

A photograph of a massive glacier wall, likely the Perito Moreno Glacier, with a red measuring beam and a scale in the foreground. The glacier is a deep blue color, and the water in the foreground is a milky turquoise. The scale shows numbers 20 and 30.

CGRER 2009

Annual Report

The Center
for Global and
Regional
Environmental
Research



CGRER

The Center for Global and 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 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. CGRER membership is composed of faculty and professional

staff from Iowa's colleges and universities. CGRER currently is composed of 76 members from 27 departments at seven 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 require 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. 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.

EXECUTIVE SUMMARY A YEAR OF OUTREACH

The year 2009 was an outstanding year for outreach at CGRER. In addition to our normal robust activities in research, seed grants, and education, we endeavored to reach the citizens of Iowa in new ways – and to communicate with them about climate change, flood recovery, and the opportunities for a new green economy in Iowa. It was also the first full year on the job for Joe Bolkcom, CGRER Outreach and Education Director, and he was busy indeed.

In 2009, I had the distinct pleasure of speaking to a joint meeting of environmental committees in the state legislature about climate change and the potential for green-collar jobs created by conserving energy, increasing efficiency in our homes, farms, and businesses, and adopting wind, solar, and combined heat and power (biomass) energy technologies. CGRER also organized a legislative breakfast at the Statehouse attended by about 50 senators and representatives where we discussed the need for a flood center in Iowa, renewal of our rural water and wastewater infrastructure, and energy efficiency options. As a result of diligent effort, Witold Krajewski and Larry Weber,

IIHR-Hydroscience & Engineering researchers and CGRER members, were awarded \$1.3 million to establish (for the first year) the Iowa Flood Center for novel research on mapping floodplains and aiding Iowans in flood recovery. We are very proud of this important new center for Iowa and its assistance to Iowans in coping with floods.

CGRER also held a briefing on climate change at the State Historical Building in Des Moines, attended by more than 100 people. Gene Takle, Iowa State professor and CGRER member, presented his latest research on Iowa climate change during the past 50 years. He discussed observations of warmer nights, longer growing seasons, more intense rainfall events, and fewer extremely cold days in the winter, but also fewer extremely hot days in the summer. There is strong evidence that Iowa is experiencing greater atmospheric humidity, accounting for higher dew point temperatures at night.

Following Gene, I spoke on the options available for mitigating, adapting, and responding to climate change in Iowa. My talk was developed from a list of 56 options

proposed by the Iowa Climate Change Advisory Council (ICCAC), a council that I have the good fortune of chairing (see www.iacclimatechange.us). ICCAC reported that about 25 of the greenhouse gas (GHG) reduction options (e.g., increased energy efficiency and no-till farming practices) would actually save the state money. The good news is that we don't need all 56 options to greatly lower our greenhouse gas emissions. Only a fraction of the proposed options would reduce our emissions by 11 to 22% by 2020, and by 50 to 90% by 2050, from a baseline year of 2005. The sooner Iowa begins to implement these options, the less they will cost in the long run. We can create jobs, enjoy cleaner air and water, and reduce our greenhouse gas emissions by taking action now.

In May, Representative Donovan Olson sponsored a successful amendment continuing the work of the ICCAC. The amendment also created a new committee to identify and assess the impacts of climate change specifically on Iowa. The committee met throughout 2009 and will file its final report by the end of December 2010.

Perhaps the high point of CGRER's 2009 outreach activities was a symposium jointly sponsored with the UI Public Policy Center, *Energy and Climate Change in the Midwest: Creating Opportunities in the New Economy*. The symposium showcased the report on the green economy produced by The Chicago Council on Global Affairs and co-chaired by UI President Sally Mason. A rich mixture of slides and audio

presentations is available on our newly designed website (www.cgrer.uiowa.edu) and at the Public Policy Center website (www.ppc.uiowa.edu).

Lastly, I would like to thank our first CGRER journalism intern, Soheil Rezayazdi, who this year graduated with his M.S. in Journalism and Mass Communications, and who has gone on to employment in New York City as a journalist. Soheil's internship with CGRER was the result of a recommendation from our Advisory Board three years ago. Soheil did a marvelous job of teaching us about "convergence journalism," i.e., using news stories, podcasts, You-Tube, and audio-visual productions to tell the rich story of CGRER members' research. We are grateful to Soheil and have

hired a new intern to continue his efforts.

The year 2009 was not only the end of another year for CGRER, it also represented the end of our second decade of existence. CGRER was officially created by the Iowa Energy Bill of 1990, so 2009 was our 19th year of operation. Along with my friend, colleague, and CGRER co-director Greg Carmichael, we thank all the people who made 2009 a successful year, and we look forward to much more outstanding research, education, and outreach in 2010.

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



CGRER Executive Committee

David Bennett • Geography, UI

Dennis Dahms • Physical Geography, UNI

Vicki Grassian • Chemistry, UI

Paul Greenough • History and Behavioral Health, UI

Diana Horton • Biological Sciences, UI

Sarah Larsen • Chemistry, UI

Lou Licht • Ecolo-Tree, Inc.

Michelle Scherer • Civil & Environmental Engineering, UI

Peter Thorne • Occupational & Environmental Health, UI

You-Kuan Zhang • Geoscience, UI

MESSAGE FROM THE ADVISORY BOARD

After the drama of 2008, which included the Iowa City flood, the historic national election, and the international financial meltdown, 2009 seemed relatively calm, though only relatively. It is particularly pleasing to see that the recent suggestions of the Advisory Board for more outreach bore such magnificent fruit in 2009, the Year of Outreach, which culminated in a CGRER symposium jointly sponsored with the UI Public Policy Center, *Energy and Climate Change in the Midwest: Creating Opportunities in the New Economy*.

After the 2007 report of the Intergovernmental Panel on Climate Change (IPCC for short) and the resulting Nobel Prize award to that body, it appeared that the basic facts of “global warming” had been accepted by both the general public and by national and international leaders. The United States and the rest of the world seemed to be moving on from that argument to seek means of mitigation through various forms of carbon sequestration and the development of low- and no-carbon sources of energy, all active areas of research at CGRER.

However, this year, with the discovery that at least some human in their love of gossip and their dislike for “skeptics,” and the not-unrelated discovery that some climate scientists had received apparently serious anonymous threats of bodily harm, the normally calm field of scientific inquiry again became a political and ideological battlefield. Nonetheless, the three key conclusions of the 2007 IPCC report stand. None have been refuted:

In the opinion of this writer, a major focus of research at CGRER in the coming years should be the development of Midwestern sources of low- and no-carbon energy, the adaptation of Midwestern agriculture to a warmer and probably dryer Midwest, and the development of agricultural practices that build up the carbon content of Midwestern farmland. I know that CGRER researchers and my fellow advisory board members stand by, ready to investigate and

educate about these and many other efforts to reduce the multiple threats of human-induced climate change.

