1 CGER MISSION
2 EXECUTIVE SUMMARY
4 MESSAGE FROM ADVISORY BOARD
6 OUTREACH
12 EDUCATION
18 RESEARCH
22 INTERNATIONAL EFFORTS
24 BUDGET, FUNDING & ADMINISTRATION
25 MEMBERSHIP

The Center for Global and Regional Environmental Research (CGER) 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), CGER is supported by revenues generated from public 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. CGER currently is composed of 96 members from 31 departments at seven institutions.

While environmental change is constant and natural, CGER 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, medicine and law, an understanding of global change requires collaborative efforts among the many disciplines involved. CGER’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 CGER’s activities in each of these three areas. Because CGER’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 CGER’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.

Photo at right: UI graduate student Ted Marks traveled to western Namibia for his CGER-funded research on how early humans adapted to life in a harsh desert environment. (photo by Paul Crigg)
**EXECUTIVE SUMMARY**

As you will learn as you read this annual report, 2012 has been another productive year for CGRER and its members. Our work was given added significance by the severe Midwestern drought and the destruction wreaked by Superstorm Sandy on the East Coast. There is no doubt that anthropogenic changes to the Earth’s systems are widespread and profound and that we are particularly vulnerable to shifts in weather and climate. We need to better understand our role in these changes in order to develop more effective mitigation and adaptation strategies.

CGRER members continue to conduct first-class research aimed at improving our understanding of environmental change and in developing practices that reduce the impacts associated with these changes. For example, through our research activities and collaborations with local, state and regional organizations we are enhancing our understanding of the causes of elevated levels of air pollutants during the winter and identifying strategies to reduce these levels. We are also working with state and national agencies to develop measures that will help restore and enhance Iowa’s agricultural landscape so it can be more resilient to future floods. You will find additional examples of our research work in our annual report.

The translation of our research findings into practice requires effective communication with the larger world. The scientific community must learn to better communicate its work to policy makers, key stakeholders and the general public. This will enhance everyone’s understanding of science and its impact on society and will ultimately lead weekly segments highlighting sustainability efforts to stations throughout Iowa. Our members traveled to the Iowa State Fair with an interactive display from the Iowa Flood Center that demonstrated projects that are helping communities prepare for future floods. We also launched the Telling Your Research Story Video Project, which advises graduate students on how they can better communicate the significance of their work to the general public.

It is also important that we continue our efforts to educate students on the Earth’s systems and processes and how we can impact them. We have a new initiative to improve elementary school science instruction by introducing hydrologic cycle modeling concepts. We are also working with middle and high school teachers to explore ways in which environmental learning can be broadly incorporated across the curriculum from science to art and music. These and other educational activities are described in the following pages.

We hope you enjoy reading our 2012 annual report. We welcome your comments and invite opportunities to further engage with our stakeholders in addressing environmental change issues.

**GREGORY R. CARMICHAEL,**
**CGRER CO-DIRECTOR WITH JERALD L. SCHNOOR**

Nitrogen monitoring and automated water samplers were installed on this Iowa creek to monitor the hydrological and nutrient responses to storm events after the 2012 drought. (photo by Adam Ward)

Pablo Sando has developed a system to predict periods of high air pollution in Santiago, Chile. (photo by Pablo Sando)

Jerry Schmaus is helping to find ways to better deal with the problem of e-waste from electronic products. (photo by Adam Ward)

U of I graduate student Simone Williams takes stream water level and GPS coordinates at a water quality sampling site in Jamaica. (photo by Damian Martin)
As an Advisory Board member since 2007, I believe CGER’s programs in the areas of research, education and outreach represent, without question, one of the most important services a university can offer the state, nation and world at this time in human history. Jerry Schnoor and Greg Carmichael have provided distinguished leadership in elevating the center to this high standard.

The challenge is how to live well in the 21st century on an increasingly interconnected, over-crowded, resource-depleted planet buffeted by an unstable and ever-changing climate. While much of the knowledge, technologies and sustainable pilot communities are already in existence to begin tackling this challenge, by and large the world is still bogged down with institutions, technologies, policies and behaviors of mind established during the unsustainable Industrial Revolution. CGER is an exemplar of how institutions of higher learning can facilitate a generational transition to a 21st-century Sustainability Revolution. CGER’s stellar research program supports projects too numerous to be listed in their entirety here. As this annual report describes, these projects range from evaluating the health effects of environmental contaminants on rural and agricultural populations to research on the climatic impact of black carbon in the Arctic and the development of ways satellites can “see” through clouds to better monitor surface pollutants.

