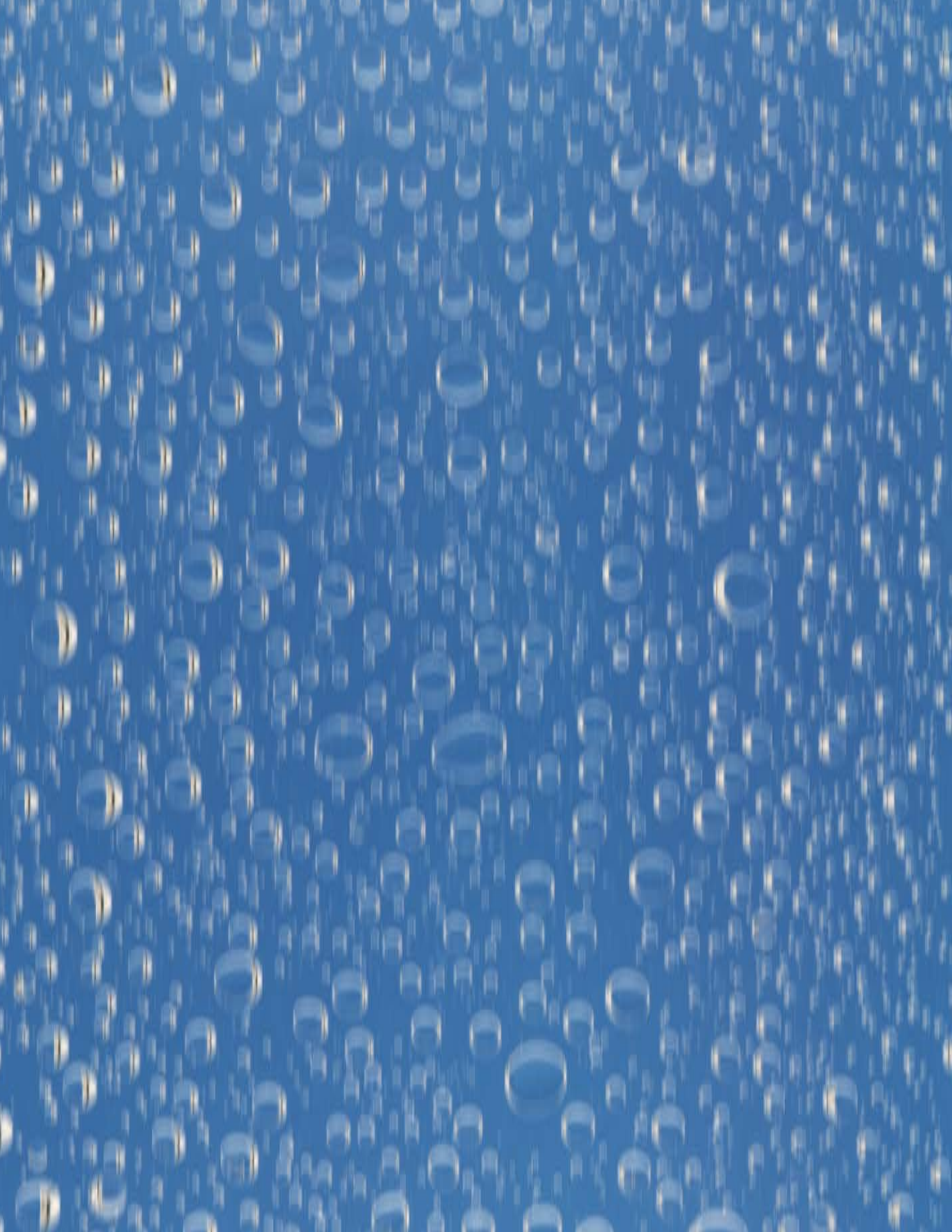


# CCGRER

THE CENTER FOR GLOBAL AND REGIONAL ENVIRONMENTAL RESEARCH

2006 ANNUAL REPORT





# Contents



Introduction	3
Executive Summary	4
CGRER Executive Committee	5
Message from the Advisory Board	6
CGRER Advisory Board Members	7
Dialogue	9
Education	15
Research	21
General Information	27
CGRER Members	28





# CGRER

The Center for Global and Regional Environmental Research

**T**he 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 70 members from 25 departments at six 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

**C**GRER enters 2007 energized by the opportunities and challenges facing the university, the state, the nation, and the world — opportunities and challenges that are tied to the coupled issues of energy and climate change. A convergence of forces at both the national and state level is renewing interest in energy. This interest has been bolstered by the findings of the International Panel on Climate Change (IPCC) 4<sup>th</sup> Assessment, *Climate Change 2007: The Physical Science Basis* (released February 2007), which concluded for the first time that global warming is “unequivocal” and that human activity is the main driver, “very likely” causing most of the rise in temperatures since 1950. This report emphasizes the urgency in developing renewable energy supplies. Iowa has the opportunity to lead the renewable energy revolution, and in the process to make our state cleaner and more prosperous. However, turning this excitement about energy into a sustainable reality will require

strategic action and considerable effort. CGRER has an important role to play in fueling Iowa’s future. Indeed, we were established to provide expertise in the complex issues surrounding global warming.

The growth in demand for one renewable energy source, ethanol, has raised a vision of an economic boom for Iowa. Quoting from the December 31, 2006, *Des Moines Register* staff editorial, “Now, as the focus in energy begins to shift from oil to renewable alternatives, Iowa can become the Texas of renewable fuels. Instead of oil fields, Iowans have an unrivaled ability to grow the crops from which renewable fuels are made. Iowa also has an abundance of another renewable energy, wind. All that’s needed to complete the Texas-like transformation of Iowa is the expertise. Iowa must establish itself as THE place the world comes to buy know-how on renewable fuels.”

While biofuels offer an attractive alternative to oil-based energy sources, meeting Iowa’s energy vision will require looking beyond simply producing more ethanol. It will demand increased efforts in energy conservation; use of other renewable

energy sources and sustainable practices; and ensuring a workforce with the appreciation and skill sets needed for managing our energy-related infrastructure. Iowa has established initiatives upon which we can build: we are currently first in the nation in ethanol production and third in wind energy, and major cities including Des Moines and Cedar Rapids are promoting green city initiatives. By expanding upon such initiatives, Iowa can establish itself as a national leader.

CGRER can help Iowa enhance its leadership role by continuing to perform appropriate research, for example on the sustainability of biofuels. The production of these fuels has profound implications for water and other natural resources. It takes six gallons of water to produce one gallon of ethanol; already groundwater tables surrounding some ethanol plants have shown significant drawdown. In addition, the projected increase in corn production implies the conversion of marginal set-aside lands to cropland. The plowing of Iowa’s CRP and other conservation lands could have

profound impacts on Iowa's wildlife and native plant communities. The removal of cropland biomass for ethanol production could decrease soil quality and increase erosion. Increasing biofuel rowcrops implies increased fertilizer and pesticide use. The effects of these changes on sediment transport, water pollution, and other features of our landscape need to be carefully evaluated.