Hiram “Chip” Levy
Geophysical Fluid Dynamics
Laboratory, NOAA

1. The earth’s lower atmosphere and its oceans are warming;
2. While many chemicals are involved, this warming is being driven in large part by the well-observed increasing concentration of carbon dioxide in the earth’s atmosphere; and
3. We humans, through the burning of carbon-based fuels and our burning of forests with their vast stores of carbon, have a major responsibility for this observed increase of carbon dioxide in the atmosphere.



CO₂

CGRER Advisory Board Members

Robert Dvorsky
Senator, Iowa State Legislature

Jon Kallen
Manager, Environmental Policy and Strategy
MidAmerican Energy

Jim Klosterbuer
Senior Environmental Consultant
Alliant Energy

Mark Kresowik
National Corporate Accountability Representative
National Coal Campaign, Sierra Club

Hiram “Chip” Levy
Senior Research Scientist
Geophysical Fluid Dynamics Laboratory, NOAA

David Osterberg
Occupational and Environmental Health
University of Iowa

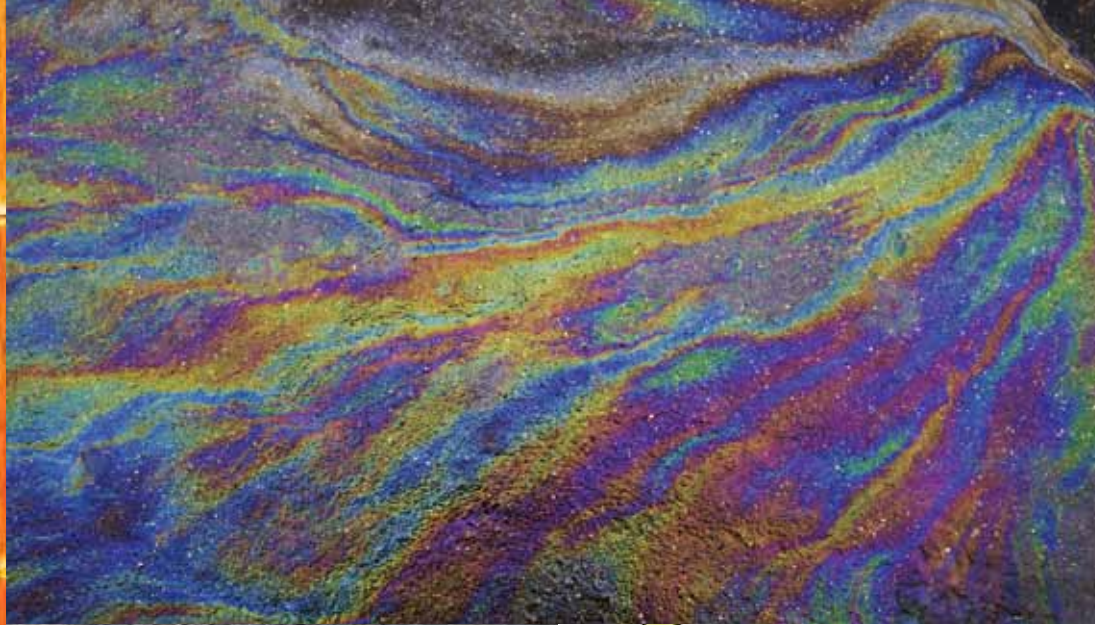
William Stigliani
Professor, Center for Energy & Environmental Education
University of Northern Iowa

Sharon Tahtinen
Special Assistant, Energy Policy
Iowa Department of Natural Resources

Krista Tanner
Iowa Utilities Board

CGRER PROMOTES INTERDISCIPLINARY DIALOGUE TO ADDRESS IOWA'S NEEDS

CGRER's efforts in 2009 reflected the increasing focus on, and evidence of, climate change around the globe. In addition to other efforts, CGRER promoted dialogue on minimizing the negative results of rapidly changing climate, while simultaneously encouraging adaptations to this process, in several ways.



CGRER-Sponsored Symposia

CGRER worked with the UI Public Policy Center to organize and sponsor a UI symposium held October 16-17. *Energy and Climate Change in the Midwest: Creating Opportunities in the New Economy* was stimulated by UI President Sally Mason's leadership of a Chicago Council on Global Affairs task force, which challenged the Midwest to move toward a post-carbon economy in order to maintain its prosperity. The symposium, which hosted over 150 attendees and nearly three dozen speakers, discussed the intersection between energy and climate change, and opportunities for the Midwest to create green jobs in the new energy economy.

CGRER and the UI Public Policy Center also co-sponsored the three-day symposium, *Living with Floods: From Science to Policy*, held at the UI in March. Subjects included state-of-the-art theories of flood causation, and flood mitigation, insurance, environmental and economic issues, and impacts.

Climate Change Committee Work in Iowa

Jerry Schnoor has chaired the state's governor-appointed Climate Change Advisory Council (ICCAC) since 2007. ICCAC activities have continued through meetings with the state legislature's new Olson Amendment Committee to produce a report on the specific effects of climate changes on Iowa's agriculture, natural resources, public health, economics and commerce, energy production and regulation, emergency management, and infrastructure. The committee, which also includes CGRER members **Laura Jackson**, **Gene Takle**, **Peter Thorne**, **Larry Weber**, and Advisory Board member **David Osterberg**, is working with the Iowa Office of Energy Independence. In preparation for the final report, due by January 2011, **Gene Takle** has produced a preliminary report on the topic at hand (see page 11).

International Climate Change Work – Black Carbon

On September 25, **Greg Carmichael** participated in the "Science-Policy Consultation on Non-CO₂ Emissions" in Washington, D.C., sponsored by the United Nations Environment Programme (UNEP). He is now a co-author of a report, to be published in 2010, that will summarize the science of black carbon (commonly called "soot") and pose key recommendations for its reduction that could feed into governmental policy decisions.

Carmichael's 2008 review of this major climate-change compound significantly expanded the scientific understanding of the importance of black carbon.¹ This compound is now thought to be the second largest contributor to global warming (following carbon dioxide), and is thus receiving increased attention in climate change research (see page 19). Produced by the incomplete combustion of diesel fuel, oil, wood and other biomass, and the like, black carbon when inhaled also significantly affects human health. However, because of its short atmospheric half-life and the

¹ Ramanathan, V., and G. Carmichael. 2008. Global and regional climate change due to black carbon. *Nature Geoscience* 1: 221-227.

availability of effective emissions control measures, atmospheric black carbon can be reduced far more quickly and easily than carbon dioxide; rapidly reducing black carbon emissions could thus significantly slow global warming trends while improving air quality. Doing so would be a way of “buying time” for the planet while slower-moving policy negotiations regarding CO₂ emissions continue.

Connecting with Iowa’s Legislature

On February 16, CGRER held a climate change briefing and discussion at the Iowa State Historical Building, Des Moines. This event brought together 130 legislators, administrators, and lay people to learn more about climate change in Iowa and to discuss future steps for limiting its effects. Talks were given by **Gene Takle**, **Jerry Schnoor**, and others.



That same day, **Jerry Schnoor** spoke to a joint meeting of the Iowa Senate and Iowa House Energy and Environment Committees on climate change and the recently published Iowa Climate Change Advisory Council Final Report.

