawny-Edged Skippers (Lepidoptera: Hesperidae). *Environmental Entomology*, doi: 10.1093/ee/nvv151.



Tawny-Skipper caterpillar and butterfly photos by Karin Jokela

Demir, I., H. Conover, W.F. Krajewski, et al. 2015. Data-enabled field experiment planning, management, and research using cyberinfrastructure. *Journal of Hydrometeorology*, doi: http://dx.doi.org/10.1175/JHM-D-14-0163.1.

Denniston, R.F., G. Villarini, A.N. Gonzales, et al. 2015. Extreme rainfall activity in the Australian tropics reflects changes in the El Niño/Southern Oscillation over the last two millennia. *Proceedings of the National Academy of Sciences of the United States of America*, doi/10.1073/pnas.1422270112.

Hood, G.R., **A.A. Forbes**, T.H.Q. Powell, et al. 2015. Sequential divergence and the multiplicative origin of community diversity. *Proceedings of the National Academy of Sciences of the United States of America*, doi: 10.1073/pnas.1424717112.

Corum, K.W, M. Fairley, D.K. Unruh, M.K. Payne, **T.Z. Forbes** and **S.E. Mason**. 2015. Characterization of phosphate and arsenate adsorption onto Keggin-type Al30 cations by experimental and theoretical methods. *Inorganic Chemistry*, doi: 10.1021/acs.inorgchem.5b01039.

Al Naiema, I., A. Estillore, I. Mudukotuwa, **V.H. Grassian**, and **E.A. Stone**. Impacts of co-firing biomass on emissions of particulate matter to the atmosphere. 2015. *Fuel*, doi:10.1016/j.fuel.2015.08.054.

Steinweg, C., and **W.J. Gutowski**. 2015. Projected changes in greater St. Louis summer heat stress in NARCCAP simulations. *Weather, Climate and Society*, doi: http://dx.doi.org/10.1175/WCAS-D-14-00041.1.

Schroer, H.W., K.L. Langenfeld, X. Li, H.-J. Lehmler and **C.L. Just**. 2015. Stable isotope-enabled pathway elucidation of 2,4-dinitroanisole metabolized by *Rhizobium litchii*. *Environmental Science & Technology Letters*, doi: 10.1021/acs.estlett.5b00278.

Kim, D., **M. Muste** and V. Merwade. 2015. A GIS-based relational data model for mul-

tidimensional representation of river hydrodynamics and morphodynamics. *Environmental Modelling & Software*, doi:10.1016/j.envsoft.2014.12.002.

Shanahan, C.E., **S.N. Spak**, A. Martinez, and **K.C. Hornbuckle**. 2015. Inventory of PCBs in Chicago and opportunities for reduction in airborne emissions and human exposure. *Environmental Science & Technology*, doi:10.1021/acs.est.5b00906.

Wu, J., T.W. Stewart, **J. Thompson**, et al. 2015. Watershed features and stream water quality: Gaining insight through path analysis in a Midwest urban landscape, U.S.A. *Landscape and Urban Planning*, doi:10.1016/j.landurbplan.2015.08.001.

Vasi, I. B., E.T. Walker, J.S. Johnson and H.F. Tan. 2015. "No Fracking Way!" Documentary film, discursive opportunity, and local opposition against hydraulic fracturing in the United States, 2010 to 2013. *American Sociological Review*, doi: 10.1177/0003122415598534.

Mallakpour, I., and **G. Villarini**. 2015. The changing nature of flooding across the central United States. *Nature Climate Change*, doi:10.1038/nclimate2516.

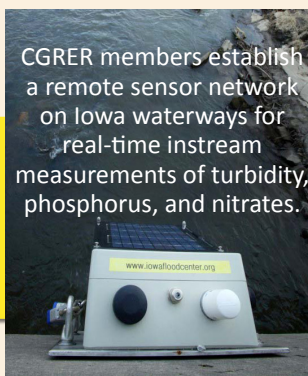
Li, J. and **D. L. Zimmerman**. 2015. Model-based sampling design for multivariate geostatistics. *Technometrics*, doi:10.1080/00401706.2013.873003.