Another urgent need is to enhance the public’s awareness of the momentous changes that are occurring in order to attain a critical mass of support for promoting effective and enduring global sustainability initiatives. CGER is doing its part through its Iowa Environmental Focus daily blog, radio show and website. In addition, Greg and Jerry helped initiate and write a nationally distributed statement, signed by more than 125 Iowa scientists, on connections between the 2012 drought and climate change. Finally, education of students is particularly important because they are the primary stakeholders in the future of this planet. Universities worldwide must equip their students with skills in leadership, civic engagement, and innovative technologies to ensure that they will make wise decisions concerning the sustainability of the planet. Again, CGER is taking a lead in this endeavor through a variety of initiatives, including providing support for graduate students doing field research on environmental change, sponsoring institutes and workshops designed to improve science education, and finding creative ways for student researchers to share the significance of their work with the larger world.

It has been an honor to serve on CGER’s Advisory Board for the past six years. I am thankful for its numerous contributions toward building a sustainable future.

William M. Stiglani
Center for Energy & Environmental Education, University of Northern Iowa

Left: Cheryl Smith, Joe Cullin and Mary Weber inject tracer solution into Fourmile Creek in Ankeny, Iowa. (photo by Adam Wastl)
Below: CGER and the Iowa Flood Center co-hosted a Legislative Breakfast Reception at the Iowa State Capitol in March.

Left: Craig Just and Columbus Community Technical Coordinator Todd Heck meet at the Columbus Junction High School to discuss ways to increase the school’s energy efficiency.

UI professors Jerry Schnoor and Greg Carmichael are co-founders of the Center for Global and Regional Environmental Research (CGER).

Right: UI graduate student Simone Williams is studying how basement mining affects stream quality in the Rio Grande Watershed in Jamaica. (photo by Simone Williams.)
CGRER members shared their expertise with the larger world through a variety of initiatives during 2012. Outreach efforts included spearheading a nationally distributed statement on Climate Change and the 2012 Drought, assisting civic leaders and public health officials during a major landfill fire in Iowa City, and the publication of an advisory report on future challenges faced by the Environmental Protection Agency.

A statement outlining the connection between the severe drought of 2012 and climate change was released in November to considerable state, regional and national attention. Jerry Schnoor, Greg Carmichael and Gene Tolle helped draft the Iowa Climate Statement: The Drought of 2012. It was signed by 136 science faculty and research staff at 27 Iowa colleges and universities, including many CGRER members. The statement says that while science cannot say for certain that the drought of 2012 was directly caused by human activities, the disaster is consistent with a growing body of research indicating that rising levels of greenhouse gases are likely to bring more extreme weather events. In a warmer climate, wet years are expected to get wetter and dry years dryer. The statement urges Iowans to act now to reduce the economic costs associated with droughts and floods by reducing their greenhouse gas emissions, increasing energy efficiency, and use of renewable fuels, and implementing mitigation strategies. The statement was reported upon in a wide variety of media outlets, including USA Today, CBS News, Newsday and The Huffington Post.

Jerry Schnoor served as chair of a national committee of 21 scientists asked to advise the U.S. Environmental Protection Agency (EPA) on how it can best meet future environmental challenges. Their report, Science for Environmental Protection: The Road Ahead, urges the EPA to develop new tools, technologies and a systems approach to interdisciplinary science. It says the agency will need to be younger, smarter and more engaged in society if it is to continue to serve the public and protect the environment.

The report, which was published by the National Research Council, predicted that new fields such as nanotechnologies will raise difficult regulatory questions and will require teams of scientists from a variety of disciplines to understand their risks. At the same time, improving the environment and human health does not always require legislation or regulation. Sometimes social and behavioral scientists can determine better solutions by designing programs to change behavior through economic incentives or by community action at the local scale. This also supports the EPA’s goals of obtaining better outcomes at lower cost. The report concludes that the EPA will need to innovate and take a long-term systems viewpoint in order to collaboratively solve emerging environmental problems.

### CLIMATE CHANGE AND THE 2012 DROUGHT

Dave Couard-Haizl from Drake University, Jerry Schnoor from the UI and Chris Anderson from ISU speak at a press conference.

### COALITION JUNCTION CONNECTIONS

Craig Just is working to decrease energy consumption in the Columbus Community School District and promote energy efficiency awareness in the town of Columbus Junction. His efforts are funded through the energy utilization platform of the Iowa NSF EPSCoR grant. The project’s goal is to make the schools more energy efficient, in the process lowering the district’s costs while also educating students about energy conservation. The EPScoR grant will fund $135,000 in improvements to local schools, providing data that will be used to educate students about energy efficiency and giving them a model for how similar changes can be made in homes. Additional learning modules will teach the design principles of energy efficient buildings and about career opportunities in environmental fields.

Research associate Melissa Ward and Craig just use thermal imaging cameras at Columbus Community High School.

### ADVISING THE EPA

Above and right: Information about the Iowa Flood Center’s work was presented at the Iowa State Fair. (photo by IFC)

### STATE FAIR OUTREACH

Faculty, staff and students from the Iowa Flood Center (IFC) hosted an interactive display during the Iowa State Fair in August. Fair-goers had the chance to learn about the Iowa Flood Information System, an online application that provides real-time information on stream levels, rainfall and additional flood-related resources for individuals and communities in Iowa. The booth also gave information on IFC research and its efforts to support Iowans in better monitoring and preparing for future flooding. CGRER members associated with the flood center include Witold Krajewski (IFC director), Allen Bradley, Joe Bolick (IFC outreach and community education director), William Eichinger and Larry Weber (director of IHR – Hydroscience & Engineering).