On March 24, CGRER hosted a legislative breakfast reception at the Iowa State Capitol. This event provided **Craig Just**, **Lou Licht**, **Gene Parkin**, **Jerry Schnoor**, **Charlie Stanier**, and **Larry Weber** an opportunity to informally meet and share information about CGRER with the 47 legislators who attended through personal discussions, displays, and handouts.



Copenhagen Travels

Jerry Schnoor accompanied a group of 12 undergraduate and graduate students from across the state to the United Nations Climate Change Conference in Denmark in December, a trip organized through the Iowa United Nations Association. The group remained in Copenhagen for seven days and observed negotiations for a new international climate change treaty. While abroad, students reported back to student organizations at their home institution on conference events, an activity that will be continued by the participants once back in Iowa. CGRER covered the expenses of three of the 12 students.

Communicating about Eastern Iowa’s Air Quality

Charles Stanier is investing considerable time in communicating the results of his air particulate-matter research to policy makers, business people, and local residents throughout eastern Iowa, both through written materials and through presentations. His communications concern eastern Iowa’s (and particularly Davenport and Muscatine’s) borderline compliance with federal air quality standards. If particulate matter levels rise further, they could significantly impact the region economically. Stanier and **Greg Carmichael** were contracted in 2008 to determine the sources of the high atmospheric particulate levels (see 2008 Annual Report, page 19), and ongoing research has resulted in a technique that can identify both local pollution sources and the regional background pollution. Explaining the balance of regional and local sources is the focus of his effective and important outreach communications.

International Atmospheric Science Committee Work

Greg Carmichael was a member of the five-person U.S. delegation to the World Meteorological Organization’s (WMO’s) Commission on Atmospheric Sciences meeting in November in South Korea. This meeting, held once every 4 years, establishes policies and sets the agenda for research projects at the WMO, which is the UN’s major scientific agency and runs the all-important Intergovernmental Panel on Climate Change (IPCC).

Carmichael is also a member of a U.S. – Canada committee formed in 2009 to address air-quality forecasting, an emerging and increasingly important area of government service. Organized by the U.S.’s NOAA and by Environment Canada, this bilateral steering committee will meet annually and work to influence the U.S. – Canada science agenda, recommending ways to improve both governments’ air-quality forecasting services and prediction of severe storms, and broadening their vision of these subjects. This forum for researchers and government agencies met for the first time in December.



CGRER’s Outreach and Community Education Efforts

CGRER’s Director of Outreach and Community Education, **Joe Bolckom**, completed his first full year on the job with an impressive list of achievements. In addition to planning and organizing the *Energy and Climate Change in the Midwest* symposium, he organized a climate change briefing and discussion (February 16) at the Iowa State Historical Building in Des Moines, and a legislative breakfast reception (March 24) at the Iowa State Capitol, which allowed CGRER researchers to mingle with state legislators (see page 8). Joe has also participated in a work group with public university scientists charged by the legislature to report on how climate change is already impacting Iowa (see page 7). And he represented CGRER at meetings with the Iowa Environmental Council, Energy Efficiency Collaborative Stakeholder Group, Commission on Energy Efficiency Standards and Practices, UNI’s Center for Energy and Environmental Education, and the annual Iowa Renewable Energy Association’s Energy Expo.



CGRER’s Journalism Intern

CGRER’s journalism intern, **Soheil Rezayazdi**, completed the following major 2009 outreach efforts and several smaller projects before finishing both his internship and his master’s degree in journalism in December:

- Worked with UI media production staff to produce a video showcasing CGRER for use on the Big Ten Network.
 - Wrote Op Ed columns on local sustainability issues that were published in *The Daily Iowan*, *Iowa City Press Citizen*, and *Little Village Magazine*.
 - Assisted with revamping CGRER’s website. Soheil also wrote or produced the following materials for CGRER’s website:
 - Videos on CGRER and the 2008 floods; Iowa Superfund Basic Research Program, featuring **David Osterberg**; Ecolo-tree, Inc., **Lou Licht**’s phyto-remediation firm; videos of **Jerry Schnoor** discussing CGRER’s interdisciplinary approach, coal-fired power plants, and “sustainability taxes.”
 - Annotated Photo Gallery of CGRER’s *Energy and Climate Change in the Midwest* symposium.
 - Profiles of CGRER’s co-directors.
- James Malewitz**, a UI graduate student in journalism, became CGRER’s new journalism intern in December.



Website revision

CGRER’s website went through a complete overhaul in 2009. Computer lab director **Jeremie Moen** and assistants redesigned web pages and added a multimedia page and interactive educational documents for K-12 teachers (see page 15). CGRER also created a new weather and energy forecasting product useful to researchers and modelers; more user-friendly weather forecasts for the general public, as well as wind-forecasting models for wind-energy utilities, are scheduled for addition in 2010. Visit the new website at <http://www.cgrer.uiowa.edu>. To further increase visibility and information sharing, CGRER is now on Facebook and Twitter.

Visiting Scientists

The first four visitor groups were associated with CGRER's atmospheric research group:

Pankaj Sadavarte (May 1 – November 10), **Chandra Venkataraman** (May 1 – 15), and **Akshay Jain** (May 26 – July 31) all visited CGRER from the Indian Institute of Technology in Mumbai, for the periods indicated. In addition, **Mohit Dalvi** (May 4 – 30) visited from the Centre for Development of Advanced Computing. All four visitors were part of an ongoing collaboration between The India Institute of Technology – Bombay, the Center for Development of Advanced Computing in Pune, and CGRER. They continued collaborations conducted under the Indo-US Joint Centre for Nanoparticle Aerosol Science and Technology (NAST) and funded under the Indo-US Science and Technology Forum.

Ken Rahn from the University of Rhode Island visited November 5 – 7 as part of a long-term collaboration centered on better understanding ambient aerosols in Asia.

Bhupesh Adhikary from Kathmandu University, Nepal, visited May 1 – 23, as part of continuing collaborations regarding a NASA atmospheric field experiment conducted in the Arctic in 2008.

Marcelo Mena from the Universidad Nacional Andres Bello, Santiago, Chile, visited July 20 – August 3 as part of a collaboration on the VOCALS atmospheric field experiment conducted in Chile in 2008.

The fifth visiting scientist, **Guangshu Zhai**, from the Chinese Academy of Sciences, State Key Laboratory on Eco-Environmental Science in Beijing, China, is a postdoctoral researcher and visiting scholar who has been working with Jerry Schnoor on an NIEHS-funded study on issues related to water sustainability and the use of phyto-remediation to clean contaminated sediments and soils. He was at CGRER for the entire year.