CGRER @ 25



2009

In collaboration with the Iowa United Nations Association, CGRER sponsors students to attend the Copenhagen Climate Conference and COP15.



2010

CGRER organizes *Anatomy of Iowa Floods: Preparing for the Future*, which is attended by 700+ people from throughout Iowa.



CGRER launches the blog *Iowa Environmental Focus* and a weekly radio segment on Iowa environmental research and news.



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, Helium and Neon, are located at the Lindquist Center and the UI Research Park. CGRER has invested financially in both clusters, which provides our researchers priority when conducting research and analysis. In 2015, CGRER researchers logged 100,000 CPU hours on Helium and over 250,000 hours on NEON. In 2016, Helium will be retired to make way for the next UI cluster. CGRER will again be an investor in this valuable campus computing resource.

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 Advisory team and facilitates campus requests for support.

SEED GRANTS

In 2015, CGRER awarded a total of \$148,191 in Seed Grants to five projects.

Early Hominins and Pleistocene Climate in Southern Wallacea; **Russell Ciochon**, UI Anthropology; \$30,000.

Fate Studies of Insensitive Munitions Explosives in Poplar and Methylobacteria; **Craig Just** and Hunter Schroer, UI Civil and Environmental Engineering; \$29,896.

Seeing the Urban Forest for the Trees: An Assessment of the Relationships Between Urban Forests and Biodiversity, Carbon Storage, and Carbon Sequestration; **Heather Sander**, UI Geographical and Sustainability Sciences; \$28,2995.

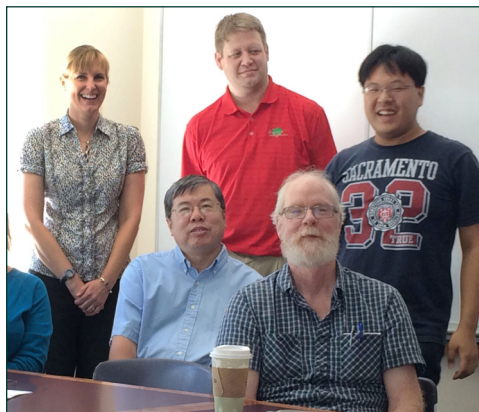


photo by Amy Toth

Effects of Larval Nutritional Stress on Honey Bee Disease Susceptibility and Immunocompetence; **Amy Toth** and Adam Dolezal, ISU Evolution and Organismal Biology; \$30,000.

Modeling Nonstationary Spatio-temporal Data on Stream Networks; **Dale Zimmerman** and Robert Hogg, UI Statistics and Actuarial Science; \$30,000.

CGRER VISITING SCIENTISTS

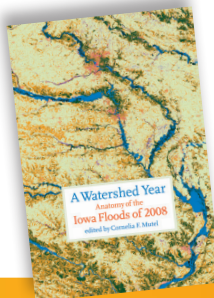


Hiroshi Hayami and **Syuichi Itahashi** from Japan's Central Research Institute for the Electric Power Industry visited **Greg Carmichael** to discuss research collaborations regarding particulate pollution in and around Japan.

Two Japanese students, **Hayato Nakashima** and **Yosuke Shinohara**, visited CGRER to learn about US engineering education as part of an exchange program with Gifu National Technical College.



Developed countries begin contributing to the \$30 billion, three-year "Fast Start Finance" module, which helps developing countries make environmentally-conscious investments and adapt to climate change impacts.



A Watershed Year: Anatomy of the Iowa Floods of 2008 published; several chapters are by CGRER members.



CGRER members contribute to *Climate Change Impacts on Iowa 2010*, a report requested by the Iowa Legislature.



CGRER helps sponsor Green Bike Tour in Slovenia.



Photo by Jeremy Susskind

INTERNATIONAL EFFORTS

CGRER's research and educational efforts span the globe. In 2015, members participated in a historic U.N. climate conference in Paris, studied women's health risks in India, explored links between fires in Central America and tornadoes in the U.S., and analyzed patterns of climate change in Chile.