### LIVING WITH FLOODS

CGRER is playing a major role in the planning for living with floods, a program that will commemorate the upcoming five-year anniversary of the 2008 flood. The UI is partnering with seven communities directly affected by devastating floods in the past five years: Cedar Rapids, Council Bluffs, Davenport, Des Moines, Dubuque, Iowa City and Muscatine. The program’s goals are to remember the floods, celebrate the progress made towards recovery, provide information on strategies to mitigate future floods, and raise awareness of the interconnectedness of our environment and watersheds. The project will culminate in June 2013 with community forums and tree, public performances by New Orleans’ Preservation Hall Jazz Band in each of the partner cities. Living With Floods is sponsored by CGRER, the UI Colleges of Engineering and Education, the Iowa Flood Center and Hancher.
Lou Licht is working on a large-scale wastewater treatment project in Port of Morrow, Oregon. Licht’s company, Ecoltree, specializes in phytoremediation, which uses plants to remove pollutants from the soil. In Port of Morrow, a food processing complex along the Columbia River puts out five million gallons of wastewater a day. Ecoltree is developing a plan to remove nitrogen and waste products from the water by using it for year-round irrigation of a forest of poplar trees. The project would eliminate the need for an expensive new wastewater treatment plant and the pulp wood from the trees could be sold for commercial uses. Craig Just is assisting Ecoltree with a research project designed to support the Port of Morrow’s application for regulatory changes needed to fully implement the plan. Ecoltree is currently working in 15 states on 22 projects in sites that include landfills, industrial facilities and fertilizer spill areas.

LEGISLATIVE RECEPTION

CGRER and the Iowa Flood Center co-hosted a Legislative Reception at the Iowa State Capitol in March. Thirty-five legislators as well as a number of state government officials and representatives from non-governmental agencies attended. Witold Krajewski, director of the Iowa Flood Center, and Larry Weber, director of IFHR—Hydroscience & Engineering, provided an update on the work of the Iowa Flood Center and its web-based tools and new technologies and projects designed to help Iowa communities better prepare for future flooding.

CGRER members Steve Hendrix, Lou Licht, Scott Spak and Elizabeth Stone shared their work in several areas of environmental research. CGRER Advisory Board members Senator Bob Dvorsky, Darrell Hanson and Sharon Takinen also attended.

A major fire at the Iowa City Landfill in early summer raised many concerns about air quality and health risks. Charlie Stanier, Scott Spak and Elizabeth Stone helped local and state officials monitor and forecast the plume using their mobile air quality sampling units, which tested for sulfur dioxide, carbon monoxide, carbon dioxide, and particle size and composition of more than 40 organic compounds. This information was combined with CGRER’s weather forecast model and an EPA dispersion model to predict hourly pollution concentrations for every neighborhood in Johnson County each day until the fire was out.

The research team’s observations and forecasts provided officials with a more complete picture of the fire’s impacts, assisting them as they responded to the fire and issued safety advisories to local residents. The team is making the knowledge gained during the Iowa City fire available on a national basis, providing valuable information for other communities facing this sort of disaster.

IOWA CITY LANDFILL FIRE

Above: Elizabeth Stone works with a particulate matter sampler on the UI campus. Below: The plume from the Iowa City Landfill Fire was visible for miles. (photo by Elizabeth Stone)

Michael Gallagher works as a half-time intern while pursuing his MA in journalism. Much of his time during the year was spent on the Student Research Video Project (see page 12), developing scripts and filming videos. He also began work on a second video project involving Water Sustainability Initiative faculty and on the development of the new CGRER webpage. He continues to be involved with recording and distributing CGRER’s radio segments and keeps the Iowa Environmental Focus blog updated with articles, photographs and links.

Josh Quinnett, an undergraduate student in journalism/mass communication, has been a quarter-time CGRER intern since December, 2011. Along with Michael Gallagher, he has worked on the Iowa Environmental Focus blog and the two video projects. He has also assisted with the design and development of the new CGRER webpage and worked with the Iowa Flood Center to develop a series of video tutorials for the Iowa Flood Information System (IFIS).

IOWA ENVIRONMENTAL FOCUS

CGRER’s blog and radio project continued to grow in popularity and visibility during the year. Launched in 2010, Iowa Environmental Focus features daily blog posts and weekly radio segments on environmental news and events. In 2012, 51 one-to-two minute segments were produced and distributed to 90 stations, 30 of which ran them weekly while the rest use the content on a more occasional basis. The radio segments highlight the work of CGRER members as well as current Iowa environmental issues and efforts toward greater sustainability. For more information, see iowaenvironmentalfocus.org.
A SAMPLING OF AWARDS, ACHIEVEMENTS & APPOINTMENTS

Pedro Alvarez (above) was honored with the Hathie Richardson Irvine Clarke Prize, which is given by the National Water Research Institute to recognize exceptional contributions to the field of water research. Alvarez was selected because of his global leadership and contributions to enhancing water resource sustainability through water pollution control.

