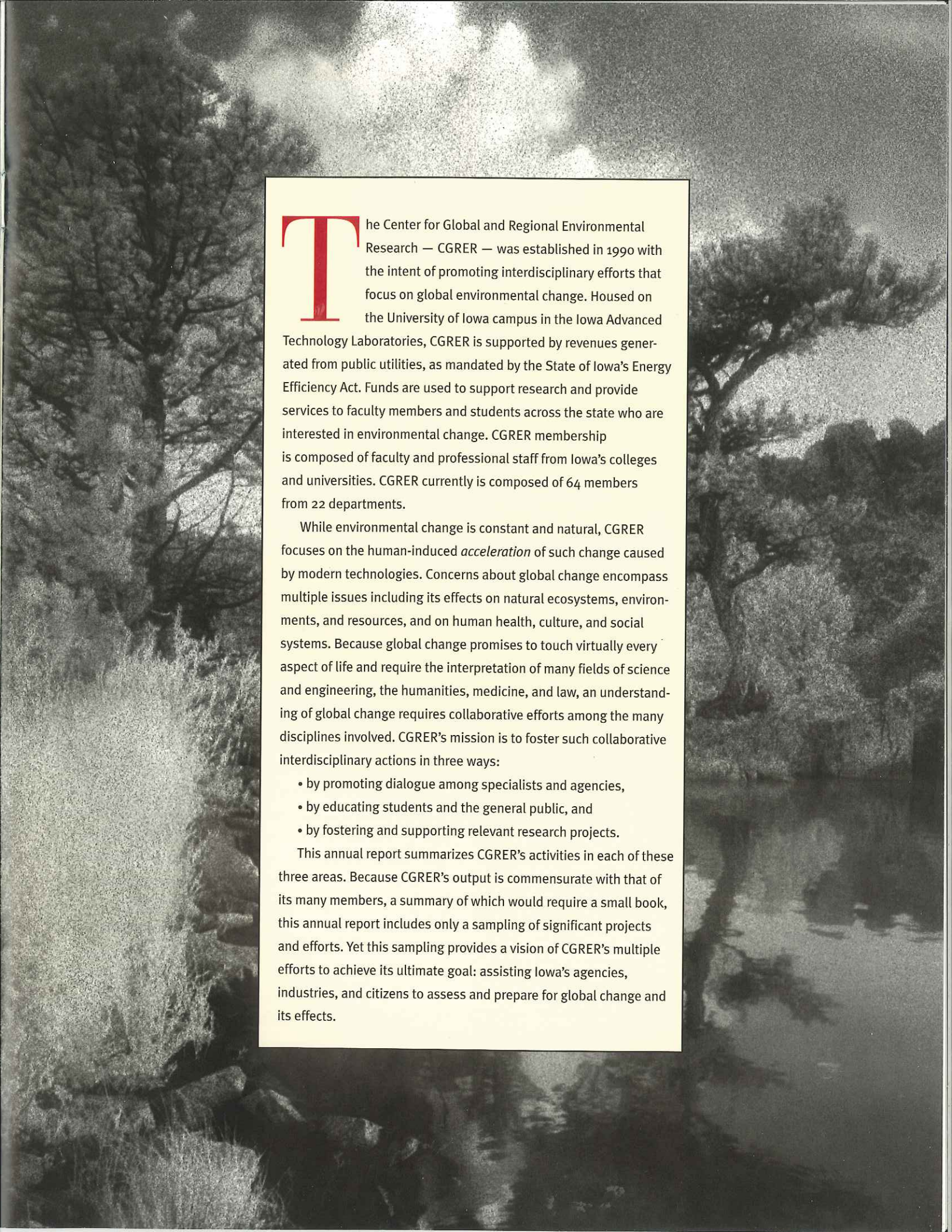
ANNUAL REPORT 2000

CGRER

The Center for Global and Regional Environmental Research

THE UNIVERSITY OF IOWA



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 campus in the Iowa Advanced Technology Laboratories, 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 64 members from 22 departments.

While environmental change is constant and natural, CGRER focuses on the human-induced *acceleration* of such change caused by modern technologies. 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 interpretation 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 to assess and prepare for global change and its effects.

Executive Summary

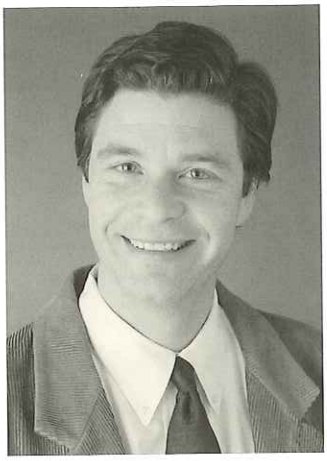
As we reflect on the activities and accomplishments of year 2000, we are reminded of the complex relationships that exist between energy and the environment. As the human population grows, the demand for energy increases, along with related pressures exerted on the natural environment. The per capita amount of energy used to support a modern human is 40 times that which was needed to support a Neolithic hunter and gatherer. In urban environments – where an increasing share of the world's people live, where most energy is consumed, and where the impacts of pollution are hardest felt – the per capita carbon dioxide emissions average 25,000 tons every day (six times the global average). With these increasing pressures, it is not surprising that we are stressing Earth's climate and environmental systems globally as well as locally.

RESEARCH BY THE FACULTY, STUDENTS, AND STAFF OF CGRER CONTINUE TO BUILD THE SCIENTIFIC FOUNDATIONS UPON WHICH EFFECTIVE ENERGY AND ENVIRONMENTAL POLICIES ARE BUILT.

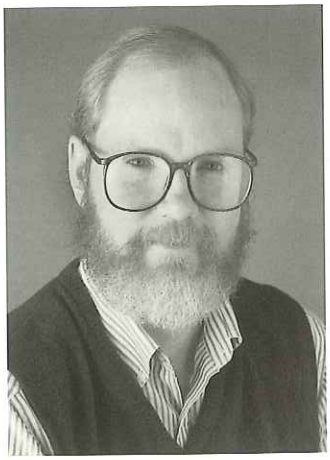
Efforts over the past decade or so have focused on improving our scientific understanding of Earth's climate system and human impacts upon it. Research by the faculty, students, and staff of CGRER continue to build the scientific foundations upon which effective energy and environmental policies are built. While some still question whether humans play a role in climate change, today's scientific, policy, and industrial agendas have shifted away from determining whether climate is changing, and now instead focus on determining what can and should be done to reduce human vulnerability to climatic and environmental change.