U.N. CLIMATE CONFERENCE IN PARIS

In December, the United Nations Climate Conference (COP 21) in Paris included four people affiliated with CGRER. **Jerry Schnoor** attended as an accredited media representative for *Chemical & Engineering News (C&EN)*. In addition to posting on social media,

he wrote an editorial for *C&EN* on climate change as the defining environmental problem of this century. While there was cautious optimism at the conference, he wrote that countries will need to double or triple their pledges to reduce greenhouse gasses in order to address the problem adequately.

Also in attendance were **Nick Fetty** and **KC McGinnis**, both MA students in the UI School of Journalism and Mass Communication who serve as CGRER communication interns, and **Andrea Cohen**, a PhD student in the UI College of Education who is affiliated with the Iowa United Nations Association. The three provided coverage of issues at COP 21 relevant to lowans, including flood insurance and soil carbon sequestration, and also interviewed Des Moines mayor Frank Cownie and Dubuque mayor Roy Buol, who were at the conference to meet with mayors from around the world interested in sustainability and reducing greenhouse gas emissions. The



Jerry Schnoor, Nick Fetty and KC McGinnis in Paris

students' print, photo and video coverage was posted on www.iowaEnvironmentalFocus.org and various forms of social media.

COP 21 focused on talks to cut greenhouse gas emissions, with the aim of keeping global warming below 2° C. The Paris Agreement was hailed as an historic accord, with 196 countries pledging a variety of efforts to combat climate change.



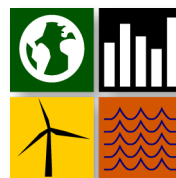
Nick Fetty and KC McGinnis record Jerry Schnoor's interview with Roy Buol, mayor of Dubuque.

CGRER @25



2011

21 Iowa middle school science teachers attend a five-day workshop on climate, weather and energy supported by NSF and CGRER.



The first cohort of graduate students enroll in the UI's new Geoinformatics for Environmental and Energy Modeling and Prediction. The program is funded by one of the highly competitive NSF Integrative Graduate Education and Research Traineeship (IGERT) grants.

Human population reaches seven billion.





Laguna Lejia in Chile (photo by Ingrid Ukstins Peate)

CLIMATE CHANGE HISTORY IN CHILE



Chilean sand (photo by Ingrid Ukstins Peate)

Ingrid Ukstins Peate is analyzing data collected from Laguna Lejia in northeast Chile, a high altitude lake in an area of extreme climate change. The samples will help her and her research team study one of the largest climate change events in recent Earth history. The Younger Dryas was a 1,300-year period of cold temperatures and drought that

happened about 12,800 years ago. Though studies have shown the effects of this period in the Northern Hemisphere, little research has been done on how the Southern Hemisphere reacted to these changes, and Ukstins Peate is hopeful the samples will provide clues. While her team is analyzing chemistry, mineral composition and temperature information from the samples, **Tim Mattes** is extracting DNA from the sediment to figure out how organisms in the lake changed during the Younger Dryas. **Scott Spak** will combine chemical and ecological data from both researchers with results from global and regional climate models to identify the climatic causes. The study will provide clues how the planet may react to climate change in the future.

EFFECTS OF SOUTH AMERICAN FIRES



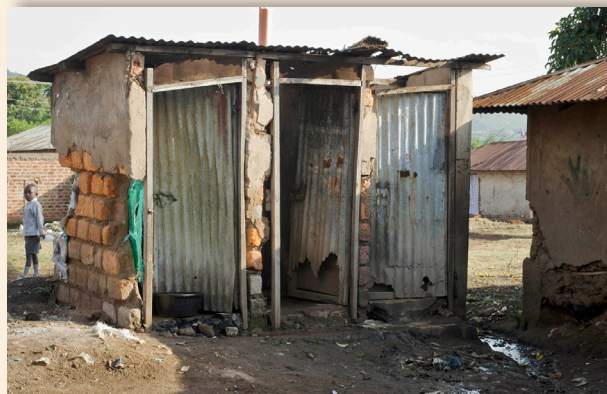
photo by Daphne Zaras

Smoke from spring agricultural land-clearing fires in Central America can intensify tornadoes in the U.S., according to a study conducted by **Greg Carmichael, Pablo Saide** and **Scott Spak**. Their research found that in 2011, smoke contributed to a historic severe weather outbreak that produced 122 tornadoes resulting in 313 deaths in the southeastern U.S. Smoke lowered the base of the clouds and increased wind shear, which increased the likelihood of more severe tornadoes. The study was published in *Geophysical Research Letters*.