Jonathan Carlson (right) and Burns Weston, along with co-author Sir Geoffrey W.R. Palmer, published the third edition of International Environmental Law and World Order: A Problem-Oriented Coursebook (West Publishing Company).

Richard Cruse delivered a keynote address on Climate Change and Agriculture at the International Soil and Tillage Research Organization meeting in Montevideo, Uruguay.

Dennis Dahms was elected a Fellow of the Geological Society of America, an honor given for distinguished contributions to the geosciences. Dahms was recognized for his work on the glacial geologic history of the Wind River Range of Wyoming.

Diane Dehinsky (below) was honored as a Distinguished Visiting Researcher by the University of Ottawa in Canada during the fall of 2012. She collaborated with University of Ottawa scientists to develop a research partnership using butterflies as bioindicators of climate change in North America.

Greg Carmichael (above) received the American Institute of Chemical Engineers’ highest environmental award. The Lawrence K. Cecil Award in Environmental Chemical Engineering recognizes Carmichael’s outstanding contributions to the field of chemical engineering and his distinguished service in environmental protection.

Allen Bradley (above) was awarded the 2012 President and Provost Award for Teaching Excellence at the UI. The award is a university-wide recognition for faculty members who have demonstrated a sustained, high level of teaching excellence.

Bill Field (above) was honored with the Michael J. Brody Award for Faculty Excellence, which recognizes those who have made exceptional service contributions to the UI and the community. Field has played a national role in radon research and public education on the risks of radon exposure. He was also appointed to the EPA’s Science Advisory Board (SAB) and continues to serve on the EPA’s SAB Radiation Advisory Committee.

David Barrett Gough, a UI graduate student in American Studies, received a Ballard Seashore Dissertation Fellowship. A CGRER travel stipend enabled him to do research for his fellowship application. His project is an ecocritical history of Robinson Forest, an ecological research site and writers’ retreat owned by the University of Kentucky. Barbara Eckstein is Gough’s dissertation advisor.

Adam Ward delivered a talk on geophysical imaging and solute transport dynamics at the European Geophysical Union 2012 meeting in Vienna, Austria.

Vicki Grassian (above) received an award for Creative Advances in Environmental Science and Technology from the American Chemical Society (ACS). Grassian was recognized for her original and creative contributions in understanding mineral dust aerosol and its impact on atmospheric chemistry and climate. In addition, she was named an ACS Fellow in August. The ACS has more than 163,000 members and is the world’s largest scientific society.

Vicki Grassian receives her award from the American Chemical Society. (Photo by ACS Cuts Photography)

VICKI GRASSIAN RECEIVES NATIONAL AWARD

Vitold Krajewski (above) received the 2012 UI Graduate College Outstanding Faculty Mentor Award in mathematical and physical sciences and engineering. Krajewski was nominated for the award by his colleagues and students. Several of his students have received prestigious national and international awards and fellowships.

Christian Mavis, a UNI post-doctoral student working with Dennis Dahms, was awarded a fellowship from the Swiss National Science Foundation for a study of global warming-induced vegetation changes and their effects on mineral weathering in the Wind River Range of Wyoming.

Maija Sipola, a UI PhD student working with Art Bettis, was awarded an NSF East Asia and Pacific Fellowship to spend three months at Macquarie University in Sydney, Australia, learning a new luminescence dating technique used in sediments dominated by volcanic quartz.

Vicki Grassian receives her award from the American Chemical Society. (photo by ACS Cuts Photography)
CGRER helps educate the next generation of researchers and scientists who will address the complex issues and problems associated with environmental change. Educational efforts during the year included a video project highlighting graduate student research, an environmental education workshop for elementary school teachers in areas affected by flooding, and a program to raise awareness of the ecological importance of perennial native plants.

TELLING YOUR RESEARCH STORY VIDEO PROJECT

Recognizing that there is a growing need for scientists to better communicate the significance of their work to the public, CGRER sponsored two projects designed to help graduate students present their research in accessible and interesting ways. The first was a workshop in which participants learned how to concisely describe their work, why it is important and how their research will benefit society. The workshop prepared attendees to participate in CGRER's Telling Your Research Story Video Project, which helped 12 graduate students create 2-3 minute videos describing their work. The videos can be found at www.youtube.com/user/CGRERResearchFocus. The video series offers a personal introduction to the valuable research being done at the UI and highlights the ways in which science can help solve problems from the local to global levels.

PRAIRIE ROOTS PROJECT

The Prairie Roots Project, begun at the University of Northern Iowa in 2009 under the direction of Laura Jackson, is drawing increasing attention to the importance of perennial native plants to ecosystem health. Canadian filmmaker Jeremy Nelson traveled to Cedar Falls this year to film the project for an upcoming documentary The Watershed Project, to be released in 2014 by Stomaway Productions.