One more question of significance involves the greenhouse gas emissions associated with biofuels. There are many ways of growing biomass for biofuels, each with its own signature potential to decrease net carbon emissions. Furthermore, renewable fuels increase in economic value if the fuels' lower carbon emissions are financially rewarded, for example through a carbon tax or through cap-and-trade policies. Evaluation of greenhouse gas emissions, carbon markets, climate change, environmental impact analysis, and sustainability are all active areas of CGRER's research program.

In addition to continuing with energy-related research, CGRER is helping to educate students to work

in renewable and sustainable energy. And CGRER is working to infuse the UI's curriculum with information on these topics.

Seeing Iowa as a leader in renewable energy, a place where sustainable energy practices are embraced and practiced, projects a bright and progressive future for our home state. This exciting vision also applies to the University of Iowa. At CGRER, we see increasing numbers of students who want to make a difference and move our nation toward a sustainable future. CGRER, through the breadth of its activities as highlighted in this annual report, is eager to help them do so.

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



## Message from the Advisory Board

**M**y Wish for the New Year:  
I write this as the New Year begins and with it, the hope for new beginnings. This is the time of year for reflection, self-evaluation, and planning for the future. It is an exciting time because each January, the future is centered on hope and optimism that we can improve ourselves and make the world a better place to live.

So, here is my wish: Iowans will provide the leadership America needs to address global warming. This opportunity will come to us as Iowa once again hosts the start of the presidential selection process, and candidates visit our state to campaign for the 2008 Iowa caucuses. During this process, we Iowans have a unique opportunity to shape our national policy debate, in particular regarding appropriate policies to protect our planet. CGRER can and should be instrumental in enhancing the level of discussion within Iowa on critical climate-change issues.

Because you are reading CGRER's Annual Report, you are likely beyond the question, "Is global climate change real and a problem we must address?"

I am also assuming that like me, you are frustrated with the seemingly endless cycle of trying to convince the rest of society, and our political leaders in particular, that global warming is real and that now is the time to take action.

As you know, the Iowa caucuses are a true example of democracy in action. Candidates who come to Iowa cannot rely solely on the media to win. They must get their hands dirty and visit small towns and large cities; living room coffees and union halls; main street diners and Rotary Clubs. At each of these locations, Iowans ask questions and demand answers. Iowa is the state where candidates learn what is troubling Americans and what policy decisions will win votes.

Our first job is to continue to educate Iowans on environmental and climate issues. In Iowa, we rely upon CGRER for leadership that moves the ball forward in this effort. CGRER's research and public educational efforts are important tools for encouraging an informed public that will clamor for policy change regarding climate change issues. The dialogue preceding the Iowa caucuses will provide fertile ground for explicit climate policy to be debated and developed, especially in the area of substantial and sustained emissions reductions.



Our second task will be to get out the vote, so to speak. We need to encourage Iowans to educate themselves about environmental issues, to participate in thoughtful policy discussion with candidates, and to provide reasonable solutions.

I am not advocating that CGRER should change its mission or play any part in politics directly. Instead, CGRER should continue efforts such as helping organize the very successful Energy Expo held at the University of Iowa this past fall. Continued leadership of such events will be pivotal in fostering necessary public policy discussions.

The year 2007 will be important for debate of national climate policy matters. My New Year's wish is that you engage yourself in the discussion and encourage others to do the same.

John Norris  
Chair, Iowa Utilities Board

### **CGRER Advisory Board Members**

John Norris  
Iowa Utilities Board

Robert Dvorsky  
Iowa Senate

Steven Guyer  
MidAmerican Energy Holdings Company

Jim Klosterbuer  
Alliant Energy

David Osterberg  
UI, Occupational and Environmental Health

Sharon Tahtinen  
Iowa Department of Natural Resources



*CGRER awardee Andria Timmer received a grant for field research on educational reforms among the Roma, a marginalized minority group in Hungary (see page 18).*



# dialogue

## CGRER promotes interdisciplinary dialogue to address Iowa's needs

### **Iowa's Energy Use**

For about the past five years, CGRER and its members have been encouraging the University of Iowa to promote energy efficiency and reduce greenhouse gas emissions. A number of resulting initiatives are now accepted as the norm — for example the co-burning of biofuels (waste oat hulls) by the university's power plant.

The year 2006 was a banner year for ongoing campus energy-saving efforts. CGRER members and students have remained prominent in promoting this goal. Jerry Schnoor chairs the UI's Energy Council Advisory Committee, with Greg Carmichael and CGRER graduate research assistants Marcelo Mena and Elliott Campbell also being members. Through this committee's efforts, the university in 2006 accepted a new challenge: to reduce its energy consumption by 10 percent by year 2013 and utilize 15 percent renewable energy by that date. CGRER is looking forward to working closely with the university to meet these new energy conservation goals. The push toward renewable energy may (among other things) involve a university-owned wind turbine, a possibility that CGRER research assistant Chris Mutel analyzed in his 2006 M.S. thesis.



Students continue to be active in these efforts, as was obvious during two on-campus events held in September. Energy-Expo, held for the second time in 2006, showcased UI energy efforts and created a forum for public education. This year the day-long event engaged the entire campus and community, with educational booths placed prominently throughout the downtown area (see photo). The following three days, several hundred students from across the country traveled to Iowa City to attend the national Engineers for a Sustainable World Annual Meeting, hosted by the UI. CGRER students were instrumental in forming the first local ESW chapter in 2004, and CGRER (through donating the organizational services of its administrator Jane Frank) contributed significantly to planning this meeting. CGRER also hosted one of the primary speakers, John Mutter from Columbia University, who lectured on how extreme climatic events and other natural disasters disproportionately affect poorer people and nations.

Through promoting these types of activities, CGRER reaches beyond climate-change research to touch our community and our daily lives, and provides hands-on education that empowers UI students to do the same.



*Energy Expo showcased UI energy efforts.*



*Mississippi River Symposium participants.*

### **Legislative Briefing on Biofuels**

In January, Iowa's three Regents institutions collectively presented an invited half-day briefing on biofuels to the state legislature. Greg Carmichael chaired the UI's delegation, which included CGRER members Keri Hornbuckle, Jerry Schnoor, Peter Thorne, and Advisory Board member David Osterberg. Carmichael also presented the summary statement that commenced the briefing. Participants worked hard to prepare coherent, balanced statements that were educational and scientifically accurate rather than prescriptive or biased.

Topics discussed were ethanol production, biofuel economics and policy, and feasibility issues, with about a third of the briefing covering sustainability issues.