WOMEN'S HEALTH IN INDIA

Kelly Baker and colleagues published the first study to link poor sanitation to a greater risk of adverse pregnancy outcomes, most commonly premature births and low birth weight. They studied nearly 700 women in Orissa, a state in eastern India that has the highest number of households in the country without toilets. In findings published in *PLOS Medicine*, the researchers reported that almost a quarter of the pregnant women without access to toilets had adverse pregnancy outcomes. Even after factoring in poverty levels, living conditions and maternal body mass index and anemia levels, open defecation was found to be significantly associated with greater risk for mothers and babies. The research highlights the critical need for improved sanitation during pregnancy.



Above photos by Jeremy Susskind

2012

Iowa Climate Statement:
The Drought of 2012
released.

CGRER members help monitor a major fire at the Iowa City Landfill, forecasting the plume using mobile air quality sampling units.

CGRER helps sponsor a three-day environmental institute for 35 middle and high school teachers from communities affected by the floods of 2008 and 2011.



ADMINISTRATION



Jerry Schnoor and Greg Carmichael

CGRER is directed by University of Iowa professors **Gregory Carmichael** (Department of Chemical and Biochemical Engineering) and **Jerald Schnoor** (Department of Civil and Environmental Engineering). Center activities are guided by an elected Executive Committee that consists of nine 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.

CGRER employs two full-time staff members. **Amy Parker** was hired this year as 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.

Joe Bolkcom, Amy Parker and Jeremie Moen



CGRER@25



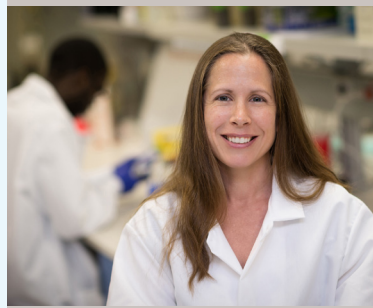
2013

CGRER helps organize *Living with Floods*, a statewide project to commemorate the five-year anniversary of the historic floods of 2008.

Iowa Climate Statement 2013: A Rising Challenge to Iowa Agriculture released.



NEW MEMBERS

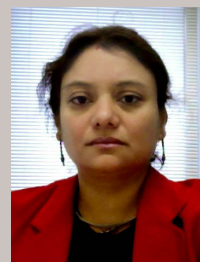


Kelly Baker is an assistant professor of occupational and environmental health at the UI College of Public Health and is a member of the UI Water Sustainability Initiative. Her work focuses on the ecology of water,

sanitation and hygiene disease transmission, which she has researched in places that include Mexico, India, Bangladesh and Ghana. Her lab is developing an environmental microbiology tool that can detect and quantify 23 globally common fecally-transmitted pathogens in water, sewage and soil samples.



Chandrashekhar (Chandru) Charavaryamath is an assistant professor of biomedical sciences in the College of Veterinary Medicine at ISU. He does research on occupational toxicology, inhalational toxicology, and innate immunity in the lung to bacterial toxins, including the lung health of swine barn workers.



Ananya Sen Gupta is an assistant professor of electrical and computer engineering and an assistant faculty research engineer at IHR—Hydroscience & Engineering. Her research interests lie at the intersection of signal processing,

pattern recognition and data engineering, with applications in water sustainability, environmental pollution monitoring and petroleum forensics.



CGRER co-sponsors the first *Iowa Climate Science Educators Forum*, to help science faculty in Iowa learn about the latest climate science information.