CGRER's 2009 Seminar Series

Speaker	Affiliation	Title of Seminar
Sudipto Banerjee	Associate Professor, Department of Biostatistics, University of Minnesota	Hierarchical Spatial Modeling for the Large Spatial Datasets
Andrew Foster	Professor & Chair, Department of Economics, Brown University	Do Voluntary Pollution Reduction Programs Help Reduce Pollution Levels? Evidence from the Mexican Clean Industry Program
Michael Kavanaugh	Vice President, Malcolm Pirnie, Inc.	Remediation of Large Groundwater Contaminated Plumes: Optimal Cleanup Strategies
Marcelo Mena	Professor, Department of Environmental Engineering and Science, Andrew Bello University, Santiago, Chile	Evaluating the Impacts of Megacities on Air Quality, Meteorology, and Climate

A Sampling of Additional CGRER-Member Publications...

Baker, R.G., E.A. Bettis III, R.D. Mandel, J.A. Dorale, and G.G. Fredlund. 2009. Mid-Wisconsinan environments on the eastern Great Plains. *Quaternary Science Reviews* 28: 873–889.

Bettis, E.A. III, . . . R.L. Ciochon, et.al. 2009. Way out of Africa: Early Pleistocene paleoenvironments inhabited by *Homo erectus* in Sangiran, Java. *Journal of Human Evolution* 56: 11-24.

Carbone, R. E., J. Block, S. E. Boselly, **G. R. Carmichael . . . , W. F. Krajewski . . . , E. S. Takle,** et.al. 2009. *Observing Weather and Climate from the Ground Up: A Nationwide Network of Networks.* Washington, D.C.: National Academies Press. 268 pp.

Carlson, J. 2009. Reflections on a problem of climate justice: Climate change and the rights of states in a minimalist international legal order. *18 Transnational Law & Contemporary Problems* 101.

Carmichael, G.R. 2009. *Independent Environmental Assessment: Beijing 2008 Olympic Games.* Chapters 2 – Air Quality, 3 – Transport, and 5 – Green Coverage and Protected Areas. Nairobi, Kenya: UN Environment Programme.

Carmichael, G.R., Bhupesh Adhikary, Sarika Kulkarni, et al. 2009. Asian aerosols: Current and year 2030 distributions and implications to human

health and regional climate change. *Environmental Science & Technology* 43 (15): 581-5817. doi: 10.1021/es8036803.

Cosh, M. H., E. D. Kabela, **B. Hornbuckle,** et. al. 2009. Observations of dew amount using in situ and satellite measurements in an agricultural landscape. *Agricultural and Forest Meteorology*, doi:10.1016/j.agrformet.2009.01.004.

Debinski, D.M., and M. Cross. 2009. Conservation and global climate change. Pp. 556-565 in Simon Levin et al. (Eds.): *The Princeton Guide to Ecology.* Princeton, NJ: Princeton University Press.

Field, R.W., co-editor and co-author. 2009. *WHO Handbook on Indoor Radon: A Public Health Perspective.* Geneva, Switzerland: World Health Organization Press.

Gorski, C. A., and **M.M. Scherer.** 2009. Influence of magnetite stoichiometry on Fe(II) uptake and nitrobenzene reduction. *Environmental Science and Technology* 43(10): 3675-3680.

Handler, R. M., B.L. Beard, C.M. Johnson, and **M.M. Scherer.** 2009. Atom exchange between aqueous Fe(II) and goethite: An Fe isotope tracer study. *Environmental Science and Technology* 43(4): 1102–1107.

Hu, D., and **K.C. Hornbuckle.** 2009. Inadvertent poly-chlorinated biphenyls in

commercial paint pigments. *Environmental Science and Technology.* DOI: 10.1021/es902413k

Kayzar, T.M., K.M. Cooper, **M.K. Reagan,** and A.J.R. Kent. 2009. Gas transport model for the magmatic system at Mount Pinatubo, Philippines: Insights from (210Pb)/(226Ra). *Journal of Volcanology and Geothermal Research* 181: 124-140.

Kleiber, P.D., V. H. Grassian, M. A. Young, and P. K. Hudson. 2009. T-matrix studies of aerosol particle shape effects on IR resonance spectral line profiles and comparison with an experiment. *Journal of Geophysical Research – Atmospheres* 114, D21209, doi:10.1029/2009JD012710.

Muste, M. 2009. From ecohydrologic observatories to integrated water resources management. *Proceedings of AWRA Summer Specialty Conference – Adaptive Management of Water Resources II,* Snowbird, UT.

Pielke Sr., R., K. Beven . . . , **W. Krajewski,** et. al. 2009. Climate change: The need to consider human forcings besides greenhouse gases. *Eos, Transactions of the American Geophysical Union* 90(45), doi:10.1029/2009EO450008.

Rigal, L. 2009. Watershed days on the treaty line, 1836-1839. *The Iowa Review* 39(2): 202-223.

Singh, R., M.J. Helmers, A. Kaleita, and **E.S. Takle.** 2009. Potential impact of climate change on subsurface drainage in Iowa's subsurface drained landscapes. *Journal of Irrigation and Drainage Engineering,* July/August: 459-466. DOI: 10.1061/ASCEIR.1943-4774.0000009

Butler, D.R., **G.P. Malanson,** S.J. Walsh, and D.B. Fagre, eds. 2009. *The Changing Alpine Treeline: The Example of Glacier National Park, Montana, USA.* Amsterdam: Elsevier.

Takle, G.S. 2009. Assessment of potential impacts of climate changes on Iowa using current trends and future projections. Unpublished white paper, 17 pp, produced through ISU Climate Science Initiative for the Iowa Climate Change Advisory Council, available at http://climate.agron.iastate.edu/Document/Climate_Changes_for_Iowa_12.pdf.

Villarini, G., F. Serinaldi, J.A. Smith, and **W.F. Krajewski.** 2009. On the stationarity of annual flood peaks in the continental United States during the 20th century. *Water Resources Research* 45, W088417, doi:10.1029/2008WR007645.

Yadav, V., **G.P. Malanson,** E.G. Bekele, and C. Lant. 2009. Modeling watershed-scale sequestration of soil organic carbon for carbon credit programs. *Applied Geography* 29: 488-500.

CGRER PROMOTES EDUCATION TO ADDRESS IOWA'S NEEDS

In 2009, CGRER supported a number of concrete educational outreach efforts for Iowans of all ages and for others beyond our state's borders. The most focused educational efforts considered Iowa's water, flooding, sustainability, and atmospheric science.



Water and Floods

Discussions of water and floods in Iowa will surely be promoted by a new book, *A Watershed Year: Anatomy of the Iowa Floods of 2008* (C. Mutel, editor, University of Iowa Press), which was released in March 2010. CGRER helped finance this book on the science of Midwestern flooding. The book's 25 diverse chapters include eight chapters with CGRER-member authors. A number of book-related community events are being scheduled across the state for spring 2010.

UI Sustainability Initiative

Jerry Schnoor (chair), **David Bennett**, **Peter Thorne**, and **Larry Weber** are members of a UI Water Sustainability Committee, a new university-wide initiative to integrate sustainability themes into the curriculum. These CGRER members and others on the initiative committee are directing the hiring of five new faculty members, one each in Chemistry, Engineering, Public Health, Geography, and Urban and Regional Planning, who will be encouraged to work in an interdisciplinary manner on sustainability issues. The interdisciplinary focus is being established through a seminar series that began in 2009, which is also organized by Initiative committee members.