### **Mississippi River Symposium**

CGRER members helped plan and execute a Mississippi River Symposium, a three-day event that broadly examined human society and nature as touched by the Mississippi River. The October symposium, organized through the UI Office of the Vice President for Research and the UI International Writing Program, provoked a broad exchange of views about water and human affairs. Invited participants included sixteen scientists, writers, scholars, and policymakers (see photo), including CGRER's Greg Carmichael, Paul Greenough, and Jerry Schnoor (all three of whom also served on the symposium's planning committee), and Connie Mutel. The symposium was intended to "give a voice to the Mississippi," most prominently through creating a book of essays (now in preparation) written by symposium attendees. The book will demonstrate the participants' common concerns about restoring the Mississippi's health, while showcasing their multidimensional approaches to the subject.

## Visiting Scientists

CGRER hosted six visitors in 2006, all of whom came to work in some capacity with its atmospheric research group.

**Alessio D'Allura** (ARINET, Milano, Italy) spent most of the year (1/29 to 12/31) at CGRER working on various studies. He participated with the CGRER team in the Mexico City and East Pacific large-scale atmospheric field experiments (see page 22). He also applied new techniques to assimilation of satellite data to constrain three-dimensional aerosol distributions, which he then used to assess the impact of aerosols on climate change.

**Giuseppe Calori** (ARINET, Milano, Italy) visited from 11/18 to 11/23 as part of a partnership between CGRER and his company ARINET, which focuses on the development of a modern air quality modeling system to support research and air quality management. His system is currently being used in several studies in Europe.

**Sarath Guttikunda** (World Bank, Washington D.C.) visited from 11/7 to 11/22 to conduct joint research on the use of regional models to help determine source receptor relationships, in particular as they apply to aerosol composition in Asia.

**Ken Rahn** (University of Rhode Island) came to Iowa City in February and October as part of a collaborative program between Chinese institutes and CGRER. The program is focused on the regional transport of aerosols (such as windblown dust) on Beijing's local air quality.

**Chul Han Song** (Gwangju Institute of Science & Technology, Gwangju, Korea) spent a few days at CGRER in September in order to establish research collaborations related to the long-range transport of aerosols in East Asia.

**Narisara Thongboonchoo** (King Mongkut's Institute of Technology, Bangkok, Thailand) visited from 2/28 through 3/3 to develop collaborative research examining the impacts of biomass burning in Southeast Asia on local and regional air quality and climate.





# CGRER 2006 Seminar Series

SPEAKER	AFFILIATION	TITLE
Andrew Foster	Department of Economics, Brown University	Inequality and the Sustainability of Agricultural Productivity Growth: Groundwater and the Green Revolution in Rural India
Anamakonda Jagadeesh	Centre for Energy & Sustainable Resources, R.M.K. Engineering College, India	Safe Drinking Water for All; Innovative Sustainable Technologies
Hector Jorquera	Universidad Catolica de Chile	Source Apportionment of PM10 and PM2.5 in Tocopilla, Northern Chile
A.P. Mitra	National Physical Laboratory, New Delhi, India	New Initiatives Linking Climate and Air Quality in India
John Mutter	Earth Institute, Columbia University	Natural Disasters and Human Development: From Sri Lanka to New Orleans and Back
Ken Rahn	Center for Atmospheric Chemistry Studies, University of Rhode Island	Sawtooth Cycles of Aerosol in Beijing and Local vs. Distant Sources
Sophie Vanwambeke	University of Louvain, Louvain-la-Neuve, Belgium	Land-Use Change and Dengue Fever in Rural Areas of Northern Thailand



## A Sampling of CGRER-Member Publications

Debinski, D.M., R.E. VanNimwegen, M. E. Jakubauskas. 2006. "Quantifying Relationships Between Bird and Butterfly Community Shifts and Environmental Change." *Ecological Applications* 16: 380-393.

Dornbush, M.E., J.W. Raich. 2006. "Soil Temperature, Not Aboveground Plant Productivity, Best Predicts Intra-annual Variations of Soil Respiration in Central Iowa Grasslands." *Ecosystems* 9: 909-920.

Field, R.W., et al. 2006. "An Overview of the North American Case-Control Studies of Residential Radon and Lung Cancer." *Journal of Toxicology and Environmental Health* 69: 599-631. (Also coauthor of other portions of this major report, published in the same journal.)

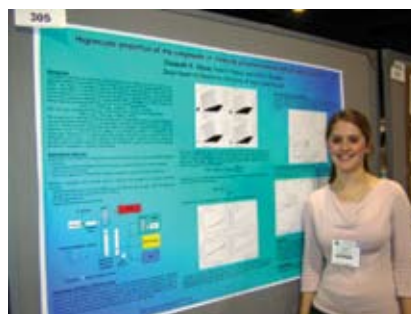
Folk, G.E., D.L. Thrift, et al. 2006. "Mammalian Activity-Rest Rhythms in Arctic Continuous Daylight." *BioRhythm Research* 37: 455-469.

Gibson E.R., P.K. Hudson, V.H. Grassian. 2006. "Aerosol Chemistry and Climate: Laboratory Studies of the Carbonate Component of Mineral Dust and its Reaction Products." *Geophysical Research Letters* 33: L13811.

Gooding, M.P., T.J. Newton, M.R. Bartsch, K.C. Hornbuckle. 2006. "Toxicity of Synthetic Musk to Early Life Stages of the Freshwater Mussel *Lampsilis cardium*." *Archives of Environmental Contamination and Toxicology* 51: 549-558.

Hegde, S.G., J.D. Nason, J. Clegg, N.C. Ellstrand. 2006. "The Evolution of California's Wild Radish has Resulted in the Extinction of its Progenitors." *Evolution* 60: 1187-1197.

Hornbuckle, B.K., A.W. England, M.C. Anderson, and B.J. Viner. 2006. "The Effect of Free Water in a Maize Canopy on Microwave Emission at 1.4~GHz." *Agricultural and Forest Meteorology* 138: 180-191.



CGRER awardee Elizabeth Gibson at American Chemical Society meeting (see page 17).

Gibson, E.R., P.K. Hudson, V.H. Grassian. 2006. "Physicochemical Properties of Nitrate Aerosols: Implications for the Atmosphere." *Journal of Physical Chemistry A* 110: 11785-11799. (Invited Feature Article and Cover Art).

Krajewski, W.F., M.C. Anderson, W.E. Eichinger, D. Entekhabi, B.K. Hornbuckle, et al. 2006. "A Remote Sensing Observatory for Hydrologic Sciences: A Genesis for Scaling to Continental Hydrology." *Water Resources Research* 42: W07301.

Mogili, P.K., P.D. Kleiber, M.A. Young, V.H. Grassian. "N<sub>2</sub>O<sub>5</sub> Hydrolysis on the Components of Mineral Dust

and Sea Salt Aerosol: Comparison Study in an Environmental Aerosol Reaction Chamber." *Atmospheric Environment* 40: 7401-7408.

Peck, A.M., E. Linebaugh, K.C. Hornbuckle. 2006. "Synthetic Musk Fragrances in Lake Erie and Lake Ontario Sediment Cores." *Environmental Science and Technology* 40: 5629-5635.