The Prairie Roots Project involves the growing of prairie plants in long tubes. When the plants are harvested, their roots are preserved in a glycerin-based solution so that they can be displayed in museums, nature centers, schools and other educational settings. The intricate root systems provide a vivid illustration of how prairie plants capture nutrients, slow run-off, prevent erosion, store carbon and re-build topsoil. The project also includes the development of educational materials to accompany the root displays. The overall goal is to increase public understanding of a complex and important part of the natural world that is normally hidden below ground. The Prairie Roots Project is funded by the Iowa Department of Transportation’s Living Roadway Trust Fund and is supported by the UNI Biology Department, with additional technical assistance from The Land Institute of Salina, Kansas.

Above left: UNI graduate student Carmen Pollich inspects plants being grown in deep pots so that their root systems can later be harvested. Below left: Ryan Knight from Stomaway Productions prepares to shoot close-up images of a root system.

PROMOTING SUSTAINABILITY

Craig Just taught an Honors First-Year Seminar on Explorations in Sustainable Campus Living. Just’s course focused on facilities, projects, programs and student-led activities that impact sustainability on the UI campus, including the Energy Control Center, Drinking Water Treatment Plant and Student Garden. The seminar included a Sustainability Rally at the Kinnick Stadium Press Box during which participants met sustainability leaders on campus and in the community with the intention of creating lasting service-learning relationships. The rally also introduced the UI’s participation in the nationwide Sustainable Citizen Program, which seeks to support and educate a network of citizens so they can think systematically and dialogue democratically about environmental issues and solutions.

FLOOD INSTITUTE FOR TEACHERS

CGRER helped sponsor a three-day institute designed to assist teachers in areas affected by the floods of 2008 and 2011 to incorporate environmental learning into their classes. Thirty-five middle and high school teachers from seven communities participated in the UI College of Education’s Interdisciplinary Flood Institute for Teachers, which is part of a larger Living With Floods project (see page 7). The institute explored how environmental learning can be incorporated into all content areas ranging from science and social studies to reading, writing and art. The goal is to help Iowa educators develop curricula that are focused on understanding the causes of flooding and how communities can develop resilience in the face of disaster. The institute was taught by UI College of Education faculty. Participants in the effort included CGRER, the Iowa Flood Center, the UI College of Engineering and Hancher.

The Interdisciplinary Flood Institute for Teachers included ways to incorporate environmental learning into music education.

IMPROVING SCIENCE EDUCATION

Cory Forbes has been awarded a $447,000 NSF grant designed to improve elementary school science instruction in modeling, an increasingly valuable tool in scientific research. The project, called Modeling Hydrologic Systems in Elementary Science (MoHSES), grew out of a CGRER seed grant and will involve three years of research investigating third-grade students’ model-based reasoning about geospheric components of the hydrologic cycle (pictured above) and how elementary teachers can support this type of reasoning. The research will be done in six elementary classrooms in the Iowa City, Clear Creek Amana and Cedar Rapids school districts and will use classroom observations, in-depth interviews with students and teachers, and student work to produce empirical findings on how modeling can best be incorporated into elementary science curricula. Partners in the MoHSES project are CGRER, Michigan State University science education programs, the Iowa Van Allen Science Teaching Center and the Grant Wood Area Education Agency.

Craig Just speaks at a Sustainability Rally at Kinnick Stadium. (Photo by George McCoy.)
### Field Research Travel Grants for Graduate Students

In 2012, $18,644 was awarded to graduate students advised by CGRER members who were traveling to sites to complete field research for their thesis or dissertation.

**Joseph Cullin**  
Geoscience, UI  
Can a Limited Suite of Tracers be used to Predict Fate and Transport of Emerging Contaminants?  
Ankeny, IA

**Ted Marks**  
Anthropology, UI  
Site Formation Processes and Geochronology at EB Tanks Rockshelter, Western Namibia  
Namibia

**Alejandro Muzzio**  
Anthropology, UI  
Protected Areas and Tourism: Cañaruna on the North Coast of Honduras  
Honduras

**Elizabeth Newbury**  
Anthropology, UI  
Community Advisory Boards in Biobanking: Mediating Lay and Expert Knowledges in Post-genomic Science  
Mansfield, WI

**Christina Nicholas**  
Anthropology, UI  
Ontogeny, Respiration and (Para)mastication: An Examination of the Relationship Between Dental and Nasal Traits in genus Homo  
London and Paris

**Jill Scott**  
Anthropology, UI  
The Implications of Dietary Shifts Across Pleistocene and Holocene Homo for Understanding Environmental and Climatic Changes Throughout the Old World Europe and Africa

**Jill Sherwood**  
Ecology, Evolution and Organismal Biology, ISU  
Examining the Impact of Reduced Snowpack and Passive Warming on Plant Phenology in a Montana Meadow System  
Wyoming

**Simone Williams**  
Geography, UI  
Water Quality Processes, Patterns, and Equity in a Jamaican Watershed  
Jamaica

---

### Conference Travel Grants for Graduate Students

In 2012, $13,600 was awarded to graduate students advised by CGRER members who were traveling to professional conferences to make oral or poster presentations.

