

2008 ANNUAL REPORT  
**CGRER**

THE CENTER FOR GLOBAL AND REGIONAL ENVIRONMENTAL RESEARCH





Photography courtesy of Carl Kurtz and illustrations courtesy of Mark Müller, republished with permission from the book *The Emerald Horizon: The History of Nature in Iowa* (Cornelia F. Mutel, 2008, Iowa City: The University of Iowa Press), research for which was initiated with CGRER support. Iowa's first comprehensive natural and environmental history, the book includes methods for reestablishing Iowa's native ecosystems and environmental integrity.

## Evacuate!

In June of 2008, Iowa City faced the worst flooding since the upstream Coralville Dam had been built in the 1950s. The Iowa River's rising waters forced CGRER to evacuate its riverside IATL offices. On June 11, as predictions of flooding worsened, CGRER staff and students started moving equipment to the UI's main engineering building, Seamans Center for the Engineering Arts and Sciences (SC). Because researchers were in the middle of a large atmospheric field experiment (ARCTAS, see page 19), every piece of computer equipment was essential, and all computers and accessories were moved—with only 3 hours of down time. Printers and other non-essential equipment were evacuated the following day. On June 13, the alarms sounded, IATL's doors were locked and chained, and all access to the building was prohibited. Over the next several days, flooding caused significant damage to research equipment and office space on the first floor. Fortunately all CGRER offices are on fourth floor, and thus they suffered no direct harm. Staff, students, office operations, and computer labs remained in temporary quarters at SC for the next 4 ½ months, returning to IATL after building cleanup operations were completed on October 24.



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# 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 74 members from 23 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

This past year has certainly been very challenging, yet rewarding. We entered 2008 with the goal of enhancing CGRER's outreach activities. As outlined throughout this Annual Report, CGRER members are involved in many forms of valuable outreach to the state and beyond. One example is co-director Jerry Schnoor's leadership in the governor's Climate Change Advisory Council. In 2008, we created a new staff position—Director of Outreach and Community Education—in order to increase CGRER's outreach efforts and promote the important environmental work being done by CGRER faculty and students. In November, Joe Bolkcom joined our staff, and we are pleased to have him on board. He brings with him an excellent understanding of environmental issues, as well as the skills and experience to communicate with key stakeholders and Iowans about our mission.

Our best examples of outreach and service were unplanned. They involved our members' responses to the June floods. CGRER and many of its members were greatly affected by the floods. We had to evacuate CGRER's administrative offices from IATL, just as many members and their students had to evacuate their offices and research laboratories across campus. Members with offices and labs in IATL could not reoccupy them until late October. Some research activities are still in recovery mode.

We would like to commend the faculty, staff, and students of the entire university and surrounding communities for their initiatives in preparing for the floods and the subsequent recovery in general, and specifically for their efforts to help accommodate displaced CGRER researchers and administrative offices.

The response of our members to the floods went above and beyond day-to-day challenges. For example, CGRER helped to host the visit of the Director of the National Science Foundation (NSF) a few short weeks after the floods peaked, and CGRER members moved immediately into research mode to capture as much information as possible about the floods for use in efforts to prevent future flood devastation. The many new NSF-funded Small Grants for Exploratory Research (SGRER) described in this report are just one example of the members' collective creative response. CGRER members are also playing leadership roles in the university, community, and state by helping to develop flood mitigation plans. This is exemplified by members who are involved with the governor's Rebuild Iowa task forces. CGRER is co-sponsoring a book on the science of the floods, written for a lay audience and non-scientists who will be influencing public policy. This educational-outreach tool will be published by the University of Iowa Press in 2009. Moving forward, CGRER is focusing its research skills on several large initiatives related to improving our ability to live with floods.



As discussed throughout this Annual Report, 2008 has been a very exciting and productive year. Looking forward into 2009, we intend to continue strengthening our efforts in outreach and research focused on helping Iowa deal with the many facets of environmental change and its ramifications.

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

## CGRER Executive Committee

**David Bennett**  
Geography, UI

**Jonathan Carlson**  
College of Law, UI

**Dennis Dahms**  
Physical Geography, UNI

**Jeff Dorale**  
Geoscience, UI

**Vicki Grassian**  
Chemistry, UI

**Paul Greenough**  
History and Behavior Science, UI

**Steve Hendrix**  
Biological Sciences, 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



“Whether it’s the science to slow global warming; the technology to protect our troops and confront bioterror and weapons of mass destruction; the research to find life-saving cures; or the innovations to remake our industries and create 21st-century jobs – today, more than ever before, science holds the key to our survival as a planet and our security and prosperity as a nation.”<sup>1</sup>

President Barack Obama



## message from the advisory board

Any eloquence I could summon to describe the Advisory Board’s hopes for the new year is overshadowed by the momentous events of the past twelve months and the enormous challenges the State of Iowa and our nation face. The last year has revealed the best and worst of our chosen way of life, from the continued onset of climate change and a financial collapse precipitated by innumerable excesses, to a vigorous political debate launched in Iowa and culminated in the historic election of a new president. Most striking for many of us was the damage wreaked by this summer’s flooding, laying bare the awesome power of nature against the best efforts of humanity, a scene perhaps reminiscent of the destructive

energies of the tsunami that bore down on Sri Lanka or the devastation of Hurricane Katrina.