Training in Atmospheric Science and Air-Quality Modeling

CGRER's atmospheric research team was active in spreading its knowledge to future researchers and international colleagues. The team was involved with the NASA-funded Student Airborne Research Program (SARP), intended to train the next generation of airborne researchers. **Greg Carmichael** traveled to California in July to teach a one-week SARP course on atmospheric chemistry and modeling to 30 undergraduates and graduate students. The students then participated in field projects that taught them atmospheric flight-based research techniques and data interpretation skills; CGRER postdoctoral research scholar **Scott Spak** served as an instructor, and CGRER performed air quality forecasts (as it usually does) to guide the research aircraft that were gathering data. CGRER graduate research assistant **Min Huang** was selected as a student participant in the course. Parallel coursework in airborne research was also offered to 30 junior high and high school teachers.

Carmichael and Spak also trained international professionals in both Mexico and China in air quality assessment and forecasting through the WMO's GURME program, which works to help foreign equivalents of the U.S. National Weather Service to study, predict, and manage urban air pollution. Carmichael traveled to Mexico City for seven days in August to teach techniques of air quality modeling, forecasting, and impacts assessment to Central and South American weather service representatives. The ability to model and predict air pollution is especially crucial for megacities in developing nations. China is rapidly implementing such forecasting, with a pilot project in Shanghai, which is slated to become one of the world's first cities to routinely forecast fine-particle air pollutants and ozone levels using state-of-the-art modeling. In September, Carmichael and Spak spent a week in Shanghai advising local modelers about implementing and improving their forecasting systems.



Travel Grants for Graduate Students

The following grants were awarded to students whose advisors are CGRER members, and who were traveling to professional conferences to make oral or poster presentations. A total of \$13,600 (from \$250 to \$750 per student) was awarded in 2009.

Student	Department	Conference
Karna Barquist	Chemistry, UI	American Chemical Society National Conference
Kirsten Beyer	Geography, UI	International Medical Geography Symposium
Jeremy Brill	Civil & Environmental Engineering, UI	World Environmental and Water Resources Congress
Kevin Denn	Civil & Environmental Engineering, UI	33rd International Association of Hydraulic Engineering & Research Biennial Congress
Dimitrios Dermisis	Civil & Environmental Engineering, UI	World Environmental and Water Resources Congress
Pitor Domaszczynski	Civil & Environmental Engineering, UI	IEEE International Geoscience & Remote Sensing Symposium
Susanna Donaldson	Anthropology, UI	Society for Applied Anthropology Annual Meeting
Sherrie Elzey	Chemical & Biochemical Engineering, UI	American Association for Aerosol Research Annual Conference
Christopher Gorski	Civil & Environmental Engineering, UI	Goldschmidt Conference
Hao-Che Ho	Civil & Environmental Engineering, UI	33rd International Association of Hydraulic Engineering & Research Biennial Congress
Robert Handler	Civil & Environmental Engineering, UI	American Chemical Society National Conference
Yang Oh Jin	Civil & Environmental Engineering, UI	American Society for Microbiology Conference
Timothy Lauth	Civil & Environmental Engineering, UI	American Geophysical Union Fall Meeting
Rachel Marek	Civil & Environmental Engineering, UI	Society of Environmental Toxicology and Chemistry 30th Annual Meeting
Andrew Martinez	Civil & Environmental Engineering, UI	Society of Environmental Toxicology and Chemistry 30th Annual Meeting
Brian Meland	Physics and Astronomy, UI	American Association for Aerosol Research Annual Conference
Mandapaka Venkata Pradeep	Civil & Environmental Engineering, UI	European Geosciences Union General Assembly
Bong Chul Seo	Civil & Environmental Engineering, UI	American Geophysical Union: Joint Assembly and Fall Meeting
Jennifer Trivedi	Anthropology, UI	American Anthropological Association Annual Meeting
Achilleas Tsakiris	Civil & Environmental Engineering, UI	33rd International Association of Hydraulic Engineering & Research Biennial Congress
Brian Viner	Agronomy, ISU	International Conference on Coexistence Between Genetically Modified and Non-GM Based Agricultural Supply Chains

In addition, \$12,549 (from \$573 to \$2,574 per student) was awarded to graduate students advised by CGRER members who were traveling to sites to complete field research for their thesis or dissertation.

Student	Department	Title of Project	Destination
Alexander Duthie	Ecology, Evolution, and Organismal Biology, ISU	Interspecific Interactions Over a Latitudinal Resource Gradient: A Graphical Modeling Approach Using Fig Wasps	Baja, Mexico
Luke Juran	Geography, UI	Water and Sanitation Infrastructure in Post-Tsunami Housing Tamil Reconstruction in Tamil Nadu, India	Nadu, India
Shelby Putt	Anthropology, UI	Taphonomic Processes at the Ngandong <i>Homo erectus</i> Site, Java, Indonesia	Java, Indonesia
Jill Sherwood	Ecology, Evolution, and Organismal Biology, ISU	Examining the Effects of Snowpack and Temperature on <i>Parnassius clodius</i> Butterfly Larvae and Adults in a Montane Meadow System	Grand Teton National Park, U.S.
Maija Sipola	Geoscience, UI	Geoarchaeological Analysis of Solo River Terrace Stratigraphy, Java, Indonesia	Java, Indonesia
Jennifer Trivedi	Anthropology, UI	Long-Term Recovery Strategies and Class in Post-Katrina Biloxi	Biloxi, Mississippi
Simone Williams	Geography, UI	Water Quality Monitoring to Protect Human and Ecosystem Health	Kingston, Jamaica



New Educational Tools on Website

CGRER's newly overhauled website provides K-12 educators access to material that can be easily presented in their classrooms. These additions were created by **Morgan Yarker**, a CGRER Graduate Research Assistant who is working on her doctoral dissertation in Science Education. Her ready-to-use powerpoints, with different versions developed for various age groups, address three topics: Climate Change, Atmospheric Brown Clouds (a major research theme for Greg Carmichael's research group), and Ways You can Save Energy Every Day. Versions are available for both students and teachers; the latter provide complete information for the presenter to read either as a script or for content knowledge. These powerpoints can be downloaded from the Education and Outreach section of the CGRER website.

A Sampling of Additional CGRER-Member Educational Efforts...

Nandita Basu led a two-week session on *Contaminant Dynamics Across Scales* at a National Science Foundation (NSF) Summer Institute (July, Vancouver). She also chaired a session *Hydrologic Predictions in a Changing Environment* at the American Geophysical Union's fall meeting in San Francisco.

Art Bettis was invited to present the paper, "Climate Controls on Tropical River Systems in Indonesia," at the *Variations in Fluvial-Deltaic and Coastal Reservoirs Deposited in Tropical Environments* conference, Jakarta, Indonesia.