**Benjamin Alhban**  
Civil & Environmental Engineering, UI  
American Geophysical Union Annual Meeting

**Keelin Baine**  
Anthropology, UI  
Society of American Archaeology Annual Meeting

**Bo Chen**  
Civil & Environmental Engineering, UI  
American Geophysical Union Annual Meeting

**Deng Ding**  
Geography, UI  
Phenology 2012 Conference

**Susanna Donaldson**  
Anthropology, UI  
Society for Applied Anthropology Annual Meeting

**Foad Khoshouei**  
Civil & Environmental Engineering, UI  
American Geophysical Union Annual Meeting

**Olga Laskina**  
Chemistry, UI  
American Geophysical Union Annual Meeting

**Leanne Martin**  
Ecology, Evolution & Organismal Biology, ISU  
Ecological Society of America Annual Meeting

**Imali Ama Mudunkotuwa**  
Chemistry, UI  
American Chemistry Society Annual Meeting

**Charith Eranza Nanayakkara**  
Chemistry, UI  
American Chemistry Society Annual Meeting

(continued on the next page)
Bin Zhang
Tsinghua University, China

Zhang visited CGRER to learn more about coupled chemistry and climate modeling. He plans to use these models in his PhD studies at Tsinghua University.

Dinesh Kumar Trivedi and Srinivas Reka
Indian Institute of Tropical Meteorology

Trivedi and Reka visited as part of a collaboration between CGRER and Indian Institute of Tropical Meteorology to launch a new operational air quality forecast system for the city of Pune, India.

Kajsa Dalrymple, who was hired in the UI’s School of Journalism/Mass Communication through the Water Sustainability Initiative, has created a new course on Risk Communication. The class (pictured above) helps students identify risks in society and develop methods to communicate this information to the public. Such scientific knowledge is essential if people are going to make informed decisions about environmental, economic, health and other risks.

Barbara Eckstein, Marc NeuCollins and Jim Gigliereano received a UI Digital Studio for Public Humanities grant to fund research assistants for the People’s Weather Map project. Under their direction, students Erica Damman and Kristen DeGree are researching Iowa’s weather history, as recorded by people who lived through it.

Cory Forbes, Charlie Stanier and colleagues have received a $473,593 grant through the federal Mathematics and Science Partnership Program, which is part of the No Child Left Behind Act and is administered by the Iowa Department of Education. Reflective Assessment for Elementary Science in Iowa (RAES-Iowa) is a three-year professional development program for elementary school teachers (pictured below) that will help them better engage students in scientific practices and promote their learning of science concepts. The program will involve 38 teachers in five school districts in eastern Iowa. Partners include CGRER, the UI Colleges of Education and Engineering, Grant Wood Area Education Agency, Van Allen Science Teaching Center and the Lawrence Hall of Science at the University of California-Berkeley. The project aligns with nationwide efforts to encourage science, technology, engineering and mathematics (STEM) educational programs with a track record of success.
CGRER fosters a wide variety of research projects that deepen our understanding of environmental change and help provide solutions to environmental problems from the local to global levels. During 2012 CGRER members worked on projects ranging from research on the Midwestern carbon cycle and the health effects of rural toxins to the development of a valuable new way of studying air pollution in the presence of cloud cover.

**EFFECTS OF CLIMATE CHANGE ON AGRICULTURE**

Gene Takle presented his research on the impact of climate change on U.S. agriculture at the United Nations Climate Change Conference in Doha, Qatar. Takle described how climate change is influencing Iowa farmers to adjust their operations. Because the growing season has lengthened, farmers are choosing seed hybrids that take longer to mature but produce greater yields. Precipitation has also tended to be more plentiful in the first half of the growing season, and farmers are taking advantage of the resulting abundance of groundwater to plant seeds more densely than in the past. While some of these changes have been beneficial for agriculture, Takle also warned that the Midwest is experiencing more extreme weather events such as drought and excessive rains, leading to accelerated erosion of valuable topsoil, property damage, and increased economic risks.

**SEEING THROUGH CLOUDS**

Greg Carmichael, Scott Spak and Pablo Saele have developed an important new way of studying air pollution that allows researchers to “see” through cloud cover. Up until now, cloud cover has made it difficult to use satellite imagery to study air pollution. Their technique makes it possible to estimate the concentration of pollutants such as soot in and under clouds, and is finding immediate applications across a wide range of scientific activities, including air quality forecasting, emissions estimation and health effects studies. The researchers combined regional weather and atmospheric chemistry modeling with NASA satellite cloud products to determine pollution concentrations, and verified the improvements using data from NSF aircraft measurements. The research was funded by NSF and NASA and was published in the Proceedings of the National Academy of Sciences.