To each of these occasions the researchers, staff, students, and stakeholders of CGRER have risen and contributed the best of their knowledge and experience. CGRER members are now leading numerous avenues of flood-related research in the hope of mitigating future occurrences and helping the region recover. The year featured some of the most notable academic work the Center has produced, with publications from co-director Greg Carmichael on the role that “black carbon” plays in global warming (*Nature Geoscience* 1: 221-227), and from Elliott Campbell (a former CGRER

graduate research assistant) and a handful of other CGRER affiliates on improving estimates of plant uptake of carbon dioxide (*Science* 322: 1085-1088).

Perhaps the most exciting development has been the efforts undertaken by CGRER to disseminate the fruits of research for public benefit. Led by co-director Jerry Schnoor’s service as chair of the Iowa Climate Change Advisory Council, and ably assisted by new and improved online and media resources, CGRER members have given presentations explaining the scientific basis for urgent action to deal with climate change, and have supported the burgeoning clean energy economy that is creating thousands of new jobs for Iowans. And now CGRER has hired a new outreach director,

Joe Bolkcom, to expand upon that base of experience.

Although at times the challenges facing our economy and planet may seem intractable, our creative capacity to research, understand, and overcome those obstacles is undiminished. With leaders at the state and federal level who are committed to advancing science and listening to the results of scientific progress, hopefully the daily work done by CGRER members can fully inform the decisions made in corporate boardrooms, the halls of the statehouse in Des Moines, and our nation’s capitol.

With Hope,  
**Mark Kresowik**  
National Corporate  
Accountability Representative  
Sierra Club’s Beyond Coal  
Campaign

## 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

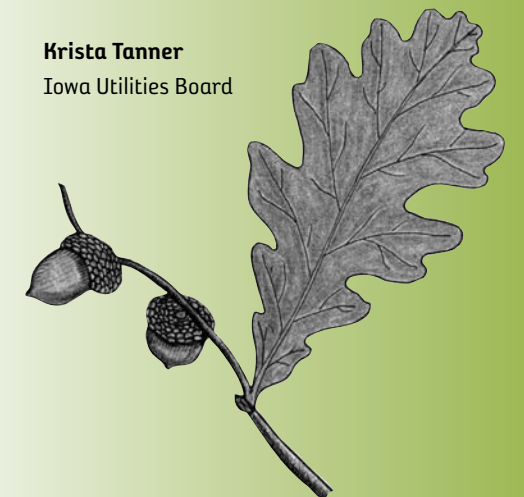
**Hiram “Chip” Levy II**  
Senior Research Scientist  
Geophysical Fluid Dynamics Laboratory, NOAA

**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



<sup>1</sup><http://www.youtube.com/watch?v=PMIXNrBxM0g>





## CGRER Promotes Interdisciplinary Dialogue to Address Iowa's Needs

Looking at flood recovery statewide, CGRER's **Larry Weber** and **Lou Licht** became members of the Governor's Rebuild Iowa: Floodplain Management and Hazard Mitigation Task Force, and **Gene Parkin** worked with its Agriculture and Environment Task Force.

**Jerry Schnoor** continues to chair the Iowa Climate Change Advisory Council. This council, formed by state legislation and appointed by Governor Culver in 2007, is charged with designing policies, strategies, and scenarios to reduce Iowa's greenhouse gas emissions. The council submitted a *Preliminary Report* in January and a *Final Report* in December 2008. These reports include goals, target years, and methods for reducing greenhouse gases in Iowa – a task that, Schnoor states, can be accomplished while boosting the state's economy. Schnoor will continue to chair the council for the next two years and explain options to stakeholders throughout the state.

Nationally, CGRER members **Greg Carmichael**, **Witold Krajewski**, and **Gene Takle** were three of 14 authors of a National Research Council report, *Observing Weather and Climate from the Ground Up: A*

*Nationwide Network of Networks* (published early 2009, The National Academies Press, Washington, DC). This report takes a comprehensive look at weather and weather-related observations across the nation, evaluating the country's current meteorologic observational capabilities and examining what will be necessary in coming years. Recommendations are made on how to develop future weather observation systems that will be important to multiple national needs such as water resources, food production, transportation, public health, and the like.

And internationally, **Greg Carmichael** used his expertise on atmospheric science when the United Nations Environment Programme appointed him to help prepare an "environmental report card" for the 2008 Olympic Games. China had included "green elements" for air quality, transportation, energy, water, and other aspects in its Olympic bid. Carmichael helped evaluate the effectiveness of these "green elements," and made recommendations on how to carry them forward both in China and in future Olympics.

In 2008, CGRER members may have worked more than ever before to spread their knowledge in meaningful ways. Their expertise influenced activities from local flood remediation to the Beijing Olympics.

CGRER's involvement with the summer's extreme flooding was a natural, since floodwaters filled many UI buildings and the home of CGRER itself. Member activities were summarized in the lead article of the Fall 2008 newsletter *IoWatch*. **Larry Weber** extended his efforts to the flood recovery stage by co-chairing the University of Iowa Flood Mitigation Task Force, a position that demanded many hours each week. This Task Force is examining and advising on all the issues dealing with UI recovery and rebuilding questions, and is evaluating steps that would reduce the university's future flood risks. CGRER members **George Malanson** and **Gene Parkin** are members of the Task Force.