This transition is important. Climate change is now widely recognized, and it is the variability in climate, year by year, decade by decade, with which we must deal. Reducing unexpected climatic extremes and having the ability to anticipate next year's climate patterns are goals shared by many of society's diverse stakeholders. At CGRER, our mission is to assess the societal and physical impacts of environmental change, and to use the knowledge generated to help inform stakeholders about their vulnerability and potential adaptive mechanisms.

That said, reducing the climate-related impacts of energy generation remains the key to controlling human-induced stress on the environment. The closely linked environmental problems of pollution and global warming share common causes and solutions.



Jerald L. Schnoor



Gregory R. Carmichael

Both air pollution and greenhouse gas emissions arise largely from fossil fuel combustion. Reducing the threat to both will require a spectrum of activities, including but not limited to:

a) reducing energy demand by increasing energy efficiencies;
b) switching to cleaner fuels and technologies;
c) increasing the utilization of renewable and carbon-free fuels;
d) finding innovative ways to reduce net emissions through activities such as carbon sequestration in managed agricultural soils, and the expansion of emissions-trading markets and mechanisms; and
e) recognizing, identifying, and exploiting co-benefits in climate and health outcomes associated with choices made in changing energy usage.

As summarized in this annual report, we are actively involved in these issues at CGRER, working closely with agencies, industries, and individuals to develop, demonstrate, and provide the modeling, analysis, assessment, and accounting methodologies that are needed to turn energy-related strategies into actions.

We live in interesting times in terms of energy and the environment, and we here at CGRER are excited about playing a significant role in identifying and following sustainable policies and paths.

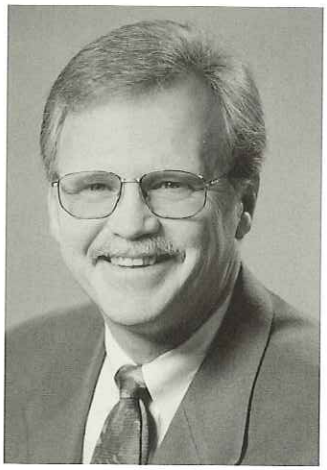
Gregory R. Carmichael
Co-Director

Jerald L. Schnoor
Co-Director

Message from the Advisory Board

As the new millennium arrives, I note little progress toward global implementation of efforts to reduce greenhouse gases. Take a closer look locally, though, and you will be encouraged by the efforts being made to manage carbon and other greenhouse gases in innovative ways.

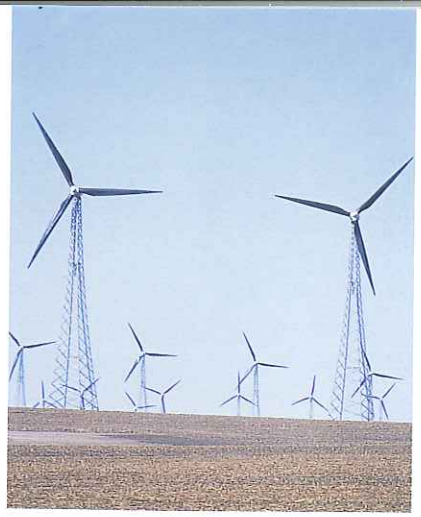
Iowa's wind farms are producing significant renewable energy today. The Duane Arnold Energy Center is now operating as part of the Nuclear Management Company along with other midwestern facilities to improve and preserve this greenhouse gas-free resource. We successfully tested burning the native tallgrass prairie plant switchgrass as a biomass crop along with coal in Alliant Energy's Ottumwa plant.



Alliant Energy, using new distributed generation technologies, is also working with its agricultural customers to produce energy commercially from methane gas produced by livestock. The environment significantly benefits from this effort, since we digest livestock waste in a way that extracts the methane gas while reducing odor and the potential threat from runoff into local water resources. We then capture that methane to produce energy onsite with a microturbine or engine, rather than releasing it into the atmosphere (a major benefit because methane is a more potent greenhouse gas than carbon dioxide). This approach results in environmental benefits, a new revenue source for the agricultural sector, and a new renewable energy source.

Customers can now promote renewable energy through Alliant Energy's Second Nature™ program. Through this new program, customers can select 25%, 50%, or 100% of their energy from renewable energy sources for an additional charge. Interest in the program has been significant and has exceeded expectations. We initially secured resources to provide renewable energy for as many as 7,000 customers.

Initiatives like these will position us as a leader in carbon management in this millennium. Iowa recently launched a statewide plan to protect and preserve its natural resources by the year 2010, and many of these initiatives are highlighted as models for success in this plan.



CGRER can play key roles in the evolving carbon management strategy. CGRER is filling the need for research on the calculated benefits of carbon management initiatives, such as the value of carbon emissions trading as markets begin to emerge. CGRER also works to educate the public and policy makers on global change issues, and one must continue to see the value of that effort as the world addresses the management of carbon in its future.