**RURAL HEALTH RESEARCH**

Peter Thorne and colleagues have received a $7.9 million grant to fund the work of the UI’s Environmental Health Sciences Research Center. The five-year grant from the National Institutes of Environmental Health Sciences will enable the center to continue investigating health effects arising from rural agricultural environmental contaminant exposures and will help the center expand its research into areas such as nanoparticles and antibiotic resistant organisms. The center’s research focuses on rural populations that face significant, unaddressed environmental health concerns including asthma, cancer, and neurodegenerative and inflammatory diseases. Members of the center have conducted innovative research on the human health effects of industrialized livestock production, radon and natural disasters such as the Iowa flood of 2008. Peter Thorne is the Center Director. Garry Buettner, Bill Field, Tori Forbes, Vicki Grassian, Joel Kline, Gerard Rushfon and Charlie Stanier are also members of the EHSCR.

**MIDWESTERN CARBON CYCLE RESEARCH**

Thanos Papanicolaou leads a research team investigating how carbon cycles through Midwestern landscapes. The group is also researching the impacts various farming practices have on the carbon cycle and the potential environmental effects these practices have on the Midwest and the world. The fertile soils of the Midwest act like storage bins for carbon, which becomes a greenhouse gas when released into the atmosphere as CO2. It is not fully known how different agricultural management practices influence the movement of carbon between the land and atmosphere. Papanicolaou’s team is conducting field studies of soil carbon sequestration under different land uses and crop rotations, using rainfall simulators to mimic precipitation. A collection system gathers the water and soil and measures the amount of organic carbon in the soil and how it is affected by erosion. These small-scale experiments are yielding valuable information on the larger issue of how much carbon is stored in Midwestern soil and how much is emitted back into the atmosphere in the form of CO2. The research team hopes to show the benefits of carbon storage in the soil and to identify farming practices that increase this storage. The team is also providing data on carbon emissions due to erosion for the use in NASA’s computer modeling efforts. Papanicolaou’s work is supported by a grant from NASA’s Experimental Program to Stimulate Competitive Research (EPSCoR). Greg Carmichael and Charlie Stanier are also involved in this research, along with colleagues from the UI, Iowa State University, University of Northern Iowa, U.S. Department of Agriculture and NASA.

**ASSESSING AIR POLLUTION IN JOHNSON COUNTY**

Scott Spak, Charlie Stanier, Elizabeth Stone and Greg Carmichael are the lead researchers for the Johnson County Air Quality Study, a project analyzing air pollution in Iowa City and eastern Iowa. The 18-month project represents Johnson County’s first air pollution assessment and attribution study, taking into account more than 50 trace gas and particle pollutants and assessing the roles of power plants, motor vehicles, fireplaces and a range of other sources. Using the latest measurement techniques and modeling tools, the researchers are trying to find the best and most cost-effective emissions control strategies for improving air quality in the region under current and future regulatory standards. While the research will provide decision-makers with the information needed to improve air quality and health in Johnson County, the study will also provide a national example of how state-of-the-science air quality modeling can improve the permitting process by contributing information that’s more complete, credible and useful to power plant operators, regulators and the public.

**IOWA WATERSHEDS PROJECT**

Working in conjunction with IHR—Hydroscience & Engineering, the Iowa Flood Center has selected four watersheds for the initial phase of the Iowa Watersheds Project, an initiative funded by the U.S. Department of Housing and Urban Development (HUD). The effort seeks to restore and enhance Iowa’s agricultural landscape so that it can better handle flood flows in coming years. The four watersheds are the Turkey River; Middle Raccoon River; Soap Creek and Chequers Creek; and Upper Cedar River. Researchers are working with local watershed management authorities, landowners and agency representatives to identify areas where flood mitigation projects are most likely to reduce downstream flood damages. During the second phase, projects will be implemented in select locations. CGRER members associated with the flood center include its director, Witold Krajewski, and Allen Bradley and William Eichinger. Larry Weber, who leads the Iowa Watersheds Project, is director of IHR—Hydroscience & Engineering.
A SAMPLING OF PUBLICATIONS
BY CGRER MEMBERS


A SAMPLING OF GRANTS
AWARDED TO CGRER MEMBERS

Art Betts (ec-Pi) and colleagues from ISU, University of Kansas, and Old Dominion University received a $305,897 NSF grant for Collaborative Research: Stabilized Organic Carbon and Palaeoenvironmental Interpretation of Late Quaternary Pembroke (2012-15).
Richard Cruse (Pi) and colleagues received a $620,898 grant from the U.S. Dept. of Agriculture for An Integrated Approach To Precision Conservation Planning In The South Fork Watershed (2012-2015).

CGRER AIDS TO RESEARCHERS

CGRER continues to provide high-performance computing and visualization resources to facilitate interdisciplinary research. During the year CGRER researchers significantly increased their use of the new Helium Cluster, which features specialized software and central processing units capable of handling large computer models and simulations. CGRER researchers logged over 76,000 CPU hours on Helium in addition to their work on other computers.