## CGRER's 2008 Seminar Series

### Charles Driscoll

Civil & Environmental Engineering and Center for Environmental Systems Engineering;  
Syracuse University  
*Every Cloud has a Quicksilver Lining: Environmental Effects of Mercury Emissions*

### James Hansen

NASA Goddard Institute for Space Studies  
*The Threat to the Planet: How Can We Avoid Dangerous Human-Made Climate Change?*

### Stuart Harrad

School of Geography, Earth, and Environmental Sciences; University of Birmingham, UK  
*Household Dust Ingestion as a Pathway of Human Exposure to PCBs in Canada and the UK and Exploiting Chiral Signatures of PCBs for Atmospheric Source Apportionment*

### Nancy Langston

Gaylord Nelson Environmental Institute; University of Wisconsin  
*Where Land and Water Meet*

### Hiram "Chip" Levy III

Geophysical Fluid Dynamics Laboratory, NOAA; Princeton University  
*Impact of Air Pollution on our Future Climate*

### Connie Mutel

IHR-Hydroscience & Engineering; University of Iowa  
*The Evolving Emerald Horizon: Iowa's Changing Water Regime*

### Sergio de Souza-Machado

University of Maryland at Baltimore  
*Remote Sensing: Measuring Atmospheric & Geophysical Parameters from Space*

## Visiting Scientists

**Alessio D'Allura** visited CGRER from March 20-31 as part of a collaboration with his home firm, ARIANET, an environmental consulting company in Milan, Italy. While here, he helped set up a new forecasting system in support of the ARCTAS field experiment (see page 19).

**Tracey Holloway** (from the University of Wisconsin) and **Jerry Lin** (from Lamar University) visited CGRER on March 27-28 as part of the Model Intercomparison Study Asia, a longstanding effort focused on improving air-quality modeling capabilities in applications in Asia.

Former CGRER graduate research assistant **Marcelo Mena** visited in July to collaborate on a new NSF-funded international field experiment designed to better understand physical and chemical processes central to the climate system of the Southeast Pacific region. The VAMOS Ocean-Cloud-Atmosphere-Land Study Regional Experiment was conducted in Chile in October 2008.

## A Sampling of Additional CGRER-Member Publications

**Bettis, E.A.**, D.W. Benn, E.R. Hajic. 2008. "Landscape Evolution, Alluvial Architecture, Environmental History, and the Archaeological Record of the Upper Mississippi River Valley." *Geomorphology* 101: 362-377.

Campbell, J. E., J.C. Moen, R.A. Ney, and **J.L. Schnoor**. 2008. "Comparison of Regression Coefficient and GIS-based Methodologies for Regional Estimates of Forest Soil Carbon Stocks." *Environmental Pollution* 152(2): 267-273.

Campbell, J. E., **G.R. Carmichael**, T. Chai, ... **J.L. Schnoor**, **C.O. Stanier**, et al. 2008. "Photosynthetic Control of Atmospheric Carbonyl Sulfide During the Growing Season." *Science* 322: 1085-1088.

Curtis, D.B., B. Meland, M. Aycibin, N.P. Arnold, **V.H. Grassian**, **M.A. Young**, **P.D. Kleiber**. 2008. "A Laboratory Investigation of Light Scattering from Representative Components of Mineral Dust Aerosol at a Wavelength of 550 nm." *Journal of Geophysical Research Atmospheres* 113, D08210, doi:10.1029/2007JD009387.

Cwiertny, D.M., R.M. Handler, M.V. Schaefer, **V.H. Grassian**, **M.M. Scherer**. 2008. "Interpreting Nanoscale Size-Effects in Aggregated Fe-oxide Suspensions: Reaction of Fe(II) with Goethite." *Geochimica et Cosmochimica Acta* 72:1365-1380, doi:10.1016/j.gca.2007.12.018.

**Denniston, R.F.**, S.C. Penn, S.J. Carpenter, A.F. Budd. 2008. "Constraints on Late Miocene Shallow Marine Seasonality for the Central Caribbean using 818O and Sr/Ca Ratios in a Fossil Coral." In Nehm, R.H. and A. F. Budd (eds): *Evolutionary Stasis: Species and Communities through Geological Time*. New York: Springer, pp. 47-52.

**Denniston, R.F.**, Y. Asmerom, V. Polyak, et al. 2008. "Caribbean Chronostratigraphy Constrained with U-Pb and 87Sr/86Sr Analysis of a Miocene Coral." *Geology* 36: 151-154.

Dornbush, M., C. Cambardella, E. Ingham, **J. Raich**. 2008. "A Comparison of Soil Food Webs Beneath C3- and C4-Dominated Grasslands." *Biology and Fertility of Soils* 45:73-81; DOI 10.1007/s00374-008-0312-4.

**Field, R.W.** 2008. *Environmental Factors in Cancer*. President's Cancer Panel - White Paper, Charleston, South Carolina, 4 Dec 2008.

Hu, D., A. Martinez, **K.C. Hornbuckle**. 2008. "Discovery of Non-Aroclor PCB (3, 3'-dichlorobiphenyl) in Chicago Air." *Environmental Science & Technology* 42: 7873-7877. DOI: 10.1021/es801823r.