James L. Christensen

James L. Christensen
Manager of Research and Technology
Alliant Energy

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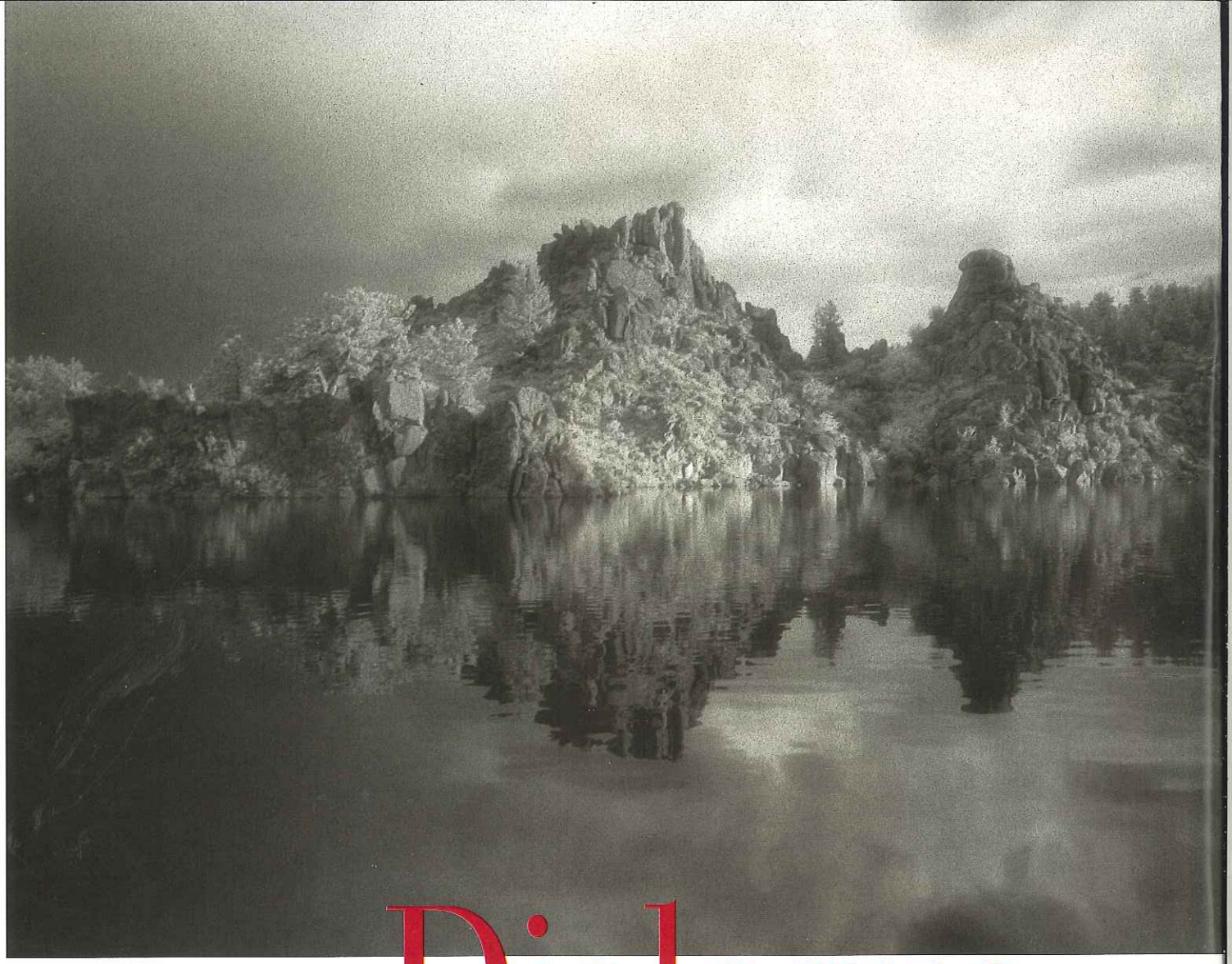


Dialogue

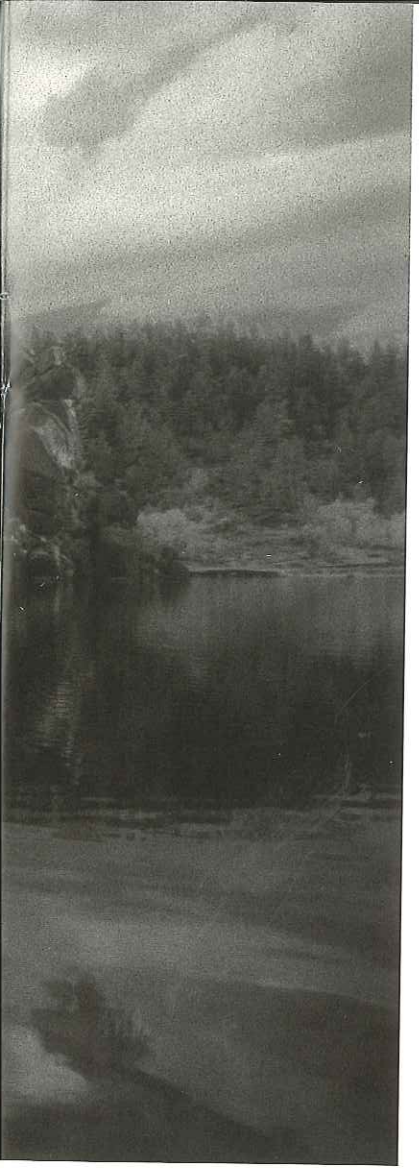
CGRER Promotes Interdisciplinary Dialogue to Address Iowa's Needs

A healthy response to environmental change depends on productive dialogue among academics, policy makers, industrial leaders, and the general public. In 2000, CGRER enhanced such dialogue in a variety of ways – through seminars, consultation with outside researchers, publications and conference presentations, and the multifaceted creativity of its 64 members.

Controlling Greenhouse Gas Emissions

Ongoing discussions regarding Iowa's carbon dioxide emissions continue to foster practical mechanisms for managing greenhouse gases and accelerating the use of renewable energy sources. These efforts once again were led by CGRER's co-director Jerry Schnoor, Associate Research Scientist Rick Ney, and graduate students. Ney participated in the conference *Carbon: Exploring the Benefits to Farmers and Society* in Des Moines in August. This successful conference (with over 500 attendees) emphasized policy matters as well as the science of climate change. Ney also joined an advisory committee for an Iowa Department of Natural Resources grant intended to educate the insurance industry about climate-related benefits of encouraging construction of energy-efficient buildings, with the hope that this would lead to insurance incentives.

Schnoor, in the meantime, spent half the year on sabbatical in Switzerland, where he worked on a textbook on sustainable development – an effort that ultimately will promote dialogue among its intended users: undergraduate environmental engineering and environmental



studies students. In November, his ongoing work toward evaluating Iowa-grown switchgrass as an "environmentally friendly" alternative fuel took a large step forward: the Ottumwa Generating Station started to co-fire this native prairie grass along with coal, thus testing the technical feasibility of producing electricity using this renewable energy source.