The Iowa Flood Center (IFC) collaborates with NASA to help develop a system that will predict precipitation and potential flooding using satellites.





Maurine Neiman is a UI associate professor of biology who studies biological diversity and evolutionary processes within organisms, populations and lineages. Many of her research projects use freshwater snails native to New Zealand. Her

work is relevant to ecotoxicology, host-parasite coevolution, the evolution of sexual reproduction, and the causes and consequences of biological invasions.



Photo of a mosquito from Yogi Shah's lecture at the Iowa Climate Science Educators Forum



Ingrid Uktins Peate is an associate professor in Earth and Environmental Sciences at the UI. She studies explosive volcanic systems and planetary geology. The latter includes research on the use of remotely operated vehicles for studying the geology of other planets and

utilizing Earth-based analogues to understand planetary processes, such as the potential for life on Mars.



Yogi Shah is associate dean of the Department of Global Health at Des Moines University and is also a board-certified physician in family medicine, geriatrics, and hospice and palliative care. He specializes in geriatrics and the health effects of climate change on human populations.



Michael Wichman is director of the Environmental Laboratory at the State Hygienic Laboratory and has an adjunct faculty appointment in the UI Department of Occupational and Environmental Health. He also serves on the executive committee for the

UI Center for the Health Effects of Environmental Contamination. His research interests include simplifying sample preparation techniques, environmental monitoring for pesticide and industrial chemicals, and measuring the amount of toxic chemical compounds and metabolites in humans after environmental exposure.



Jill Pruetz is a professor of anthropology at ISU. As a primatologist she researches the behavior of non-human primates such as chimpanzees, spider monkeys, howling monkeys and tamarins. She is particularly interested in the influence of ecology on primate and early human feeding, ranging and social

behavior and has an ongoing project in Senegal to conduct research on chimps in a habitat similar to that of early hominids.

Photo by Forest Mims III



The Mauna Loa Observatory in Hawaii reports daily mean concentration of carbon dioxide exceeds 400 parts per million, the highest level since record keeping began.

CGRER is a co-sponsor of a symposium on *Meeting the Renewable Energy Challenge*.



2014

Iowa Climate Statement 2014: Impacts on the Health of Iowans released.

The Iowa Flood Center's network of flood sensors on Iowa bridges reaches 200.

2015

Iowa Climate Statement 2015: Time for Action released.



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
 Maurine Neiman

Chemical and Biochemical Engineering

Gregory R. Carmichael
 A. Umran Dogan
 Charles O. Stanier

Chemistry

Tori Z. Forbes
 Vicki H. Grassian
 Sarah C. Larsen
 Sara E. Mason
 Scott K. Shaw
 Elizabeth Stone
 Mark Young

Civil and Environmental Engineering

Allen Bradley
 David M. Cwiertny
 William E. Eichinger
 Keri C. Hornbuckle
 Craig L. Just
 Witold F. Krajewski
 Lou Licht
 Timothy E. Mattes
 Marian V. Muste
 Wilfrid A. Nixon, Emeritus
 A. Jacob Odgaard
 A.N. Thanos Papanicolaou
 Gene F. Parkin, Emeritus
 Michelle Scherer
 Jerald L. Schnoor
 Richard L. Valentine
 Gabriele Villarini
 Larry Weber

Community & Behavioral Health

Paul R. Greenough

Earth and Environmental Sciences

Richard G. Baker, Emeritus
 E. Arthur Bettis
 Ann F. Budd, Emeritus
 Robert S. Carmichael, Emeritus

BUDGET & FUNDING

Research
& Education
56%



High
Performance
Computing
25%



Administration
15%



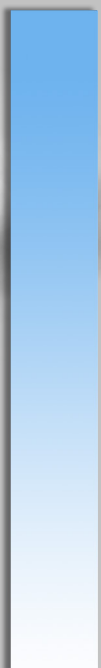
Publications
3%



Speakers
& Visitors
1%



\$11,440,706
in new
external funding



In 2015, CGRER received \$772,180 in revenue from 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 2015, CGRER members brought in \$11,440,706 in new external research funding.