Hudson, P.K., E.R. Gibson, **M.A. Young**, **P.D. Kleiber**, **V.H. Grassian**. 2008. "Coupled Infrared Extinction and Size Distribution Measurements of Several Clay Components of Mineral Dust Aerosol." *Journal of Geophysical Research* 113, D01201, doi:10.1029/2007JD008791.

Larese-Casanova, P.L., **M.M. Scherer**. 2008. "Abiotic Reduction of Hexahydro-1,3,5-trinitro-1,3,5-triazine by Green Rusts." *Environmental Science & Technology* 42: 3975-3981.

**Malanson, G.P.** 2008. "Extinction Debt: Origins, Developments, and Applications of a Biogeographic Trope." *Progress in Physical Geography* 32: 277-291.

Muhs, D.R., **E.A. Bettis III**, J.N. Alienikoff, et al. 2008. "Origin and Paleoclimatic Significance of Late Quaternary Loess in Nebraska: Evidence from Stratigraphy, Chronology, Sedimentology and Geochemistry." *Geological Society of America Bulletin* 120:1378-1407.

Prather, K., C. Hatch, **V.H. Grassian**. 2008. "Analysis of Atmospheric Aerosols." *Annual Reviews of Analytical Chemistry* 1: 485-514.  
Ramanathan, V., **G. Carmichael**. 2008. "Global and Regional Climate Changes Due to Black Carbon." *Nature Geoscience* 1: 221-227.

**Rushton, G., M.P. Armstrong**, J. Gittler, B. Greene, C. Pavlik, M. West, and **D. Zimmerman** (editors). 2008. *Geocoding Health Data: The Use of Geographic Codes in Cancer Prevention and Control, Research and Practice*. Boca Raton, FL: CRC Press (Taylor & Francis), 256 pp.

**Schnoor, J.L.** 2008. "Lessons from the Flood." *Environmental Science & Technology* 42: 5379.

Yadav, V., **G.P. Malanson**. 2008. "Spatially Explicit Land Use Land Cover and Soil Organic Carbon Transformations in Southern Illinois." *Agriculture, Ecosystems & Environment* 123: 280-292.







# education

## CGRER Promotes Education to Address Iowa's Needs

CGRER members have had a banner year for educating others about their fields of knowledge. During and immediately after the summer flooding, some members coached the public on flood-related health hazards. As the floodwaters receded, others explained the flooding through public lectures. And within a few months, CGRER members were incorporating flood and other environmental hazard information and analysis into classroom lectures. These types of efforts, once again, are described in the Fall 2008 edition of *IoWatch*.

CGRER is taking a more enduring educational step by co-sponsoring (with IIHR-Hydroscience & Engineering) a book on the science of the floods for the lay public. The book, which was largely completed in 2008 and will be published in 2009, is edited by CGRER publications editor Connie Mutel and includes eight CGRER authors. Its 24 chapters cover topics from the hydrology of the 2008 floods to contributing factors, the floods' effects on a variety of entities (farmland, the economy, air quality, nature, etc.), and steps that might limit future exceptional floods.

Education strives to stretch minds. The Climate Legacy Initiative (CLI), a collaborative project of Vermont Law School and the UI's Center for Human Rights, does this by asking what moral and legal obligations we have to future generations in the context of climate change and other major environmental hazards. Its findings lead the CLI to call for a paradigm shift in the way law interacts with nature, and therefore to a proposed set of creative "out-of-



the-box" recommendations that are designed to enhance law's relation to nature in and for the future. CGRER's **Burns Weston**, **Jerry Schnoor**, and **Jonathan Carlson** are active CLI participants, with Weston serving as the CLI's Project Director and Senior Researcher. CLI's "white paper," *Recalibrating the Law of Humans with the Laws of Nature: Climate Change, Human Rights, and Intergenerational Justice*,<sup>1</sup> will serve as a major outreach document to stimulate discussion and action.

As a contribution to the CLI, CGRER co-sponsored a Climate Change & Human Rights Symposium held at the UI College of Law on February 15. Carlson, Schnoor, Carmichael, and Weston were speakers.

CGRER members educate the public about environmental change on a continuing basis. Examples include **Jerry Schnoor's** many 2008 public lectures on climate change issues and their mitigation and his webcast on future water availability; **Gene Takle's** multiple presentations on climate change and its implications in the Ames area; and **Jonathan Carlson's** lecture on Climate Justice at a UI law symposium.

<sup>1</sup> To be officially released in March 2009. An unedited pre-release version is available on the CLI's website at Vermont Law School (<http://www.vermontlaw.edu/x4128.xml>). All three CGRER participants were contributors.



## Travel Grants for Graduate Students

Grants are awarded to students traveling to professional conferences to make oral or poster presentations, whose advisors are CGRER members. A total of \$12,765 was awarded in 2008.