Visiting Researchers

Six visiting researchers came to CGRER in 2000 to initiate or participate in collaborative research projects, most concerning air quality and greenhouse gas emissions:

- **Hector Jorquera** (Chemical and Bioprocess Engineering Department, Universidad Catolica de Chile) spent a six-month sabbatical at CGRER establishing research linkages focused on energy policy in Chile from both a greenhouse gas and local air pollution perspective. Several resulting joint research projects funded by the Chilean government are expected to begin in 2001.
- **Jung-Hun Woo** (Environmental Planning Institute, Seoul National University, Korea) came to CGRER for nearly a year of efforts related to energy and emissions in Asia. His expertise in GIS and integrated assessment modeling is being used to produce emissions files for several new CGRER projects.
- **Shang-Gyoo Shim** (Korea Institute of Science and Technology, Korea) visited CGRER for a day in conjunction with a project he's initiating to look at health implications of fine particles in the Seoul metropolitan area. This study will help support Korea's continuing work on the co-benefits of efforts to reduce both global warming and local pollution.
- **Todd Johnson, Jitendra Shah,** and **Chaoyang Peng** (all from The World Bank Groups, Washington, D.C.) came for a short visit to invite CGRER's participation in the "China: Sulfur Emission Mitigation Policies" project, which will involve urban-scale modeling, sulfur emission mitigation scenario analysis, and cost-benefit analysis for two provincial capitals in China (Shijiazhuang, Hebei, and Changsha, Hunan).

IN 2000, CGRER ENHANCED DIALOGUE IN A VARIETY OF WAYS – THROUGH SEMINARS, CONSULTATION WITH OUTSIDE RESEARCHERS, PUBLICATIONS AND CONFERENCE PRESENTATIONS, AND THE MULTIFACETED CREATIVITY OF ITS 64 MEMBERS.

A test burn of switchgrass as an alternative "green fuel," Ottumwa Generating Station, November 2000.

ONGOING DISCUSSIONS REGARDING IOWA'S CARBON DIOXIDE EMISSIONS CONTINUE TO FOSTER PRACTICAL MECHANISMS FOR MANAGING GREENHOUSE GASES AND ACCELERATING THE USE OF RENEWABLE ENERGY SOURCES.

More Efforts

CGRER meanwhile continued with its traditional methods of distributing information to others: publication of the newsletter *IoWatch*, implementation of its web page (www.cgrer.uiowa.edu), and sponsorship of the following series of seminars:

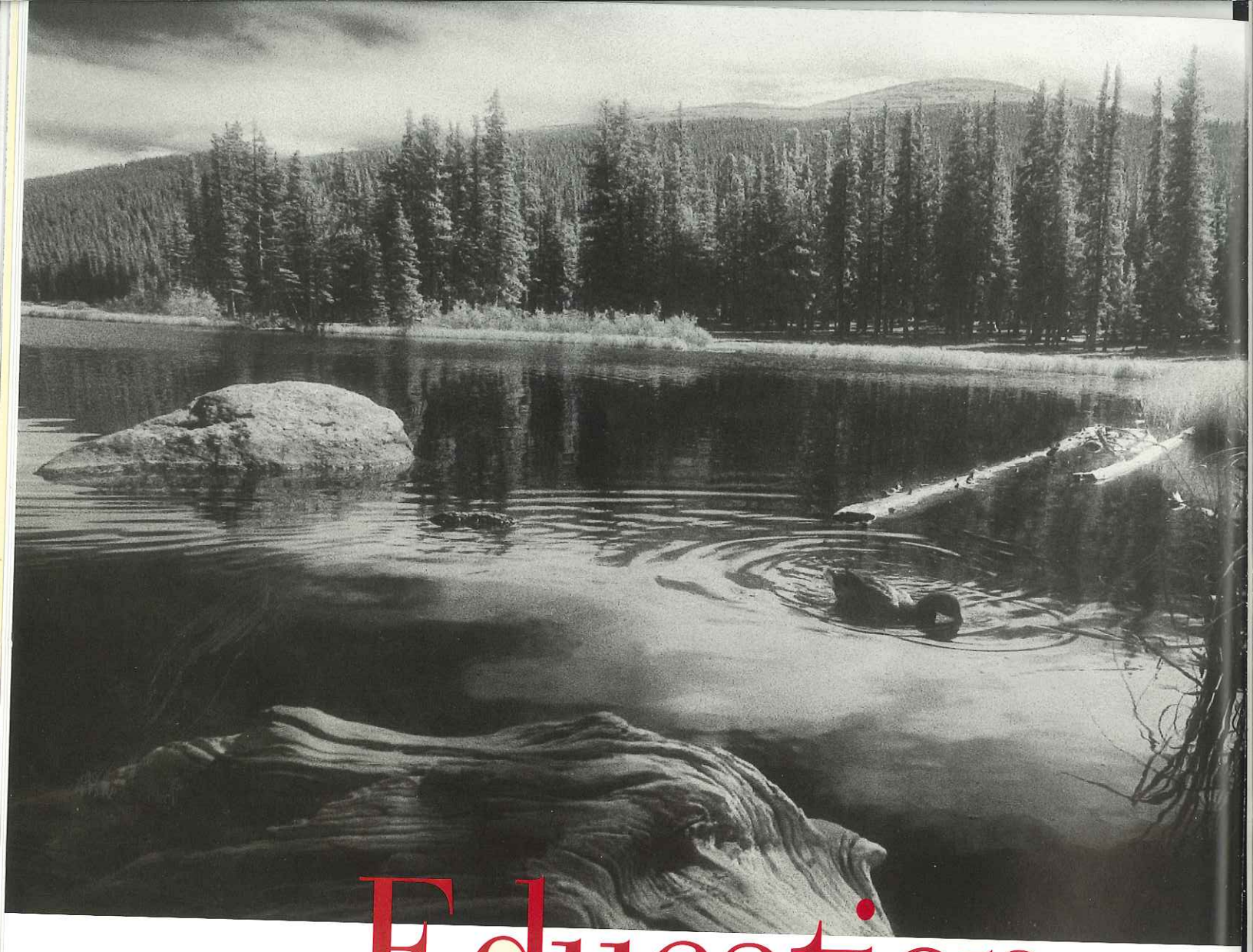
CGRER Seminars, 2000

Speaker	Affiliation	Title of Seminar
Yu-Ping Chin	Dept. of Geological Sciences, Ohio State University	Direct and Indirect Photolysis of Carbaryl in Wetland Surface Water
James Donaldson	Dept. of Chemistry, University of Toronto	Making a Splash: Interactions and Chemistry at Atmospheric (and Other) Liquid Surfaces
Ellen Dorsey	Director, Rachel Carson Institute, Chatham College	Human Rights and the Environment
Steven Eisenreich	Dept. of Environmental Science, Rutgers University	A "New" Look at Sources, Dynamics, and Sinks of Atmospheric PCBs
Ramachandra Guha	Morrison Institute for Population and Resource Studies, Stanford University	The Indian Environmental Movement in Comparative Perspective
Greg Ludvigson	Dept. of Geoscience, University of Iowa	Sphaerosiderite Paleoclimatology at The University of Iowa, and the Case for an Intensified Hydrologic Cycle during Greenhouse Warming
Scot Martin	Dept. of Environmental Sciences & Engineering, Univ. of North Carolina	Aerosol Phase Changes Induced by Mineral Dust
Jerry Schnoor	Dept. of Civil & Environmental Engineering, University of Iowa	Global Change and Sustainable Development
Carl-Axel Soderberg	U.S. Environmental Protection Agency, Puerto Rico	EPA's Non-Traditional Approaches for Pollution Prevention in the Caribbean

Additional Faculty Activities

CGRER members regularly contribute to ongoing global change dialogue with other professionals and the general public through a variety of activities. Following is a sampling of the global change-related publications and outreach activities of CGRER members in 2000:

- G. Edgar Folk Jr (UI, Physiology and Biophysics): Convened and chaired the symposium, "Experimental Physiology in the Polar Regions: The Historical Development;" Edited its proceedings published in *Comparative Biochemistry and Physiology* (June2000)126/A (2).
- Keri Hornbuckle (UI, Civil and Environmental Engineering): Organized and directed the workshop, "Using Models to Develop Air Toxics Reduction Strategies: Lake Michigan as a Test Case," intended to bring scientific findings on Lake Michigan pollution research to policy makers and public stakeholders; Co-authored (with her students) three publications on their Lake Michigan studies (*Environmental Science and Technology* 2000:34).
- Lou Licht (UI, Civil and Environmental Engineering): Starred in a segment of Iowa Public TV's program "Living in Iowa" on using trees for environmental cleanups; Consultant with Oregon State University's Bioresource Engineering Department on urban stormwater cleanup and manure lagoon closure research /educational programs.
- Greg Ludvigson (UI, Geoscience): Presented invited lectures on "Global Warming: Some Lessons from Earth History" at Baylor University, Northwestern University, the University of Missouri at Columbia, the University of Iowa, and the Iowa Department of Natural Resources.
- David McGinnis (UI, Geography): Keynote speaker, National Meeting of the Izaak Walton League, "Climate Change and the Future of Water Resources" (July, Des Moines); Consultant to Grinnell College on efforts to establish a Department of Geography and International Studies.
- James Raich (ISU, Botany): Participated in annual Riparian Buffers Field Day, which brings about 50 landowners, members of the press, scientists, and government personnel to the Bear Creek National Restoration Demonstration Watershed (the only such demonstration site in the Midwest), Story County, IA.
- Tim White (until August – UI, Geoscience postdoctoral fellow partially supported by CGRER): Had first of a series of forthcoming articles on his recent Cretaceous paleoclimatologic research published in the *Bulletin of the Geological Society of America* and the *Saskatchewan Geological Survey, Summary of Investigations 2000.*



Education

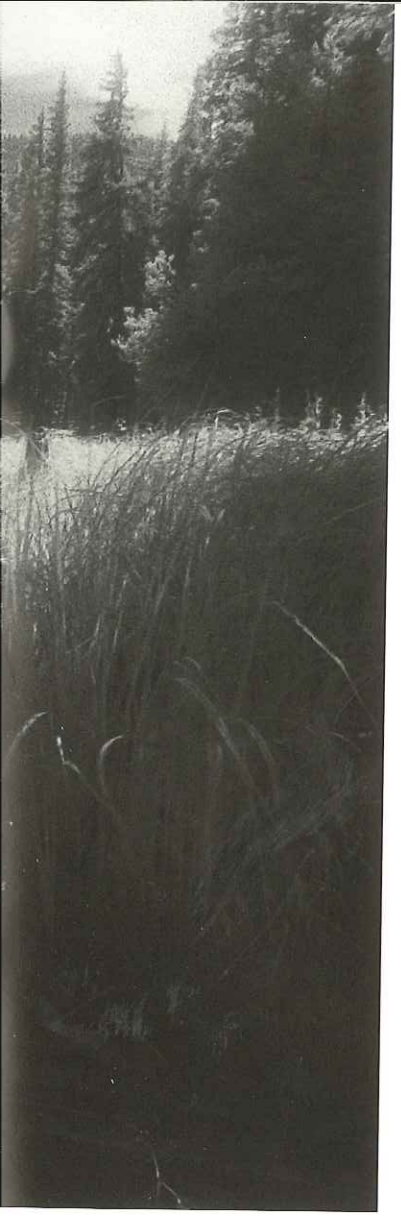
CGRER Provides Education to Address Iowa's Needs

CGRER strives to supplement the education of future environmental scientists in a variety of manners. In 2000, ongoing efforts were boosted by two new programs that allowed undergraduate students to come to Iowa City to perform research with CGRER members, and enabled Iowa graduate students to travel to field research sites elsewhere.

Research Experience for Undergraduates Program

CGRER hosted 16 undergraduate majors in chemistry, geology, geography, chemical engineering, and environmental engineering for eight summer weeks. These students, brought to Iowa City from institutions and locations across the country, came to participate in diverse research projects with CGRER members. The gifted future scientists and engineers also attended weekly seminars at CGRER, participated in organized social events, and presented poster papers on their research at the completion of the program.