Raich, J.W., A.E. Russell, et al. 2006. "Temperature Influences Carbon Accumulation in Moist Tropical Forests." *Ecology* 87:76-87.

Stireman, J.O., J.D. Nason, S.B. Heard, J.M. Seehawer. 2006. "Cascading Host Associated Genetic Differentiation in Parasitoids of Phytophagous Insects." *Proceedings of the Royal Society of London, Series B* 273: 523-530.

Streets D.G., C. Yu, M.H. Bergin, X. Wang, G.R. Carmichael. 2006. "Modeling Study of Air Pollution Due to the Manufacture of Export Goods in China's Pearl River Delta." *Environmental Science and Technology* 40: 2099-2107.

Weldon, M.B., K.C. Hornbuckle. 2006. "Concentrated Animal Feeding Operations, Row Crops and their Relationship to Nitrate in Eastern Iowa Rivers." *Environmental Science and Technology* 40: 3168-3173.

Zimmerman, D. L. 2006. "Optimal Network Design for Spatial Prediction, Covariance Parameter Estimation, and Empirical Prediction." *Environmetrics* 17: 635-652.



# education

## CGRER promotes education to address Iowa's needs

### **CGRER Internships**

In the summer of 2006, CGRER funded two student internships. Raymond Rinkol, in his third year at the UI's College of Law, worked with CGRER Advisory Board chair Steve Guyer and with Jerry Schnoor. Ray applied his legal prowess to researching and producing reports on two topics: MidAmerican Energy's climate change strategy, and the legal and financial aspects of the UI's possible installation of a wind turbine. Ray states that he found the internship inspirational as well as educational, encompassing climate change topics that he hopes to explore in a future private practice.

Collin Haffey, a UI undergraduate in Environmental Sciences, worked with the Johnson County Secondary Roads Department and Iowa Geological Survey. Collin received training in botanical field techniques, global positioning system (GPS) data collection and entry, and use of geographical information system (GIS) software for map-making. He applied these techniques to prairie and wetland remnants along county-maintained roads, gathering data that will assist in the management and preservation of these roadside remnants of native plant communities.

In the coming year, CGRER hopes to establish additional internships for students in journalism and creative writing, believing that by doing so, student interns will receive solid education in scientific topics, even as they extend CGRER's goals through their analyses and writings.



### **Training Programs and Outreach in Air Quality Forecasting**

Greg Carmichael participated in two international training programs in 2006, both focused on air quality forecasting. He helped organize and deliver a five-day basic training course for meteorologists and atmospheric scientists. This World Meteorological Organization (WMO) course was held in Lima, Peru, in July. He also helped deliver a five-day course for experts, which dealt with use of numerical models and satellites. This was held in San Paulo, Brazil, in January.

CGRER graduate research assistant Marcelo Mena, who participated in the Mexico City large-scale field experiment (see page 22), helped educate the general public during this research project by meeting daily with public school children from Veracruz. He also met with Mexican newspaper and TV reporters to explain the day's activities and their importance. Upon returning home, he presented the project's main findings at the Iowa City Public Library, as a part of the UI's International Mondays series.

### **Additional Educational Outreach**

CGRER continues to publish its newsletter *IoWatch*, which in 2006 addressed environmental conditions associated with the world's growing number of megacities. CGRER's ever-changing website received around 3.75 million hits in 2006. On that website, CGRER continues to post the Iowa Weather Forecasting System as a community service. In addition, CGRER will continue to host a virtual herbarium website and database in place of the physical herbarium samples that have been moved to Iowa State University. CGRER will provide website development and usage statistics for this website.

CGRER CONTINUES TO SEEK MULTIPLE VENUES FOR INFORMING THE PUBLIC ABOUT GLOBAL CHANGE ISSUES. ONE SUCH EFFORT WAS AN INVITED EDITORIAL, PUBLISHED IN THE DES MOINES REGISTER ON DECEMBER 21, 2006. EXCERPTS FOLLOW:

## **No Controversy — Earth Is Warming Due to Us**

Having just reviewed the 4<sup>th</sup> Scientific Assessment of the Intergovernmental Panel on Climate Change (IPCC) which was vetted by more than 1500 scientists world-wide, I can tell you there's much to worry about and some opportunities as well.... There are multiple lines of evidence that tell us carbon dioxide concentrations are increasing in the atmosphere and that those increases are due to human emissions... Human activities are warming the earth and the ecological and economic consequences are already grave: more than 1° F warmer atmosphere with inertia for much more already in place; similarly warmer sea surface temperatures; rapidly melting continental glaciers and arctic ice; increased sea-level rise; changing patterns of rainfall; and a global migration of animals to higher latitudes and elevations (cooler regions).

A great convergence is forming politically in our country – a perfect storm of the need for energy independence, security, and environmental sensibility. We must transition from the fossil fuel age. It will be a task much greater than the Marshall Plan after World War II to rebuild Europe and Japan. Sending a man to the moon is child's play in comparison to the challenge to end our addiction to oil. The challenge: we must decrease our emissions from fossil fuels by 70% over the next 50 years, and we must begin this decade. It can be done.

Let's create "Renewable, Sustainable Iowa" as a better future for our children. Iowa can be a leader in energy conservation, renewable wind and biofuels, sequestration of carbon dioxide, and sustainable agriculture. Transitioning from the fossil fuel age will create good jobs, contribute to the quality of rural life, and provide energy security. There is no scientific controversy – let's get to work.

Jerry Schnoor  
Co-Director, Center for Global and  
Regional Environmental Research  
The University of Iowa



## Travel Grants for Graduate Students: Conference Awardees

In 2006, for the first time, CGRER awarded two types of graduate student grants. Twenty-five students received a total of \$15,000 to fund their travel to a conference in their field, with the stipulation that they give either an oral or poster presentation at the conference.

- Ozan Abaci, UI Civil & Environmental Engineering, American Society of Civil Engineers - World Environmental & Water Resources Congress
- Brandon Billing, UI Civil & Environmental Engineering, Seventh International Conference on HydroScience and Engineering
- Humberto Carvajal-Ortiz, ISU Geological & Atmospheric Sciences, Geological Society of America Annual Meeting
- James Correia Jr., ISU Agronomy, Twelfth Conference on Cloud Physics
- Dimitrios Dermisis, UI Civil & Environmental Engineering, American Society of Civil Engineers - World Environmental & Water Resources Congress
- Cihan Erbas, ISU Electrical & Computer Engineering, IEEE International Geoscience & Remote Sensing Symposium
- Elizabeth Gibson, UI Chemistry, American Chemical Society National Meeting
- Sunday Goshit, UI Geography, Association of American Geographers Annual Meeting
- Robert Handler, UI Civil & Environmental Engineering, American Chemical Society National Meeting
- Erik D. Kabela, ISU Agronomy, American Geophysical Union Joint Assembly
- Philip Larese-Casanova, UI Civil & Environmental Engineering, American Chemical Society National Meeting
- Zhongwei Li, UI Geoscience, American Geophysical Union Fall Meeting
- Jen-Miau Lin, UI Geography, Association of American Geographers Annual Meeting
- Stephen Miller, UI Anthropology, American Association of Physical Anthropology
- Praveen Mogili, UI Chemical & Biochemical Engineering, Seventh International Aerosol Conference
- Joshua Polanski, UI Anthropology, American Association of Physical Anthropology
- Jennifer Schuttlefield, UI Chemistry, American Chemical Society National Meeting
- Kyle Strom, UI Civil & Environmental Engineering, Seventh International Conference on Hydroscience & Engineering
- Ranjani Theregowda, UI Civil & Environmental Engineering, American Society of Civil Engineers - World Environmental & Water Resources Congress
- Pradeep Mandapaka Venkata, UI Civil & Environmental Engineering, American Geophysical Union Fall Meeting
- Gabriele Villarini, UI Civil & Environmental Engineering, American Geophysical Union Fall Meeting; also European Geosciences Union General Assembly
- Brian Viner, ISU Agricultural Meteorology, Seventeenth Conference on Biometeorology & Aerobiology