Name	Department	Conference Attended
Ozan Abaci	Civil & Environmental Engineering, UI	River Flow 2008 (International Conference on Fluvial Hydraulics), Turkey
Kirsten M.M. Beyer	Geography, UI	Assoc of American Geographers Annual Meeting
Dimitrios Dermisis	Civil & Environmental Engineering, UI	River Flow 2008 (International Conference on Fluvial Hydraulics), Turkey
Piotr Domaszczynski	Civil & Environmental Engineering, UI	World Environmental & Water Resources Congress 2008
Susanna M. Donaldson	Anthropology, UI	The Society for Applied Anthropology, 68 <sup>th</sup> Annual Meeting
Sherrie Elzey	Chemical & Biochemical Engineering, UI	American Association for Aerosol Research Conference
Cihan Erbas	Electrical & Computer Engineering, ISU	Microwave Radiometry and Remote Sensing of the Environment 2008 (Microrad '08) Meeting
Christopher Gorski	Civil & Environmental Engineering, UI	American Chemical Society National Meeting
Drew Latta	Civil & Environmental Engineering, UI	American Chemical Society National Meeting
Timothy Lauth	Civil & Environmental Engineering, UI	World Environmental & Water Resources Congress 2008
John V. Loperfido	Civil & Environmental Engineering, UI	American Geophysical Union Fall Meeting
Rachel Marek	Civil & Environmental Engineering, UI	51 <sup>st</sup> International Association for Great Lakes Research Conference
Andres Jose Martinez Araneda	Civil & Environmental Engineering, UI	51 <sup>st</sup> International Association for Great Lakes Research Conference
John Pettibone	Chemical & Biochemical Engineering, UI	AIChE Annual Meeting
Anton Petushkov	Chemistry, UI	Gordon Research Conference, Nanoporous Materials
Bong Chul Seo	Civil & Environmental Engineering, UI	American Geophysical Union Fall Meeting
Wenwu Tang	Geography, UI	Association of American Geographers Annual Meeting
Achilleas Tsakiris	Civil & Environmental Engineering, UI	River Flow 2008 (International Conference on Fluvial Hydraulics), Turkey
Mandapaka Venkata Pradeep	Civil & Environmental Engineering, UI	American Geophysical Union Fall Meeting
Gabriele Villarini	Civil & Environmental Engineering, UI	Third NASA/JAXA International Science Conference

In addition, \$5,963 was awarded to graduate students advised by CGRER members who were traveling to sites to complete field research for their thesis or dissertation.

Name	Department	Title of Project	Travel Destination
Kirsten Beyer	Geography, UI	Exploratory Spatial Data Analysis in Community Context: Integrating Geographic Information Science and Community Engagement for Colorectal Cancer Prevention and Control	Storm Lake, Iowa
Luke Juran	Geography, UI	Natural Disaster Response: 'Unnatural' Factors Affecting Response to the 2004 Tsunami in Nagapattinam District, Tamilnadu, India	Tamilnadu, India



## A Sampling of Additional CGRER-Member Educational Efforts

**Art Bettis** and B.K. Nations (editors) completed the seventh edition of *Introduction to Environmental Science Laboratory Manual* (Hayden McNeil), which is used in the UI's large "Introduction to Environmental Science" course. The manual's wide range of labs all focus on the Midwest and the UI.

**Jonathan Carlson** taught a course segment, "Global Climate Change and U.S. Business: Risks, Responsibilities, Opportunities," in the UI's Executive MBA program.

**Mike Chibnik** taught a new UI graduate seminar, "Ecological Anthropology,"

which examined individual and group responses in the past and present to environmental problems.

**Bill Field** was invited to testify before the President's Cancer Panel regarding environmental factors in cancer, where he explained his concerns about the increasing exposure to radon in family homes.

**Vicki Grassian** was an invited participant and speaker at two NSF workshops: "Environmental Nanoparticles: Science, Ethics and Policy," and "Reversing Global Warming: Chemical Recycling and Utilization of CO<sub>2</sub>."

**Paul Greenough** taught the course "History of Natural Disaster Response," where he examined vulnerability, relief, socio-ecological resilience, and other factors associated with historical disasters from ancient times to Hurricane Katrina in 2005. He also gave the keynote address, "Can There Be – Should There Be – A Comparative Study of Natural Disaster Responses?" at a Natural Disaster Response Agency conference in New Delhi.

**George Malanson** was science advisor to North Central Junior High's (North Liberty) first Lego League team, whose project on climate change and

flood impacts won first place in the regional all-around category competition. His graduate student Vineet Yadav completed his dissertation "Soil Carbon Dynamics in the Big Creek Basin in Southern Illinois, USA" (which assessed the effectiveness of different agricultural rotations in sequestering carbon), and is now a post-doctoral associate at the University of Michigan.

**Mark Young** taught the UI course "Environmental and Atmospheric Chemistry," which addressed climate change issues in multiple respects.





### ... And Additional Awards and Appointments

**Pedro Alvarez** received the Frontier in Research Award (from the Association of Environmental Engineering and Science Professors), and became a Fellow of the Leopold Leadership Foundation and the American Leadership Forum.

**Art Bettis** received the Geological Society of America, Archaeological Geology Division's 2008 Rip Rapp Archaeological Geology Award for outstanding contributions to the interdisciplinary field of geoarchaeology. He also was appointed to the U.S. National Academy's National Committee to the International Quaternary Association.

**Gary Buettner** became a Fellow of the American Association for the Advancement of Science (AAAS) for his contributions and leadership in free radical biology.

**Bill Field** was appointed for three years to the U.S. EPA Science Advisory Board. His students, Kainan Sun and Alicia Quella, were winners of the prestigious American Statistical Association's New Investigator Award.