Jonathan Carlson taught a UI first-year undergraduate seminar on *What to do About Climate Change*, helped teach a UI International Programs Summer Institute for Teachers on *Global Climate Change: Human Rights, Consequences & Responsibilities*, and taught a one-week seminar on international environmental law that focused on global climate change, in Lisbon, Portugal.

Diane Debinski organized the symposium, *Landscape-level Approaches to Experimentally Studying Plant and Animal Responses to Climate Change*, held at the International Association of Landscape Ecologists' April meeting in Utah. She also spoke on the ecological effects of snow removal in the montane at this meeting.

Bill Field gave invited presentations to the U.S. President's Cancer Panel on Environmental Causes of Cancer, and to the National Academy of Science on the World Health Organization's Global Initiative to Reduce Radon Concentrations.

Paul Greenough organized a workshop held in November in Mysore, India, titled *The New Piracy: Rehabilitation of Natural Disaster-Affected and Development-Affected Communities in South Asia*.

Matt Hill has created a new UI undergraduate course, *Human Impacts on the Environment*, which uses archaeological case studies to explore how long-term changes in social organization, subsistence patterns, population growth, and settlement practices have influenced the nature and scale of human impacts on the environment around the globe over the last 30,000 years.

Craig Just, Mark Reagan, Laura Rigal, and John Solow were members of the UI's Task Force to establish an undergraduate Sustainability Certificate; Just, Reagan, and Rigal are now on the curriculum committee for this certificate. Craig Just also initiated the course *Introduction to Sustainability* as part program's curriculum.

George Malanson organized and ran a workshop at Glacier National Park, at which recent progress on alpine treeline dynamics was reviewed in terms of long-term context.

Wilfrid Nixon taught a first-year undergraduate seminar titled *The Perils of Global Warming*.

CGRER members **Michelle Scherer** (chair), **Craig Just** and **Tim Mattes** (co-chairs), and **Keri Hornbuckle, Gene Parkin, Jerry Schnoor, and Rich Valentine** hosted the Association of Environmental Engineers and Science Professors' 2009 conference, *Grand Challenges in Environmental Engineering and Science: Research and Education* in Iowa City in July.

In an effort to improve public understanding and decision-making, **Gene Takle** provided a number of invited presentations on climate science and climate change to a variety of professional organizations, corporations, state and local government groups, and service organizations across the state.

Clockwise from top left: Capitol building, Washington, DC; Ys River, Jamaica; Palacio da Pena Sintra, Lisbon, Portugal; Wasatch Mountains, Utah; Mysore Palace, Mysore, India; Bromo volcano, Java, Indonesia; Damage from Hurricane Katrina, Biloxi, Mississippi; Coit Tower, San Francisco, California; Cactus, Baja, Mexico





CGRER FOSTERS
GLOBAL CHANGE
RESEARCH
TO ADDRESS
IOWA'S NEEDS

The many programs of CGRER's dozens of research scientists continue to focus on multiple traits of our changing planet. Three of the significant new programs of major importance in 2009 are described at the right.

The Iowa Flood Center

Prior to 2009, despite Iowa's eminence in hydrological and global change studies, neither Iowa (nor the nation) claimed a central institute for advanced research and education specific to floods. In 2009, that reality was transformed when the Iowa legislature granted \$1.3 million to establish the Iowa Flood Center (IFC). The IFC is housed at CGRER's sister institute, the UI's IIHR-Hydroscience & Engineering, one of the nation's preeminent hydraulics laboratories. It is headed by **Witold Krajewski**. The IFC is now actively engaged in several local studies collaborating with Iowa communities and state and federal agencies. Research conducted at the UI and Iowa State University (ISU) employs several graduate and undergraduate students. Projects include design of a sensor network to better monitor local river flow, improving the use of radar data for precipitation measurement and better prediction of small and large-scale flooding events, mapping river basins for flood-vulnerable Iowa communities, preparing flood inundation maps, and assessing the accuracy of National Weather Service seasonal flood forecasts for Iowa rivers. More information is available at www.iowafloodcenter.org/.

EPSCoR Planning Grant

Several CGRER members at all three of Iowa's Regents institutions have been active in an NSF-funded EPSCoR (Experimental Program to Stimulate Competitive Research) planning grant. EPSCoR is a program that works to even out federal research dollars across the country, by awarding grants that combine infrastructure improvement, interdisciplinarity, and outreach to states that have historically received below-average federal funding in basic and applied science and engineering. Iowa is eligible for applying for EPSCoR funds from NSF as well as several other agencies. In 2009, an EPSCoR proposal was submitted for \$25 million, focusing on research on renewable energy, specifically wind, solar, and biomass energy, and energy efficiency. Funds would go to Iowa's junior researchers at public and private institutions across the state, with hopes that EPSCoR-funded projects would enable these researchers to become more competitive in future applications to non-EPSCoR projects. A number of creative projects were proposed. For example, energy-efficiency competitions among Iowa's cities would be established, with social scientists studying mechanisms for encouraging citizens to reduce energy consumption. Further NSF-EPSCoR funding, if received, would commence in 2010 and extend for five years.

Black Carbon and Climate Change

CGRER's atmospheric research team, led by **Greg Carmichael**, is helping to establish the importance of black carbon as a global-warming emission (see page 7). He and other climate change researchers are creating a wedge of hope for avoiding serious climate change in the next decade or two, even as the slower-working political efforts to address global CO₂ emissions, and techniques for adapting to the changing climate, move forward.

One hopeful contribution along these lines is a pilot program to lower the large amounts of black carbon commonly produced throughout Asia by lights and cookstoves fueled by biomass (e.g. dung or crop residues). This demonstration project will test the results of replacing biomass-burning stoves and lights with cleaner-burning or emissions-free technologies such as solar lanterns and cookers. Air pollution and associated health problems are expected to plummet along with black carbon. The project will comprise the most carefully monitored and rigorous scientific evaluation to date on the efficacy of reducing biomass-fueled cooking on climate change. Carmichael's team will be major contributors to this comprehensive effort; CGRER's researchers will be modeling atmospheric conditions before and after the stoves are used, thus helping to assess their positive effects.



A Sampling of CGRER-Member New Grants, Appointments, and Awards

Nandita Basu and Purdue colleagues were awarded the grant *Dynamics of Hormone Loads & Attenuation in Ditches and Streams Draining Agricultural Fields Receiving Animal Manure Applications*, 2009-2011, from U.S. Department of Agriculture, subcontract

from Purdue University, for \$90,282.

Art Bettis was appointed as hydrogeomorphologist to the U.S. Fish and Wildlife Service's Missouri River Restoration Task Force.

Allen Bradley (PI) and colleagues received the grant *The Use of Retrospective Hydrologic Forecasts for Forecast System Improvement Using Hydrologic Forecast Verification Concepts*, 2009-2012, from NOAA Climate Prediction Program for the Americas, for \$388,000.

Garry Buettner was awarded the Silver Medal for Biology and Medicine by the International Electron Paramagnetic Resonance Society.