CGRER's program was directed by member Vicki Grassian, who received a $181,000 National Science Foundation grant to offer the REU (Research Experience for Undergraduates) program for three sequential years. The REU program is designed to heighten student involvement in research, thus allowing students to make informed decisions about future graduate studies and career goals. It is hoped that the program will attract high quality students



CGRER's Research Experience for Undergraduates students, summer 2000.

Student	Home Institution	Faculty Sponsor	Project
Colleen Burrichter	Buena Vista University, Storm Lake, IA	Vicki Grassian	Surface Science Studies of Environmental Catalysis and Heterogeneous Atmospheric Processes
Erin Carlson	Franklin & Marshall College, Lancaster, PA	Bill Eichinger	Air Pollution Control and Optical Remote Sensing
Christina Eck	University of Missouri, Rolla, MO	Greg Carmichael	Tropospheric Trace Gas Cycles in East Asia
Valerie Gamble	Cornell College, Mt. Vernon, IA	Luis Gonzalez & Greg Ludvigson	Sedimentary Geochemistry
Jessica Gittinger	University of Iowa, Iowa City, IA	Luis Gonzalez & Greg Ludvigson	Sedimentary Geochemistry
Ross Holden	University of Texas, Austin, TX	Michelle Scherer	Transformations of Organic Pollutants in the Presence of Green Rust
M. Bradley Hoos	Michigan State University, East Lansing, MI	Keri Hornbuckle	The Fate and Transport of Semi-Volatile Organics in Environmental Systems
Timothy Hunt, Jr.	Earlham College, Richmond, IN	Vicki Grassian	Surface Science Studies of Environmental Catalysis and Heterogeneous Atmospheric Processes
Sara Isley	Cornell College, Mt. Vernon, IA	Sarah Larsen	Spectroscopic Investigations of NO_x Catalysts
Gretchen Rodegerdts	Syracuse University, Syracuse, NY	Dave McGinnis	Global Climate Change
Ryan P. Shadbolt	Central Michigan University, Mt. Pleasant, MI	Dave McGinnis	Global Climate Change
Elizabeth Smith	University of Massachusetts, Amherst, MA	Luis Gonzalez & Greg Ludvigson	Sedimentary Geochemistry
Jason Veit	University of Iowa, Iowa City, IA	Greg Carmichael	Tropospheric Trace Gas Cycles in East Asia
Michelle von Arb	University of Iowa, Iowa City, IA	Gene Parkin	Bioremediation of Reducible Pollutants
Jennifer Wade	University of Iowa, Iowa City, IA	Vicki Grassian	Surface Science Studies of Environmental Catalysis and Heterogeneous Atmospheric Processes
Sarah I. Walker	University of Iowa, Iowa City, IA	Dave McGinnis	Global Climate Change

to work in the field of environmental science, who may continue their future association with CGRER. CGRER's REU program differs from those at other institutions by offering opportunities for involvement in multiple departments and colleges.

Graduate Student Travel Awards

In 2000, CGRER initiated a grant program to aid graduate students in traveling to their field research sites – a need that is overlooked by most other funding sources. A total of $10,500 was granted to the following 11 University of Iowa recipients of CGRER Graduate Student Travel Awards. To qualify, students were required to submit proposals that included demonstration of additional funding from sources (often home departments) other than CGRER.

THE REU PROGRAM IS DESIGNED TO HEIGHTEN STUDENT INVOLVEMENT IN RESEARCH, THUS ALLOWING STUDENTS TO MAKE INFORMED DECISIONS ABOUT FUTURE GRADUATE STUDIES AND CAREER GOALS.