**Vicki Grassian** received the Graduate College Outstanding Mentor Award. She also was appointed to the editorial boards of the journals *Energy and the Environment*, *Surface Science*, *Atmospheric Environment*, and *Aerosol Science and Technology*, and elected to the Executive Committee of the Physical Chemistry Division of the American Chemical Society. Her doctoral student and post-doctoral associate, Jonas Baltrusaitis, was awarded the Graduate Dean's Distinguished Dissertation Award in 2008.

**Craig Just** received the UI's 2008 President and Provost Award for Teaching Excellence, and became Coordinator of Sustainability Programs for the UI College of Engineering.

**Lou Licht's** firm, Ecolotree, Inc., won (with LBG Consultants) an American Consulting Engineering Council Environmental Grand Award for a poplar phytoremediation project now operating in St. Louis. They irrigated 2.9 million gallons of landfill leachate onto a six-acre ETCap planted by Ecolotree, thus preventing 600 semi-loads of water from being hauled to the local wastewater treatment plant.

**George Malanson** received the Sagarmatha Career Award from the Association of American Geographers, Mountain Geography Specialty Group.

**Mark Reagan** became a member of the UI's Sustainability Certificate Task Force.

**Michelle Scherer** was appointed Associate Editor of *Environmental Science and Technology (ES&T)*. Her student, Rob Handler, was selected to attend the American Chemical Society's Green Chemistry Summer School at the Colorado School of Mines in Golden, Colorado.



### CGRER Welcomes its First Director of Outreach and Community Education

If new knowledge is not spread to policy makers and the general public, it is not likely to lead to positive change. For this reason, CGRER is fortunate to welcome Joe Bolkcom, hired in November for half-time work, as Director of Outreach and Community Education. Joe will be encouraging educational efforts about environmental change in Iowa, as well as spreading the word about the discoveries and accomplishments of CGRER's

members and their students. His presence is expected to significantly increase CGRER's outreach to the lay public and to Iowa's decision makers. As an Iowa State Senator and leader for environmental issues, Joe brings considerable expertise, vision, and skill in communication to his new position.







# research



## CGRER Fosters Global Change Research to Address Iowa's Needs

CGRER members continue to research subjects of importance to the future of Iowa and areas beyond. Within months of the 2008 flooding, CGRER members had received eight National Science Foundation (NSF) grants to study this event and develop information to help prevent future flood devastation (see “SGER” grants, page 21). These and other of CGRER’s flood-related grants and research are discussed in the Fall 2008 *IoWatch*.

Approaching water from another vantage, **Jerry Schnoor, Dave Bennett, Marian Muste,** and colleagues received nearly a million dollars from NSF for a three-year water-related research project (see page 21). This project will feed into the national need for comprehensive water information by working on an “intelligent digital watershed” – a computer-based monitoring, analysis, and modeling system that presents comprehensive water data to the broader public, decision-makers, and administrators. The goal is to translate a picture of water’s flow at a given point, and through time, into computer models that

can be readily used by farmers, city administrators, natural resource managers, and anyone else making water-related management decisions. The project will address questions of water pollution as well as water location and flow.

Tied more closely to Iowa’s immediate future, **Charles Stanier, Greg Carmichael,** Morgan Brown (a CGRER-sponsored research assistant), and colleagues have been studying in detail the monitoring data for particulate matter in Iowa’s air, and determining which sources of these pollutants could be most effectively controlled. This effort addresses a very real problem: because of human health concerns, the Environmental Protection Agency (EPA) has tightened the standards for atmospheric particulate matter, and several regions of eastern Iowa are now non-compliant or close to being so. This research will help such regions address the problem and avoid the more onerous requirements for new and existing air pollution sources than otherwise would be applied.

Looking further abroad, **Greg Carmichael** and a number of CGRER research associates spent four months

(April through July) assisting with the large ARCTAS project, NASA’s contribution to the International Polar Year. As with other recent multifaceted atmospheric field-research efforts, CGRER provided real-time forecasts of the movement of air pollutants that were then used by aircraft that followed and sampled the pollutant plumes. ARCTAS is attempting to determine the source of the pollution haze that builds over the Arctic in winter, where it deposits ice-melting black carbon – does it originate in Europe, Asia, or elsewhere? And how do the large wildfires burning in Canada and Asia, themselves the product of a hotter, drier climate, contribute to the rapid melting of the Arctic ice? In 2009, CGRER will be assisting with analysis of the ARCTAS field data. In Fall, 2008, Carmichael’s group also participated in a large NSF field project called VOCALS, conducted off the coast of Chile and Peru.

Many research efforts of CGRER members have received substantial press. Examples include the finding of unexpectedly high levels of certain PCBs (polychlorinated biphenyls) remaining in Chicago air samples decades





after the manufacture of these highly toxic chemicals was banned (see Hu et al, page 11); the discovery that soot from cooking fires and diesel engines – which is both an air pollutant and a global warming agent – has an atmospheric warming effect three to four times greater than previously estimated (see Ramanathan and Carmichael, page 11); and the new knowledge that carbonyl sulphide (COS), taken up by plants during photosynthesis, can help track the parallel uptake of CO<sub>2</sub>, and thus studies of COS can improve estimates of global photosynthetic activity and add precision to climate models (see Campbell et al, page 11). Lead author Elliott Campbell performed this research while he was a CGRER graduate research assistant under the mentorship of Stanier, Schnoor, and Carmichael.