\$772,180 in revenue
from utilities



Jeffrey Dorale
Lon D. Drake, Emeritus
David W. Peate
Ingrid Ukstins Peate
Mark K. Reagan
Holmes A. Semken, Jr., Emeritus
Frank H. Weirich
You-Kuan Zhang, Emeritus

Economics

Thomas F. Pogue
John L. Solow

Electrical and Computer Engineering

Ananya Sen Gupta

Electron Spin Resonance Facility

Garry R. Buettner

English

Barbara Eckstein
Laura Rigal

Geographical and Sustainability Sciences

Marc P. Armstrong
David Bennett
Margaret Carrel
Marc Linderman
George P. Malanson
Michael L. McNulty, Emeritus
Rangaswamy Rajagopal
Gerard Rushton, Emeritus
Heather A. Sander
Kathleen E. Stewart
Ramanathan Sugumaran
James D. Tamerius
Eric Tate

History

Paul R. Greenough
Tyler Priest

IIHR-Hydroscience & Engineering

Ibrahim Demir
Marian V. Muste
Connie Mutel
Douglas Schnoebelen

Journalism and Mass Communication

Kajsa E. Dalrymple

Law

Jonathan Carlson

Mechanical and Industrial Engineering

Geb Thomas
H.S. Udaykumar

Molecular Physiology and Biophysics

G. Edgar Folk, Emeritus

Occupational and Environmental Health

Kelly K. Baker
R. William Field
Joel N. Kline
Peter S. Thorne

Office of Sustainability

Elizabeth A. Christiansen

Physics and Astronomy

Donald A. Gurnett
Paul D. Kleiber
Steven R. Spangler

Sociology

Ion B. Vasi

State Hygienic Laboratory

Michael Wichman

Statistics and Actuarial Science

Kate Cowles
Dale L. Zimmerman

Urban and Regional Planning

Charles Connerly
Scott Spak
Aaron Strong

IOWA STATE UNIVERSITY

Agronomy

Christopher J. Anderson
Raymond W. Arritt
Richard M. Cruse
Brian K. Hornbuckle

Anthropology

Jill D. Pruetz

Biomedical Sciences, College of Veterinary Medicine

Chandrashekhar Charavaryamath

Ecology, Evolution, and Organismal Biology

Diane M. Debinski
John Nason
James W. Raich
Amy Toth
Brian J. Wilsey

Economics

David A. Swenson

Geological and Atmospheric Sciences

William J. Gutowski
Eugene S. Takle

Iowa Water Center

Richard Cruse

Natural Resource Ecology and Management

Janette Thompson

UNIVERSITY OF NORTHERN IOWA

Biology

Laura Jackson

Center for Energy and Environmental Education

Kamyar Enshayan

Physical Geography

Dennis E. Dahms

CORNELL COLLEGE

Geology

Rhawn Denniston

DES MOINES UNIVERSITY

Global Health

Yogesh Shah

COLORADO STATE UNIVERSITY

College of Engineering

Robert Ettema

HACETTEPE UNIVERSITY, TURKEY

Geological Engineering Department

Meral Dogan

HYDROLOGIC RESEARCH CENTER, SAN DIEGO, CA

Konstantine P. Georgakakos

INDIANA UNIVERSITY

Public & Environmental Affairs

Adam S. Ward

RICE UNIVERSITY

Civil and Environmental Engineering

Pedro Alvarez

UNIVERSITY OF NEBRASKA-LINCOLN

School of Natural Resources

Cory T. Forbes



CGRER

THE CENTER FOR GLOBAL & REGIONAL
ENVIRONMENTAL RESEARCH

The University of Iowa
424 IATL, Iowa City,
Iowa 52242
(319) 335-3333
www.cgrer.uiowa.edu

2015 ANNUAL REPORT

Writer & Editor: Lori Erickson
Designer: Mary Moyer-Rowley
Printed by The University of Iowa
Printing Department



photo by Ingrid Ukstins Peate