During the year CGRER-owned storage capacity increased by nearly 150TB. CGRER also is one of four UI departments that supports and distributes geographical information system (GIS) software through a campus-wide site license with the Environmental Systems Research Institute, Inc.
CGRER’s research and educational efforts span the globe. In 2012, members worked on projects ranging from studies of e-waste recycling in China and air quality modeling in Chile to research on the effects of black carbon in the Arctic.

**E-WASTE RECYCLING IN CHINA**

As electronic and electrical products such as computers and mobile phones have become ubiquitous, their recycling has become an increasingly important global issue. Such products often contain toxic materials such as heavy metals and PCBs as well as valuable elements such as copper and gold. The relatively high cost for e-waste disposal in developed countries has driven recycling operations to developing countries such as China, India and Pakistan. Jerry Schnoor and two Chinese colleagues published an article on e-waste recycling in China in Environmental Science & Technology. The piece analyzes the economic, social and environmental implications of e-waste recycling in the developing world and makes recommendations on improving its management. As China is home to the world’s largest e-waste recycling operation, lessons learned in China can be beneficial for other nations attempting to deal with this growing environmental issue.

**AIR QUALITY MODELING IN SANTIAGO, CHILE**

Pablo Saide has developed a system to predict periods of high pollution in Santiago, a Chilean city of six million that is especially prone to smog during the winter months. The new system has a longer lead time than previous forecasting models, giving the city several days to prepare for an upcoming surge in pollution through strategies such as limiting the use of private cars and shutting down factories. The prediction system is currently in use in a year-long pilot trial by the Chilean Meteorological Office, which is sharing its results with Saide so that additional improvements can be made. A native of Chile, Saide is an environmental engineering Ph.D. student advised by Greg Carmichael and Scott Spak. His collaborators on the forecasting project include UI alumnus Marcelo Mena, currently at Universidad Andrés Bello, and researchers from Universidad de Chile and U.S. National Oceanic and Atmospheric Administration (NOAA).

**COLLABORATION WITH THE EUROPEAN UNION**

Greg Carmichael is representing CGRER in a new European Union project funded by the Commission on Science and Technology (COST). The COST Action – European framework for online integrated air quality and meteorology modeling (EuMetChem) is a three-year initiative. Its goal is to develop a comprehensive strategy and specific action plan for the development of a new modeling framework to improve air quality, weather and climate prediction in Europe.

**RIVERS AS BRIDGES PROGRAM**

A group of China’s top high school students visited the UI’s Lucille A. Carver Mississippi Riverside Environmental Research Station (LACMERS) on the Mississippi River in July. Doug Schnoebelein, LACMERS director, and Larry Weber, director of IIHR—Hydroscience & Engineering, welcomed the students. Schnoebelein discussed the significance of the Mississippi River and led the students in hands-on experiments relating to the work of the research station. The event was part of Rivers as Bridges, a program that celebrates the sister-river relationship of the Mississippi River and China’s Yangtze River. LACMERS is part of IIHR—Hydroscience & Engineering.

**BLACK CARBON AND THE ARCTIC**

Greg Carmichael was part of a U.S. team that participated in a U.S.-Russian symposium on the Ecological, Economic and Medical Consequences of Emissions of Black Carbon into the Environment. The symposium was held in Moscow and was organized by the Russian Academy of Sciences and the U.S. National Academy of Sciences within the framework of the U.S.-Russian Bilateral Presidential Commission.

The meeting focused on the impacts of black carbon emissions resulting from gas flares, open mining operations and forest fires on the air quality and climate of the Arctic. These emissions accelerate warming in a part of the globe that is already experiencing faster climate change than other regions. There is a growing international recognition of the role black carbon plays in climate change and the importance of limiting it around the globe. Russian and American scientists are planning joint investigations to better understand the effects of black carbon and how they can be mitigated.
CGRER is directed by University of Iowa professors Gregory Carmichael (Dept. of Chemical and Biochemical Engineering) and Jerold Schnoor (Dept. of Civil and Environmental Engineering). Center activities are guided by an elected Executive Committee that consists of eight members (listed on page 3) plus the two co-directors. The Executive Committee meets monthly to plan initiatives and chart CGRER’s course. An Advisory Board of nine members from outside the academic community (listed on page 3) meets annually to lend oversight to CGRER’s activities.

Since 1992, CGRER has employed two full-time staff members. Administrative assistant Jane Frank oversees office operations. Jeremie Moen manages CGRER’s computer facilities with the aid of services contracted from the Iowa Computer Aided Engineering Network. In addition, Joe Bolcom serves as half-time Director of Outreach and Community Education. CGRER reports directly to the UI’s Vice President for Research.
THE CENTER FOR GLOBAL AND REGIONAL ENVIRONMENTAL RESEARCH

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

2012 CGRER Annual Report
Writer & Editor: Lori Erickson
Designer: Mary Moye-Rowley
Printed by the University of Iowa Printing Department