And finally, some CGRER members continue to study the past to expand our knowledge base and better understand the future. **Rhawn Denniston** and colleagues published two papers on the effects on ocean temperature and species diversity during the closure of the Central American Seaway 3 million years ago (see page 11), and have dated and analyzed a stalagmite from northern Australia in order to examine the combined influences of the El Nino/Southern Oscillation (ENSO) and solar output on the Holocene Australian Summer Monsoon. And in August, CGRER members **Russ Ciochon** and **Art Bettis** began stratigraphic studies in Central Java, Indonesia, on what are reported to

be the youngest *Homo erectus* fossils in the world (ca. 20,000 – 50,000 years old). Detailed information on these fossils has never been firmly established. Last year's field work recovered fossils, now being dated, from demonstrated stratigraphic context.

### Aids to Researchers and the UI Community

CGRER continued to offer state-of-the-art computing and visualization resources to members and their students. In 2008, CGRER increased processing capabilities by obtaining high-end multi-core servers. These high performance machines, with up to 32 processors per machine, combine with large system memory to allow for the visualization of complex data sets. Our latest addition incorporates 256GB of RAM for in-depth visualizations of various models. The servers have played a key role in modeling and forecasting the movement of air pollutants, efforts crucial to CGRER's large atmospheric field experiments. These servers are able to house several ongoing research projects. CGRER's focus for 2009 will be obtaining a large data storage unit to meet the ever-growing needs of CGRER's high-end computing. 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.



*A Molecular Microbiological Search for Active Biphenyl Dioxygenases in Polychlorinated Biphenyl-Contaminated Sediments.* 2008-2009. Center for Health Effects of Environmental Contamination. \$30,000. **Tim Mattes** and **Keri Hornbuckle.**

*Cancer Maps website.* 2008. Iowa Department of Public. \$10,260. **Gerard Rushton.**

*CAREER: Strengthening the Predictive Ability for New Particle Formation: A Combined Field, Data Analysis, and Modeling Approach.* 2008-2013. NSF. \$151,000. **Charles Stanier.**

## A Sampling of CGRER-Member New Research Grants

*Collaborative Research: A 210Pb paradox?* 2008-2009. NSF. \$117,090. **Mark Reagan.**  
*Collaborative Research: Refinement of Techniques for Estimating Evapotranspiration from Narrow Riparian Zones – Water Balance and Atmospheric Measurements.* 2008-2011. NSF. \$614,165. **Bill Eichinger,** Anton Kruger.

*Collaborative Research: VOCALS—Climate Simulation and Operational Forecasting Using a Regional Earth System Modeling Framework.* 2008-2011. NSF. \$250,025. **Greg Carmichael** with colleagues at the University of California Los Angeles.

*Design and Testing of a Point of Use Electrolytic Chlorine Generator for Drinking Water Disinfection in Poor Countries.* 2008-2010. EPA P3 Student Sustainability Competition. \$75,000. **Craig Just** and engineering students.

*Dynamic Updating of Emissions by Systematic Integration of Bottom-up Activities and Satellite-Based Top-Down Constraints to Support Air Quality Forecasting and Analysis.* 2008-2011. NASA. \$310,536. **Greg Carmichael.**

*Northern Annular Mode (NAM) Variability during the Little Ice Age and Medieval Warm Period in a Cave Ice Core Record from Northwestern Romania.* 2008-2010. NSF. \$132,694. **Jeff Dorale.**

*SGER: Anatomy of the 2008 Iowa Flood: Exploring the Interplay Between Successive Storms and Basin Drainage Topology.* 2008-2009. NSF. \$52,514. **Witold Krajewski** and Ricardo Mantilla.

*SGER: Contribution of the 2008 Midwestern Flood to Gulf Hypoxia.* 2008-2009. NSF. \$99,343. **Jerald Schnoor,** **Craig Just,** and colleagues.

*SGER: Determining the Effects of Severe Flooding of Residential Areas on the Educational Development of Public School Students who Live in Such Areas.* 2008-2009. NSF. \$62,879. **Gerard Rushton** and colleagues.

*SGER: Evaluation of the Rating Curve Hysteresis Due to Unsteady Channel Flows Using Non-Intrusive Measurements Acquired During the Iowa 2008 Flood.* 2008-2009. NSF. \$56,869. **Marian Muste.**

*SGER: The Impact of Extreme Flooding on Mussel and Microbial Nutrient Dynamics at the Water-Sediment Interface.* 2008-2009. NSF. \$75,613. **Craig Just, Gene Parkin,** and colleagues.

*SGER: Theoretical Design of a Flood Warning System for Eastern Iowa.* 2008-2009. NSF. \$69,471. **Witold Krajewski** and Ricardo Mantilla.

*SGER: Transport of Sediments and Pollutants into the Terrestrial Regions of a Small Urban-Industrial City: The June 2008 Flood of Cedar Rapids, Iowa.* 2008-2009. NSF. \$99,000. **Keri Hornbuckle,** **Thanos Papanicolaou.**

*SGER: Understanding Spatiotemporal Dynamics of Community Response to Natural Disaster.* 2008-2009. NSF. \$44,484. Kathleen Stewart and **David Bennett.**

*Understanding Water-Human Dynamics with Intelligent Digital Watersheds.* 2008-2011. NSF. \$899,391. **Jerald Schnoor,** **Marian Muste, David Bennett,** and colleagues.