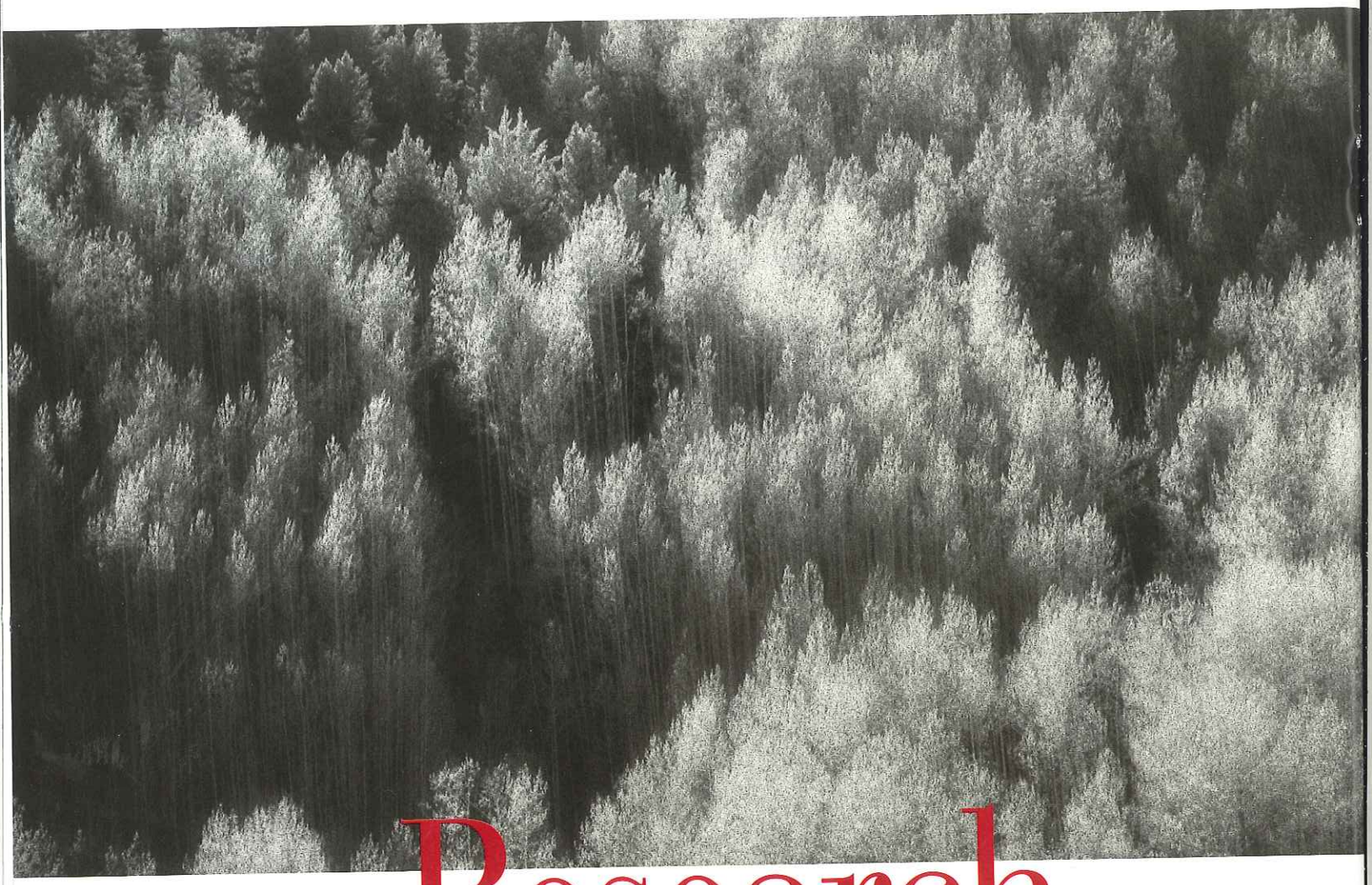
Student	Destination	Project
Matthew Bekker	Glacier National Park, Montana	Biotic Feedback and Spatio-Temporal Patterns of Tree Invasion into Tundra, Glacier National Park, Montana
Christopher Gienapp	Johnson & Cedar County field sites, Iowa	Pollination Rates and Pollinator Assemblages in Tallgrass Prairie Fragment
Roger Gomez	Jamaica	Paleoclimatic Reconstruction of the Caribbean Region from the Interpretation of Jamaican Stalagmites
Consuelo Guayara	Columbia & Brazil	Construction of Environmental Discourses in Columbia and Brazil
Patricia Levendofsky	Argentina	Comparing Desertification in Rio Negro, Argentina
Sondra Miller	Milwaukee, Wisconsin	Persistent Bioaccumulating Toxic Substances in Lake Michigan Air and Sediment
Nancy Muturi	Kenya	Reproductive Health Approach to Family Planning: Toward Strategic Communication for Development in Kenya
Heather Quevado	Hope, New Jersey	A High-Resolution Carbon Isotope Record of Atmospheric CO Increases During the Last Deglaciation from Varved Lake Sediments of the Pequest River Valley, New Jersey
Matthew St. Pierre	Johnson County field sites, Iowa	Do Host Plant Patch Size and Isolation Affect Population Dynamics and Dispersal Patterns of Phytophagous Prairie Insects?
David Ufnar	Calgary, Alberta, Canada	Excursion to Drill Core Repositories and Laboratories in Calgary, Alberta
Frederick Williams	Belgium Farm and Cone Marsh, Iowa	Genetic Divergence Between Sympatric Host Races of the Goldenrod Elliptical-Gall Moth

Additional Student Accomplishments

In 2000, approximately a dozen masters degrees and an equal number of doctoral degrees were awarded to students working with CGRER members. In addition, students working with CGRER members won a variety of awards, signs that they are already contributing to our developing body of knowledge about global change issues. The following is a sampling of honors and awards won by students of CGRER members in 2000:

- Amy Blair (honors student of Diana Horton), Hughes Undergraduate Summer Research Internship; Hughes Undergraduate Fall Research Internship
- Nicole Brown (student of Keri Hornbuckle), Kirsten Fellowship; Travel award from International Association for Great Lakes Research to present paper at IAGLER conference (Cornwall, Ontario)
- Dacian Daescu (student of Greg Carmichael), NASA Goddard Space Flight Center Summer Internship
- James Dorwart (student of Greg Carmichael), Selected for International Institute of Applied Systems Analysis Young Scientist Summer Program (Vienna, Austria)
- Jerry Gander (student of Gene Parkin and Michelle Scherer), National Science Foundation Graduate Research Fellowship; U.S. Environmental Protection Agency's Great Plains/Rocky Mountain Hazardous Substance Research Center's Best Poster Award (Third Place)
- Kelvin Gregory (student of Gene Parkin and Michelle Scherer), National Institutes of Health Traineeship in Biotechnology
- Sarath Guttikunda (student of Greg Carmichael), World Bank Summer Internship (China); NASA Global Change Fellowship
- Emad Habib (student of Witold Krajewski), Cited by the American Geophysical Union for writing the outstanding student paper of AGU's Hydrology Section
- Jennifer Holman-Dodds (student of Allen Bradley), EPA Star Fellowship
- Sondra Miller (student of Keri Hornbuckle), IAGLR/Mott Fellowship from the International Association for Great Lakes Research; Travel awards from International Association for Great Lakes Research and from the University of Iowa Women in Science and Engineering Program to present paper at IAGLER conference (Cornwall, Ontario)
- Aaron Peck (student of Keri Hornbuckle), Fisher Fellowship; Travel awards to present paper at Gordon Research Conference in Environmental Sciences (Plymouth, NH), and from International Association for Great Lakes Research to attend IAGLER conference (Cornwall, Ontario)
- Jeremy Rentz (student of Jerrry Schnoor), National Science Foundation Research Training Grant Fellowship
- Gretchen Smith (student of Keri Hornbuckle), Kirsten Fellowship; Travel award from University of Iowa Student Government Association to present poster session at International Association for Great Lakes Research Conference (Cornwall, Ontario)
- Narisara Thongboonchoo (student of Greg Carmichael), Participant in National Center for Atmospheric Research workshop on use and application of mesoscale models
- Renee Van't Land (student of William Eichinger), National Science Foundation Fellowship
- Aaron Williams (student of Michelle Scherer), nominated by U.S. Environmental Protection Agency's Great Plains/Rocky Mountain Hazardous Substance Research Center for Karen Morehouse Best Paper Award

STUDENTS WORKING WITH CGRER MEMBERS WON A VARIETY OF AWARDS, SIGNS THAT THEY ARE ALREADY CONTRIBUTING TO OUR DEVELOPING BODY OF KNOWLEDGE ABOUT GLOBAL CHANGE ISSUES.