Bill Field was appointed to the U.S. Dept. of Health and Human Service's Advisory Board on Radiation and Worker Health. He also assisted the Environmental Protection Agency with a preliminary assessment of the impact of global warming on indoor air quality.

CGRER's atmospheric research group received the NASA Group Achievement Award for their contributions to the 2008 Arctic Research with Aircraft and Satellites experiment.

Paul Greenough received the grant *Implementing a Second-Curriculum Project in Undergraduate South Asian Studies at the University of Iowa*, 2009-2011, from the U.S. Department of Education, for \$333,903 (cost-shared with the UI).

Craig Just is on the planning committee for a Sustainability Living and Learning Community that will be created in the UI's Mayflower Residence Hall in 2010. His graduate student, **Jeremy Brill**, received an award for his paper "Grand environmental challenge: Nutrient cycling, global climate change, and large river systems," at the UI's Jakobsen Conference.

Paul Kleiber's graduate student **Brian Meland** received a NASA-NESSF Graduate Student Fellowship, and also won an American Association for Aerosol Research Student Poster Competition award for his paper, "Laboratory studies of light scattering from representative components of atmospheric mineral dust."

Witold F. Krajewski was appointed director of the newly formed Iowa Flood Center (see page 19), and he presented the 2009 Boussinesq Lecture at the Royal Netherlands Academy of Arts and Sciences, Boussinesq Center for Hydrology. His

graduate students **Piotr Domaszczyński** and **Bongchul Seo** won Best Student Paper awards at American Geophysical Union meetings; in addition, Domaszczyński was awarded a NASA Global Change Graduate Fellowship.

Krajewski (PI) and **Anton Kruger** (Co-PI) also received the grant *Enhancing Hydro-NEXRAD: Community Resource for Use of Radar-Rainfall Data*, 2009-2011, from NSF, for \$397,422.

George Malanson (co-PI with colleagues) received the grant *Implications of an Invasive Forest Pathogen for Alpine Treeline Dynamic*, 2009-2012, from NSF Geography & Spatial Sciences, for \$439,006.

Marian Muste was PI for a project that led to the designation of the Iowa-Cedar River basin as a UNESCO-Hydrology for Environment Life and Policy (HELP) Basin, a designation that will promote research on human-induced changes in this basin.

Wilfrid Nixon received the Environmental Leadership Award from the national environmental organization, the Freshwater Society.

Mark Reagan was appointed chair of the UI's Geoscience Department.

Aaron Thompson, **Michelle Scherer**, and **Christof Meile** were awarded the grant *Quantifying Soil Iron Oscillations in Redox Transition Environments: Impacts on Carbon Degradation Rates and*

Phosphorus Availability, 2009-2012, from U.S. Department of Agriculture, Soils and Soil Biology Program, for \$444,260.

Scherer's graduate student **Michael Schaeffer** received an NSF Graduate Student Fellowship; her student **Tim Pasakarnis**, co-advised with **Gene Parkin**, received a University of Iowa Presidential Doctoral Fellowship.

Jerry Schnoor and two of his students were awarded the SERDP/ESTCP (Strategic Environmental Research and Development Program/Environmental Security Technology Certification Program) Project of the Year award from the U.S. Department of Defense for their work at Eglin Air Force Base, Florida, involving phyto-remediation, the use of plants to alleviate the effects of pollution.

Seed Grants Awarded by CGRER

In 2009, CGRER awarded a total of \$156,650 in seed grants to six projects.

PI/s	Title	Amount Awarded
Rhawn Denniston, Department of Geology, Cornell College	Speleothem Evidence for the Influences of Enso and Solar Variability on the Holocene Australian Summer Monsoon	\$27,000
Vicki Grassian, Department of Chemistry, UI	Carbon Dioxide Adsorption and Conversion on Nanomaterials	\$27,000
Thanos Papanicolaou, Department of Civil and Environmental Engineering, UI	The Effects of Climate Change on Soil Organic Matter and Soil Quality in Iowa	\$25,870
George Malanson, Department of Geography, UI	A Context for Alpine Tundra Response to Climate Change	\$24,902
Moti Segal, Agronomy Department, ISU	Sustainability of Crop Yields and Wind Power in Iowa under Expansion of Wind Farms	\$27,000
Carl Thurman, Department of Biology, UNI	Ecological Physiology, Gene Flow, and Demography among Fiddler Crab Populations (Genus <i>Uca</i>) Along the South Atlantic Coast of Brazil	\$24,878

Schnoor also was appointed by Governor Culver to be the Iowa United Nations Day Chair, effective October 15, and thus will represent Iowa at official United Nations functions and celebrations.

Gene Takle commenced three-year terms on the American Meteorological Society's Commissioner for Education and Human Resources, and on the University Corporation for Atmospheric Research's Board of Trustees. He also participated in a NOAA-sponsored *Regional Climate Services Planning Meeting for Agriculture* (September, Illinois), the *World Climate Conference* (September, Switzerland), and the *International Scientific Congress on Climate Change: Global Risks, Challenges and Decisions* (March, Denmark).

Takle and colleagues received the grant *Wind Forecast Model Validation and Improvement for*

the Central US, 2009-2010, from U.S. Department of Energy, for \$250,000.

Peter Thorne became Acting Head of the UI College of Medicine's Department of Occupational and Environmental Health.

Mark Young, **Paul Kleiber**, and **Vicki Grassian** were awarded the grant *Development of a Single Particle Mass Spectrometer for Field and Laboratory Studies of the Environmental Impact of Atmospheric Aerosols and Engineered Nanoparticles*, 2009-2013, from NSF, for \$630,000.

Dale Zimmerman was elected chair of the American Statistical Society's Section on Statistics and the Environment, a body of over 800 statisticians with interests in ecology and environmental science.

Black carbon accelerates the effects of global warming when it is deposited on Arctic or Himalayan ice fields. There, this dark substance absorbs the sun's heat and hastens the melting of ice, perhaps causing as much as 30 to 50% of observed Arctic warming. Carmichael's team is very active in deciphering this effect as well, through measurements taken by the UNEP-funded, multi-year Atmospheric Brown Cloud (ABC) research initiative. The ABC project is creating unique sets of Asian black carbon data that are now feeding into major IPCC and other climate models. As a result of this increased understanding of the importance of black carbon, the White House Council on Environmental Quality on December 17 declared that it would establish an initiative to reduce black carbon emissions in and around the Arctic.¹

Aids to Researchers and the UI Community

CGRER continues to offer high performance computing and visualization resources to facilitate interdisciplinary research. Such large, collaborative research efforts generate large amounts of data. In 2009, CGRER invested in state-of-the-art scalable storage. With the support of the UI's College of Engineering, researchers now have 24TB of online redundant storage. Several new high-end computer servers were also added. As the high performance computing world evolves, CGRER will continue to adapt and evolve with it. In 2010, CGRER intends to add further to its array of servers while expanding redundant data storage even more. CGRER continues to function as one of four departments on the UI campus that supports and distributes geographical information system (GIS) software through a campus-wide site license with ESRI.