*US-Spain Planning Visit: Collaborative Research on Sea-Level Changes Recorded in Coastal Caves of Mallorca.* 2008-2010. NSF. \$9,394. **Jeff Dorale.**



## Seed Grants Awarded by CGRER

In 2008, CGRER awarded a total of \$143,873 in seed grants to five projects.

PRINCIPLE INVESTIGATORS	PROJECT TITLE	AMOUNT AWARDED
William Eichinger, Witold Krajewski, and Thanos Papanicolaou; Civil & Environmental Engineering, UI	Development of Prototype Instrumentation for Ultra-High Resolution Measurement of Land Surface Relief	\$30,000
Kristie J. Franz; Geological and Atmospheric Sciences, ISU	Climate Change Impacts on Cold Season Hydrologic Processes and Spring Soil Moisture Recharge in the Upper Midwest	\$27,073
Sarah Larsen; Chemistry, UI	Tailoring the Surface Properties of Nanocrystalline Zeolites for Environmental Applications: Insights from DFT Calculations	\$30,000
Thanos Papanicolaou and Jerry Schnoor; Civil & Environmental Engineering, UI	Observations on the Movement of Bedload Using Motion-Sensing Radio Transmitters	\$26,800
Charles O. Stanier; Chemical and Biochemical Engineering, UI	Discovering the Vertical Dimension of Atmospheric New Particle Formation: Aircraft Profiling Proof of Concept	\$30,000

In addition, CGRER awarded \$5,000 to the Iowa Valley Resource Conservation & Development in Amana, Iowa, to fund a summer intern who completed a survey of native roadside remnant plants and communities, in preparation for preparing a roadside tour of these prairie natives.





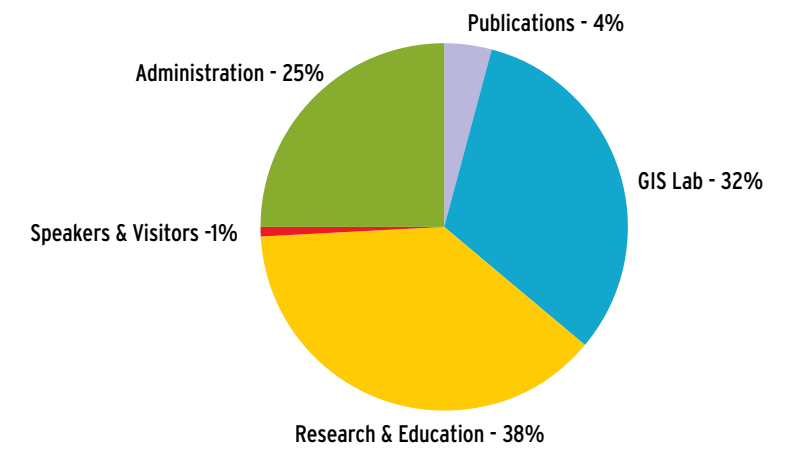
# GENERAL information

## Budget

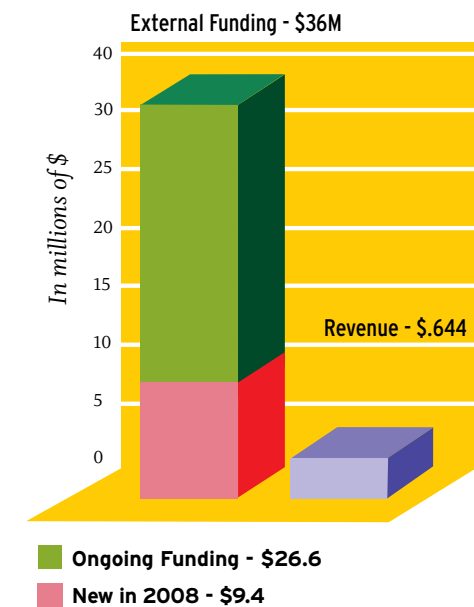
In fiscal year 2008 (July 1, 2007-June 30, 2008), 75 percent of CGRER's \$644,427 of revenue was spent on research, education, and outreach directed toward global change issues (Figure 1). The remaining 25 percent of the budget was dedicated to administration.

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 2008 CGRER members, working through their respective departments, were performing research that brought in a total of \$36 million in external funds. Of this amount, \$9.4 million was new funding that was initiated in 2008, while the remaining \$26.6 million came from ongoing projects.

**Figure 1 CGRER's Expenses**



**Figure 2 Leveraging of CGRER's Income**





## 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 thirteen members (see list, page 5) 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 (see list, page 7) 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

#### BIOLOGICAL SCIENCES

Stephen D. Hendrix  
Diana G. Horton

#### CHEMICAL AND BIOCHEMICAL ENGINEERING

Gregory R. Carmichael  
Charles O. Stanier

#### CHEMISTRY

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Mark Young

#### CIVIL & ENVIRONMENTAL ENGINEERING

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William E. Eichinger  
Keri C. Hornbuckle  
Craig L. Just  
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Jerald L. Schnoor  
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Larry Weber

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John L. Solow

#### ELECTRON SPIN RESONANCE FACILITY

Garry R. Buettner

#### ENGLISH

Laura Rigal

#### GEOGRAPHY

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

#### GEOSCIENCE

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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

#### 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

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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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