*CGRER conference awardee Erik Kabela (left, with advisor Brian Hornbuckle) at American Geophysical Union meeting.*

- Brian Wardman, UI Civil & Environmental Engineering, American Society of Civil Engineers — World Environmental & Water Resources Congress
- Danting Yin, UI Geoscience, Western Pacific Geophysics Meeting
- Gang Zhong, UI Geography, Association of American Geographers Annual Meeting

# Travel Grants for Graduate Students: Field Research Awardees

Eleven students received another \$15,000 in grants to assist with their field travels and research.

NAME	DEPARTMENT	TITLE OF PROJECT	TRAVEL DESTINATION
Humberto Carvajal-Ortiz	ISU Geological & Atmospheric Sciences	Perturbations in Ancient Carbon Cycle Dynamics as a Proxy to Evaluate Future Global Change Scenarios	Indiana
Susana Cortina de Cardenas	UI Geography	The Effects of Water Privatization on the Provision of Safe Drinking Water and Sanitation Services: Case Studies of Bolivia and Puerto Rico	Bolivia and Puerto Rico
Francis Dube	UI History	Cross-Border Movements, Disease Ecology and Public Health: Institutional Responses to Disease and the History of Public Health in Central Mozambique and South-Eastern Zimbabwe, 1900-1990	Zimbabwe and Mozambique
Cihan Erbas	ISU Electrical & Computer Engineering	Research Trip to NASA Global Hydrology and A Climate Center for the Development of Microwave Emission Models and Verification through a Field Experiment	Huntsville, AL
Renato Prata de Moraes Frasson	UI Civil & Environmental Engineering	Observational Studies of Rainfall Interception by Corn	Field Sites Southwest of Iowa City
Rachel Horner	UI Anthropology	The Italian Slow Food Movement: The Embodiment of Risk Discourse	Bra, Italy
Adam Kuester	ISU Interdepartmental Genetics	Insect-Plant Interactions: Studying the Affect of Gossypol on the Interaction Between Wild Cotton and its Wild Boll Weevil Pest ( <i>Gossypium davidsonii</i> and <i>Anthonomus grandis</i> )	Cabo San Lucas, Mexico
Andres Martinez	UI Civil & Environmental Engineering	Identification of Emission Sources of Semivolatile PCBs in the Chicago Urban Industrial Region	Chicago
Fitzgerald (Jerry) Steele	UI Industrial Engineering	Identification of Emission Sources of Semivolatile PCBs in the Chicago Urban Industrial Region	Chicago
Andria Timmer	UI Anthropology	Defining Need: Organizational Efforts to Aid the Hungarian Roma	Budapest, Hungary
Gang Zhong	UI Geography	Land Use Change in Montane Mainland Southeast Asia	Yunnan, China



## A Sampling of CGRER-Member Educational Activities and Awards

**Greg Carmichael** delivered the 2006 Vernon L. Snoeyink Distinguished Lectures hosted by the University of Illinois Environmental Engineering Program, speaking on “The Globalization of Air Pollution: Implications for the Quality of the Air We Breathe” and “Integrating & Assimilating Chemical Data in Air Quality and Atmospheric Chemistry Models.”

**Bill Field** participated in the World Health Organization’s International Radon Initiative, an effort to reduce lung cancer around the world, serving as chair of the Radon Measurement Working Group and member of two other working groups. He also developed and taught the UI College of Public Health’s first course on Environmental and Occupational Epidemiology (175:220).

**Bill Field** received the U.S. Environmental Protection Agency’s Children’s Environmental Health Recognition Award.

**G. Edgar Folk** presented “International Society of Biometeorology: A Fifty-Year History” at the society’s annual meeting. A written monograph on the topic will be published by the society.

**Konstantine P. Georgakakos** became a Fellow of the American Meteorological Society. In addition to directing the Hydrologic Research Center in San Diego, CA, he is an adjunct professor with Scripps Institution of Oceanography, UCSD.

**Vicki Grassian** received the Regents Award for Faculty Excellence.

Vicki Grassian’s student **Elizabeth Gibson** received a graduate fellowship through the U.S. Department of Energy, Global Change Education Program (GCEP).

**Vicki Grassian** co-chaired a three-day NSF-sponsored workshop on Sustainability and Chemistry.

Participants discussed sustainability challenges as they apply to energy, green chemistry and processing, the environment, and education. The workshop report, “Chemistry for a Sustainable Future,” is available at [www.chem.uiowa.edu/research/sustainability/index.html](http://www.chem.uiowa.edu/research/sustainability/index.html).

**Keri Hornbuckle** received the 2006 International Association for Great Lakes Research Appreciation Award.

Keri Hornbuckle’s students **Bill Wombacher** and **Mark Weldon** both received Fisher Fellowships; Bill also wrote a successful \$30,000 proposal to the UI’s Center for Health Effects of Environmental Contamination.

**Keri Hornbuckle** participated in an NSF-funded workshop organized by the Center for Sustainable Engineering at Carnegie Mellon University, which assisted instructors on integrating sustainable engineering concepts into the curriculum.

**John Nason**, in collaboration with Virginia Commonwealth University, is developing a spring 2007 International Study Abroad course that will include eight days in Baja California, Mexico. The course will engage undergraduates in hypothesis-driven field research that will investigate geographical variation in biodiversity in terrestrial and aquatic environments.



*CGRER field research awardee Francis Dube (right) studied cross-border movements and public health in Zimbabwe.*

**Michelle Scherer** received a three-year University of Iowa Faculty Scholar Award, and was also a visiting scholar at the UI’s Obermann Center (at the Oakdale Research Campus) during the fall semester.

**Jerry Schnoor** received the Best Paper of the Year award from the journal *Human and Ecological Risk Assessment* for “Global Warming: A Consequence of Human Activities Rivaling Earth’s Biogeochemical Processes” (11: 1105-1110), published in 2005 in that journal.