¹ *The White House, Office of the Press Secretary. 12/17/2009. "Fact Sheet: Initiative to Reduce Black Carbon Emissions Affecting the Arctic."*

GENERAL INFORMATION



Budget

In fiscal year 2009 (July 1, 2008-June 30, 2009), 76% of CGRER's \$657,450 of revenue was spent on research, education, and outreach directed toward global change issues (Figure 1). The remaining 24 percent of the budget was dedicated to administration.

This funding, received in total from an assessment on Iowa's gas and electric utilities through the State Department of Commerce, was magnified many times in the millions of dollars of external grants and contracts awarded to CGRER members (Figure 2). In calendar year 2009 CGRER members, working through their respective departments, were performing research that brought in a total of about \$31.3 million in external funds. Of this amount, \$6.3 million was new funding that was initiated in 2009, while the remaining \$25 million came from ongoing projects.

Figure 1
CGRER'S EXPENSES

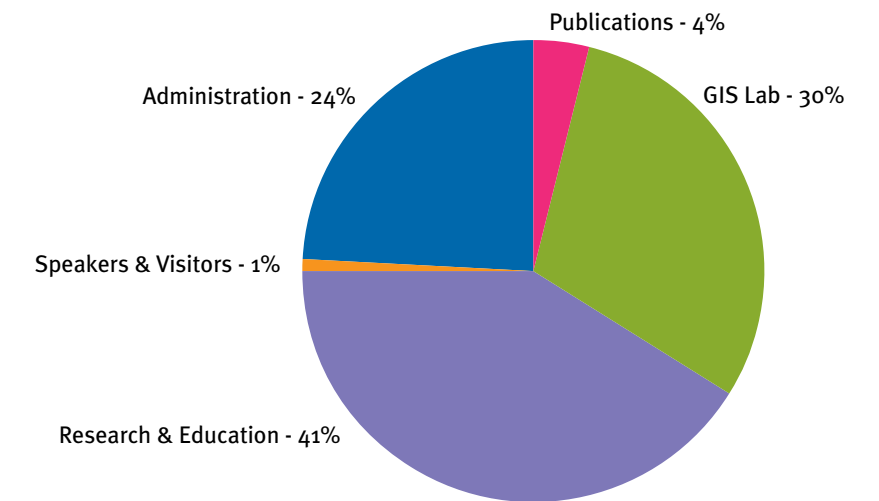
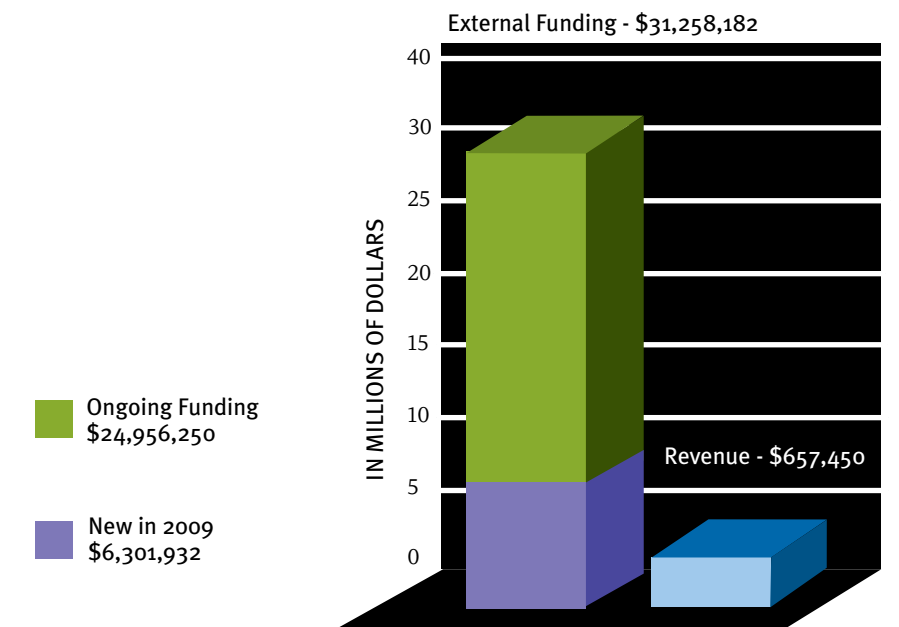


Figure 2
CGRER'S REVENUE



Administration and Membership

CGRER is directed by University of Iowa professors Gregory Carmichael (Dept. of Chemical and Biochemical Engineering) and Jerald Schnoor (Dept. of Civil and Environmental Engineering). Center activities are guided by an elected Executive Committee that consists of 10 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 5) meets annually to lend oversight to CGRER's activities.

Since 1992, CGRER has employed two fulltime 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 Bolkcom serves as half-time Director of Outreach and Community Education. CGRER reports directly to the UI's Vice President for Research.

CGRER Members

UNIVERSITY OF IOWA

Anthropology

Michael S. Chibnik
Russell L. Ciochon
Matthew E. Hill, Jr.

Biological Sciences

Stephen D. Hendrix
Diana G. Horton

Chemical and Biochemical Engineering

Gregory R. Carmichael
Charles O. Stanier

Chemistry

Vicki H. Grassian
Sarah C. Larsen
Mark Young

Civil & Environmental Engineering

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

Economics

Thomas F. Pogue
John L. Solow

Electron Spin Resonance Facility

Garry R. Buettner

Geography

Marc P. Armstrong
David Bennett
Naresh Kumar
Marc Linderman
George P. Malanson
Michael L. McNulty, Emeritus
R. Rajagopal
Gerard Rushton

Geoscience

Richard G. Baker, Emeritus
E. Arthur Bettis
Robert S. Carmichael
Jeffrey Dorale
Lon D. Drake, Emeritus
Mark K. Reagan
Holmes A. Semken, Jr.,
Emeritus
Frank H. Weirich
You-Kuan Zhang

English

Laura Rigal

History and Community & Behavioral Health

Paul R. Greenough

Law

Jonathan Carlson
Burns H. Weston

Mechanical & Industrial Engineering

Geb Thomas

Occupational & Environmental Health

William R. Field
Joel N. Kline
Peter S. Thorne

Physics & Astronomy

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

Physiology & Biophysics

G. Edgar Folk, Emeritus

Statistics & Actuarial Science

Dale L. Zimmerman

IOWA STATE UNIVERSITY

Agronomy

Raymond W. Arritt
Brian K. Hornbuckle

Ecology, Evolution, and Organismal Biology

Diane M. Debinski
John Nason
James W. Raich

Geological & Atmospheric Sciences

William J. Gutowski
Germán Mora
Eugene S. Takle

Natural Resource Ecology and Management

Jan Thompson

UNIVERSITY OF NORTHERN IOWA

Biology

Laura Jackson

Physical Geography

Dennis E. Dahms
Ramanathan Sugumaran

Cornell College - Geology

Rhawn Denniston

Hydrologic Research Center, San Diego, CA

Konstantine P. Georgakakos

Rice University - Civil & Environmental Engineering

Pedro Alvarez

University of Wyoming - College of Engineering

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