# research

## CGRER fosters global change research to address Iowa's needs

### **Nanoscience and Nanotechnology**

In recent years, CGRER members have become increasingly involved in the rapidly developing fields of nanoscience and nanotechnology, fields that focus on the fundamental properties and use of nanoparticles, whose extremely small size and relatively large surface area afford them extraordinary properties. As cases in point, Sarah Larsen, Vicki Grassian, and colleagues have been conducting research on the use of nanoparticles for environmental remediation and decontamination. In addition, Larsen in 2006 received an NSF grant to commence work on drug delivery by nanoparticles. Michelle Scherer and Vicki Grassian have been conducting NSF-funded research on the behavior of nano-scale iron oxides in the environment.

In August, these ongoing efforts were recognized by the formation of the *Nanoscience and Nanotechnology Institute at the University of Iowa* (NNI@UI), housed in the same building as CGRER and directed by Vicki Grassian. This institute is intended to bring researchers from different UI departments and colleges together to stimulate nanoscience research and education, particularly as applied to health sciences and environmental processes. Outreach activities are also an integral part of the institute's activities; multiple talks have already been presented to elementary and middle school children about nanoscience. CGRER and NNI@UI have partnered to write a graduate training program proposal



to NSF that focuses on environmental aspects of nanoscience and nanotechnology. If funded, the new training center will be jointly managed by the two institutes. The ongoing excitement about applications of nanoscience and nanotechnology and this new institute are expected to multiply rich fields of investigation for CGRER members, even as it promises to continue drawing CGRER members into ongoing multidisciplinary grants and collaborations.

### Semivolatile PCBs Multidisciplinary Program

Keri Hornbuckle, Jerry Schnoor, and Peter Thorne are joining a dozen other researchers from the UI's engineering, medical, pharmacy, and public health colleges in a new \$12 million program focusing on semivolatile polychlorinated biphenyls (PCBs), which are considered some of the nation's most hazardous pollutants. This program, titled *Semivolatile PCBs: Sources, Exposures, and Toxicity*, will study PCBs that are found in the air worldwide. Hornbuckle's research project focuses on current sources of atmospheric PCBs, particularly those in the Chicago metropolitan area. Schnoor's research project focuses on phytoremediation of contaminated sites. Thorne's project examines inhalation exposure to the chemicals in northwest Indiana and eastern Iowa. This multifaceted four-year grant is funded by the National Institutes of Health through the Superfund Basic Research Program.

### Large-Scale Atmospheric Field Experiments

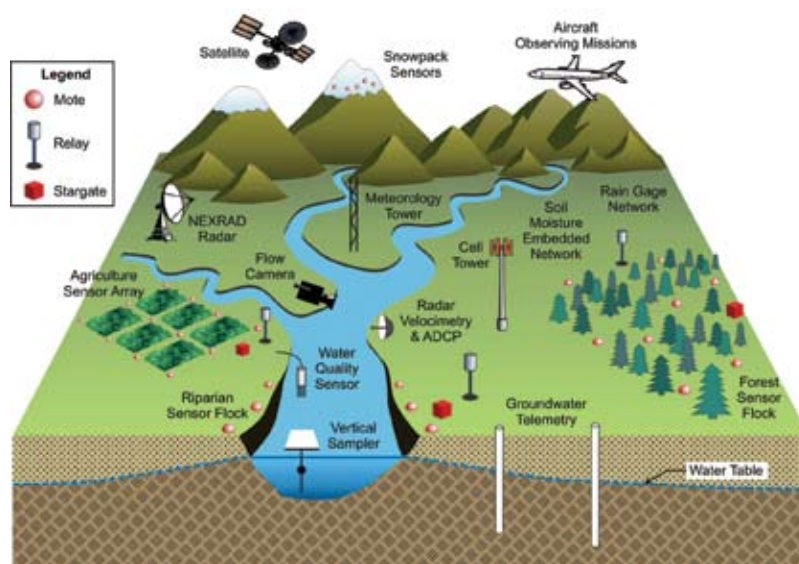
CGRER continues to play a significant role in large-scale, multi-institutional atmospheric field experiments that trace the movement

of air pollutants around the globe. In 2006, three such massive experiments took place. The first of these, held in Mexico City in March, was described in CGRER's 2006 newsletter. Here CGRER members Bill Eichinger and Charlie Stanier took ground-based measurements that characterized and traced pollutants and their chemical changes. CGRER's atmospheric chemistry research group, headed by Greg Carmichael, used its STEM numerical model to provide chemical weather forecasts that guided the flight patterns of data-collecting research aircraft and the sampling locations of mobile ground units. Carmichael and students later executed similar chemical weather forecasts for experiments held in April and May in the eastern Pacific region, and in September in Houston, Texas.

### National Environmental Observatory

Jerry Schnoor, with CGRER members David Bennett, Keri Hornbuckle, Thanos Papanicolaou, Witold Krajewski, and other colleagues at the UI and elsewhere, continues to develop a strategic plan for creating a multi-

institutional environmental-hydrologic observing system for water research. In 2006, the project's planning group, CLEANER (Collaborative Large-scale Engineering Analysis Network for Environmental Research), merged with CUAHSI (the broader Consortium of Universities for the Advancement of Hydrologic-Sciences Inc.) to form the WATERS (Water and Environmental Research Systems) network. WATERS is continuing to bring together the nation's environmental engineering and hydrologic science researchers to prepare an NSF proposal for a \$300 million observatory, to be built in 2012, for the sensing, process-level understanding, and real-time forecasting of water quality and quantity problems (see graphic (below) of one proposed segment). Three workshops were held in 2006 to assist with the necessary planning and community building. In addition, NSF has funded a test bed, to be constructed along Clear Creek just northwest of Iowa City, to assess the feasibility of creating such an environmental field facility.



## Seed Grants Awarded by CGRER

In 2006, CGRER awarded a total of \$145,092 in seed grants to six recipients.

PROJECT DIRECTOR/S	AMOUNT AWARDED	TITLE
Robert Anex, Agricultural and Biosystems Engineering, ISU; Robert C. Brown, Center for Sustainable Environmental Technologies, ISU; Mathew Z. Liebman and Kenneth J. Moore, Department of Agronomy, ISU	\$18,074	Ecological Intensification of the Industrial Bioeconomy: Sustainable Biofuel Production Through the Integration of Perennial Crops with Advanced Biomass Conversion Technologies
Robert Ettema and Allen Bradley, Civil & Environmental Engineering, UI	\$29,059	A Workshop to Assess Climate-Change Effects on the Ice Regimes of Northern Rivers
Jiasong Fang, Geological and Atmospheric Sciences, ISU	\$27,959	Assessing the Ecotoxicology of Nanomaterials and Identifying Biomarkers in Bacteria Exposed to Nanomaterials
Paul Greenough, History and Community & Behavioral Health, UI	\$30,000	Equity in Relief: Urban Water-supply and Recovery from Tsunami During Suspended Civil War in Sri Lanka
Thomas Peters, Occupational and Environmental Health, UI	\$30,000	Real-time, Personal Sampling for Airborne Nanoparticles
Lisa Schulte, Landscape Ecology, Natural Resource Ecology and Management, ISU; Paul Brown, Agriculture and Natural Resources Extension, ISU	\$10,000	Using the Past to Create a Sustainable Future for Agriculture: The Impact of Federal Farm Policy on Environmental and Social Landscape Change in Iowa

## Aids to Researchers and the UI Community

As in past years, CGRER continued to offer state-of-the-art computing and visualization resources to members and their students. In 2006 CGRER's computing facilities were supplemented with two new Linux servers to replace the outdated UNIX servers. Each new server expands CGRER's data-storage capability and provides additional computing power for modeling and visualization. CGRER also functions as one of four departments on the UI campus to support and distribute geographical information system (GIS) software through a campus-wide license with ESRI. CGRER continues to be a member of the High Performance Computing and Cyber-infrastructure groups on campus. Both groups work to discuss and improve high performance computing and networking issues as they relate to CGRER and the UI campus.

## A Sampling of CGRER-Member New Research Grants...

*HSD: Collaborative Research: Social Complexity and the Management of the Commons.* 2006-2009. NSF. \$675,000. PIs: **David Bennett**, Catherine Kline, Paul Robbins, David McGinnis

*NSF Chemistry Workshop on Sustainability.* 2006-2007. NSF. \$93,517. PI: **Vicki H. Grassian**

*A Laboratory and Modeling Study at the University of Iowa Designed to Better Understand the Atmospheric Fate of D4 and D5.* 2006-2008. Dow Corning Corporation. \$221,264. PI: **Vicki H. Grassian**, co-PIs **Charles Stanier**, **Mark Young**

*A Prototype Remote Sensing Validation Site: Towards a Multi-Variable Approach to Validating and Scaling Remotely-Sensed Observations of the Water Cycle.* 2006-2011. NASA. \$1,305,188. PI: **Brian Hornbuckle**; Co-PIs: **Witold Krajewski**, **William Eichinger**, Amy Kaleita, Anton Kruger.

*Health and Air Quality Regulation in Delhi, India.* 2006-2007. NIH. \$110,735. PIs: **Naresh Kumar**; Co-PIs: Andrew Foster, Allen Chu

*NER: Self-assembly of Nanostructures in Functionalized, Hierarchical Zeolite Structures.* 2006-2007. NSF. \$129,663. PI: **Sarah Larsen**; co-PI: Aliasger Salem

*Visit to the Three Gorges Dam Region in Support of NSF Proposal Development; Yichang, China.* 2006-2007. NSF. \$18,320. PIs: **Marc Linderman**, **George Malanson**, Zehao Shen

*The Evolution of Genetic Structure in Species-Specific Plant-Insect Relationships: The Relative Importance of Biogeographical and Coevolutionary Processes.* 2006-2009. NSF. \$350,000. PIs: **John Nason**, R. Dyer

*Mechanisms of Geographic Variation in the Stability of a Fig-Fig Wasp Mutualism.* 2006-2007. National Fish and Wildlife Service Budweiser Conservation Scholarship Award. \$10,000. PIs: **John Nason**, D. Gates

*Salvage Excavation of the Tarkio Valley Ground Sloth, Page County, Iowa.* 2006-2007. NSF. \$8,114. PI: **Holmes Semken**

*NASA Graduate Student Researchers Program: Simultaneous Chemical Transport Inversion of CO<sub>2</sub> and CO Signal: Data Analysis with MOPITT CO Columns.* 2006-2009. NASA. \$24,000. PI: **Charles Stanier**

*Role of Free Chlorine, Chloramines, and Natural Organic Matter in the Release of Lead into Drinking Water.* 2006-2008. American Water Works Association. \$149,674. PI: **Richard Valentine**



## ... and Other Research-Related Activities

Fifty international scientists attended a DEBITS workshop (Deposition of Biogeochemically Important Tracer Species, a project within the International Global Atmospheric Chemistry Program) in Kruger Park, South Africa, which focused on the monitoring of deposition. **Greg Carmichael**, a member of the workshop steering committee, provided an overview of the use of passive samplers within the DEBITS program. He also summarized plans for a synthesis publication.

**Diane Debinski** delivered an invited talk, "Quantifying Ecological Effects of Climate Change," as part of a symposium on using remote sensing to detect climate change at the annual Mountain Climate (MTCLIM2006) meeting held in Oregon in September. Her talk focused on using satellite data and field-based surveys to detect changes in ecological communities of montane meadows.

**Paul Greenough** has been working with another half-dozen UI faculty members on studies of innovation in science and technology in India, in particular as this topic applies to the culture of innovation in the laboratory and industrial workshop. The UI's ongoing interactions with India's University of Hyderabad have led to a number of faculty exchanges and technical and research collaborations involving the two universities.

CGRER members **Brian Hornbuckle**, **Witold Krajewski**, and **William Eichinger** held a two-day June workshop with invited participants from across the country, to evaluate plans for Iowa's new Remote Sensing Validation Site (see grant information, page 24). The site, now being established south of Ames, will help refine the accuracy of remote sensing measurements of the water cycle.

**Lou Licht** is finding widespread acceptance of his firm Ecolo-Tree's plantings, which help clean up environmental pollution. In 2006, Ecolo-Tree Inc. planted the first Superfund site, providing a full-scale landfill cover near Philadelphia, PA.

It also successfully matched tree plantings with disposal of saline water (a major environmental waste product) pumped from coalbed methane wells in the Powder River Basin, WY (see photo below).

In June, **Jim Raich** moved to Arlington, VA, to accept a two-year position as Program Director in NSF's Division of Environmental Biology.

**Michelle Scherer**, with Andreas Kappler of Germany's University of Tuebingen, organized the 2006 Telluride Summer Research Workshop on Iron Redox Chemistry.



*Ecolo-Tree Inc. plantings irrigated with saline water from methane well, Wyoming*





General Information





## Budget

In fiscal year 2006 (July 1, 2005-June 30, 2006), 80 percent of CGRER's \$635,689 of funding was spent on research, education, and outreach directed toward global change issues (Figure 2). The remaining fifth 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 1). In calendar year 2006, CGRER members were performing research that brought in a total of \$25.5 million in external funds. This included both those grants awarded to CGRER directly and other grants awarded to CGRER members through their respective departments. Of this amount, \$5.4 million was new funding that was initiated in 2006, while the remaining \$20.1 million came from ongoing projects.

Figure 1

### Leveraging of CGRER's Income\*

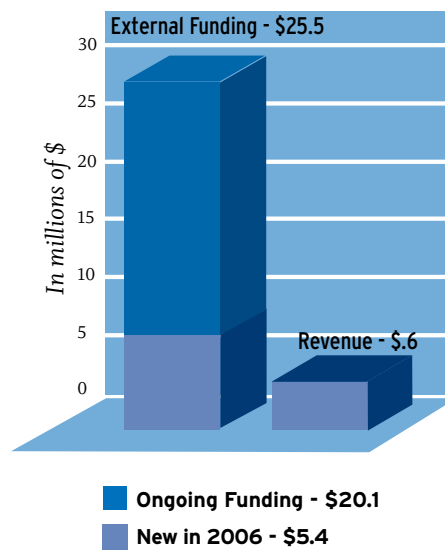
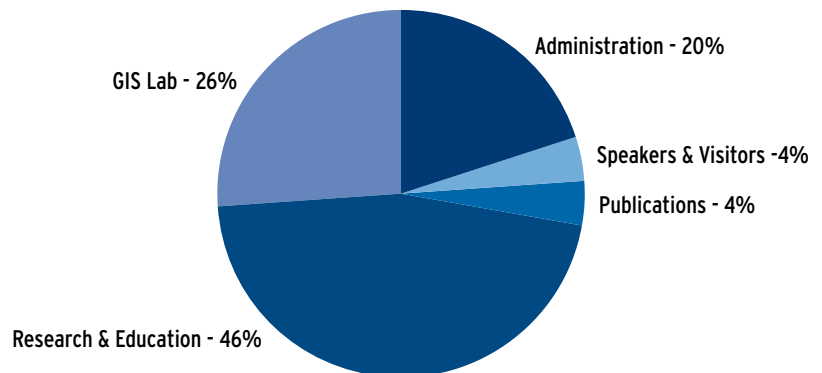


Figure 2

### CGRER's Expenses\*





## 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 six 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. CGRER reports directly to the UI's Vice President for Research.

### CGRER MEMBERS

#### University of Iowa (UI)

##### *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*

Vicki H. Grassian  
Sarah C. Larsen  
Mark Young

##### *Civil & Environmental Engineering*

A. Allen Bradley  
William E. Eichinger  
Robert Ettema  
Keri C. Hornbuckle  
Witold F. Krajewski  
Lou Licht  
Timothy E. Mattes  
Wilfrid A. Nixon  
A. Jacob Odgaard  
A.N. Thanos Papanicolaou  
Gene F. Parkin  
Michelle Scherer  
Jerald L. Schnoor  
Richard L. Valentine

##### *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  
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

##### *Physics & Astronomy*

Louis A. Frank  
Donald A. Gurnett  
Steven R. Spangler

##### *Physiology & Biophysics*

G. Edgar Folk, Emeritus

##### *Occupational & Environmental Health*

William R. Field  
Peter S. Thorne

##### *Public Policy Center*

David J. Forkenbrock

##### *Statistics & Actuarial Science*

Dale L. Zimmerman

#### Iowa State University (ISU)

##### *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 (UNI)

##### *Biology*

Laura Jackson

##### *Physical Geography*

Dennis E. Dahms  
Ramanathan Sugumaran

#### Cornell College

##### *Geology*

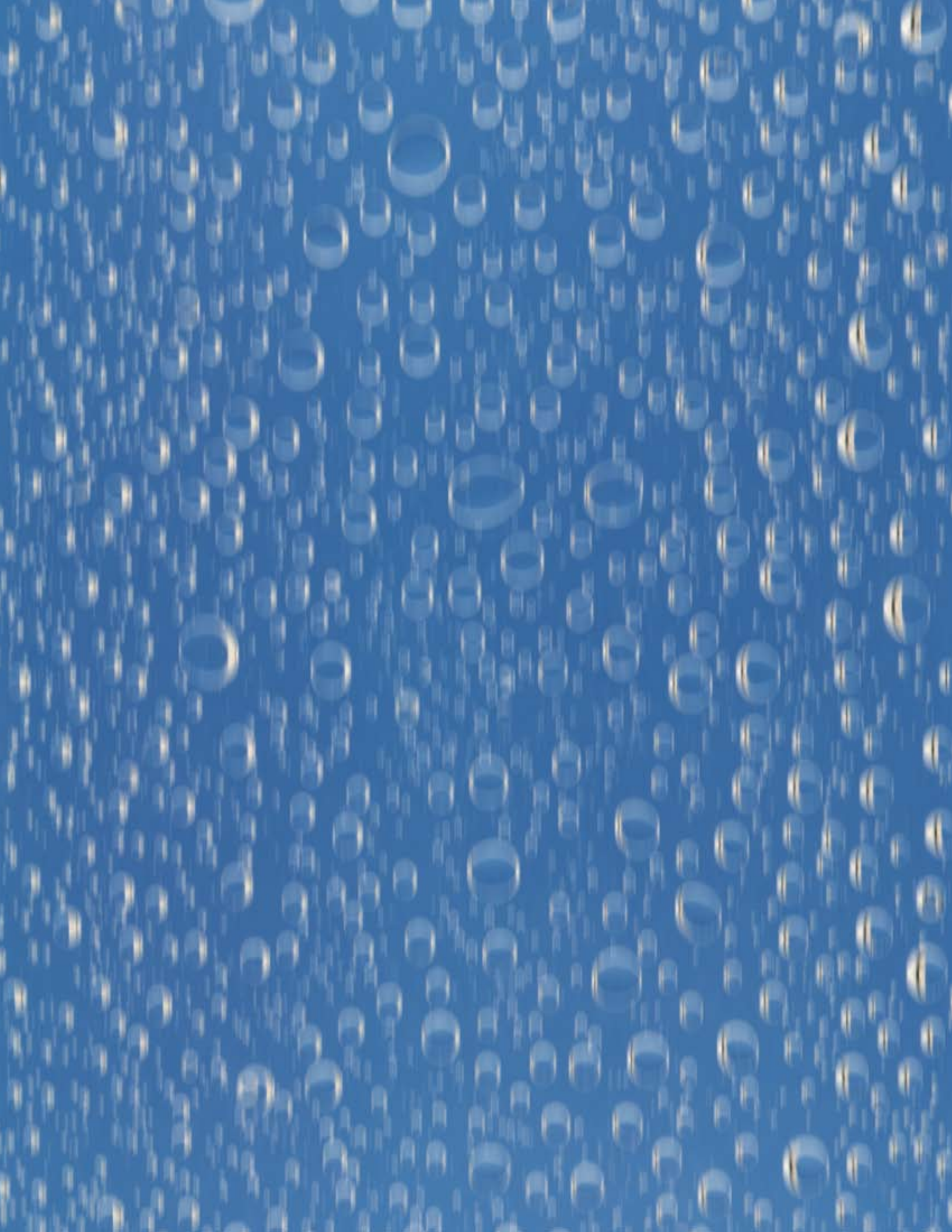
Rhawn Denniston

#### Hydrologic Research Center,

San Diego, CA  
Konstantine P. Georgakakos

#### Rice University

*Civil & Environmental Engineering*  
Pedro Alvarez





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