Research

CGRER Fosters Global Change Research to Address Iowa's Needs

In 2000, CGRER continued to bring major new grants to the Center, as well as distribute seed grants to fund new research initiatives among its members. CGRER also continued to stimulate global change research through providing state-of-the-art research facilities and computer equipment to members and their students. These incentives have combined to shape research and policy agendas in a broad manner around the globe.

New CGRER Grants

CGRER received three major new three-year grants in 2000:

- Impact of Mineral and Other Aerosols and Asian Emissions on the Chemistry of the Troposphere (NASA, $375,748)
- Regional Scale Forecasting and Experiment-Specific Emission Estimates of Gas and Aerosol Distributions in Support of the TRACE-P Experiment (NASA, $263,099)
- Three-Dimensional, Regional-Scale Modeling of the Processes Affecting Aerosol and Chemical Distribution in East Asia and Support of Ace-Asia (NSF, $228,310)

The three projects are directed by principal investigator Greg Carmichael; David Streets, Argonne National Laboratory, will collaborate on the TRACE-P grant, and Itsushi Uno, Kyushu University, Japan, will collaborate on the Ace-Asia grant.

All three grants are working toward further characterizing Asia's air pollutants and their local and global impact, a subject of increasing international concern because of the rapid growth of Asia's economy and its resulting pollutant emissions. One of the grants examines the theoretical chemical changes in mineral aerosols as these pollutants are

released above Asia and as they move eastward across the Pacific Ocean. The other two grants are funding field studies of Asia's mineral aerosols and gas phase pollutants.

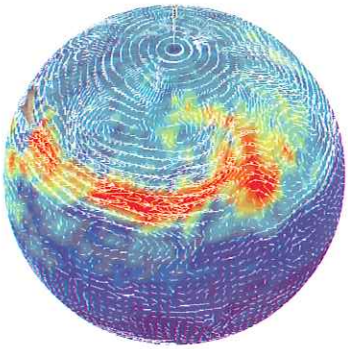
The latter studies are utilizing large aircraft to collect data on the quantity and source of these two types of pollutants, data that will enable determination of how the pollutants are modifying air quality in Asia and throughout the Pacific Basin, including the western United States. The studies are exciting in their use of sophisticated research aircraft guided by a new technology – computer models that predict air pollutant movement – to collect the data. After further refinement, such models will routinely provide "air pollution forecasts" (similar to today's weather forecasts) to the general public. Ultimately project data will feed into the testing and refinement of large global computer models of pollutant change and movement, which in turn will provide tools for further understanding of Asia's impact on global air quality and climate.

CGRER Research Spinoffs

While research results produce their own satisfaction, it's especially rewarding to see one's efforts playing a part in shaping broad new policy and research agendas. CGRER's Asian air quality studies have done so in the past year. A year ago, Greg Carmichael co-authored the first combined measurement and modeling study that established Asian air pollutants' demonstrable reduction of air quality in the western U.S. In July 2000, Carmichael traveled to Seattle to participate in the first workshop on this subject. Carmichael and Hiram Levy (Geophysical Fluid Dynamics Laboratory, Princeton), along with their graduate students, published a follow-up report in November 2000 (*Journal of Geophysical Research* 105:26931-26945). The birth of awareness of Asia's impact on global air quality has jolted both the research and policy communities. The U.S. Environmental Protection Agency and National Oceanic and Atmospheric Administration have initiated research programs on the subject, while policy makers are pondering how the growth of Asian emissions may be masking and thus aggravating efforts to control ozone and fine particle pollution in the western U.S.

CGRER's work also has impacted China's air quality.

THE BIRTH OF AWARENESS OF ASIA'S IMPACT ON GLOBAL AIR QUALITY HAS JOLTED BOTH THE RESEARCH AND POLICY COMMUNITIES.



A graphic generated by a CGRER model that demonstrates Asia's clear impact on Pacific Basin air quality. In red is a plume of combustion-generated carbon monoxide blowing rapidly from its site of generation (China, on left) eastward across Hawaii (center) to the western U.S. (right), extending from southern California to Anchorage, AK.

Over the past decade, a large international team of researchers has been developing a major computer model, RAINS Asia, that integrates the assessment of policy matters (such as fuel use or cost) with ecosystem threats (for example crop loss or acid rain). Carmichael has directed development of the model's atmospheric component; in December, he returned from the Sixth International Conference on Acidic Deposition in Japan, where a new version of the model was officially released. The model has encouraged the Chinese government to reduce and switch fuel use in regions with sulfur emission problems, with the unexpected result that China's sulfur emissions not only have stabilized, but also recently have decreased.

The emerging recognition of ties between environmental problems and human health concerns currently is stimulating an extension of the model to provide a single integrated tool for investigating air quality problems, policies, and health issues in Asia's megacities.

CGRER Seed Grants

In 2000, CGRER distributed a total of $120,000 to the following seven University of Iowa recipients of seed grants, which were awarded for the period 8/2000 through 7/2001:

Name	Amount	Title
Arthur Bettis, Geoscience	$19,252	Stable Carbon Isotope Record of Holocene Vegetation and Climate Change in Alluvial Fans
Vicki Grassian, Chemistry	$20,000	The Role of Heterogeneous Photochemistry in the Atmosphere
Stephen Heard, Biological Sciences	$18,750	Latitudinal Gradients in Phenology of Insect Attack and Host-Associated Genetic Differentiation in the Goldenrod Elliptical-Gall Moth
Rich Horowitz, American Studies	$14,295	An Ethnographic Study of Climate Considerations in Regional Agricultural Decisions
Diana Horton, Biological Sciences	$9,245	Fragile Flora Database: Iowa's Endangered, Threatened, and Special Concern Plants
Sarah Larsen, Chemistry	$19,908	Solid State NMR Studies of Environmental Catalysts
David McGinnis, Geography	$18,550	Downscaling Local Precipitation from Large-Scale Atmospheric Conditions Using Synoptic Weather Classification and Neural Networks

CGRER Aids for Researchers

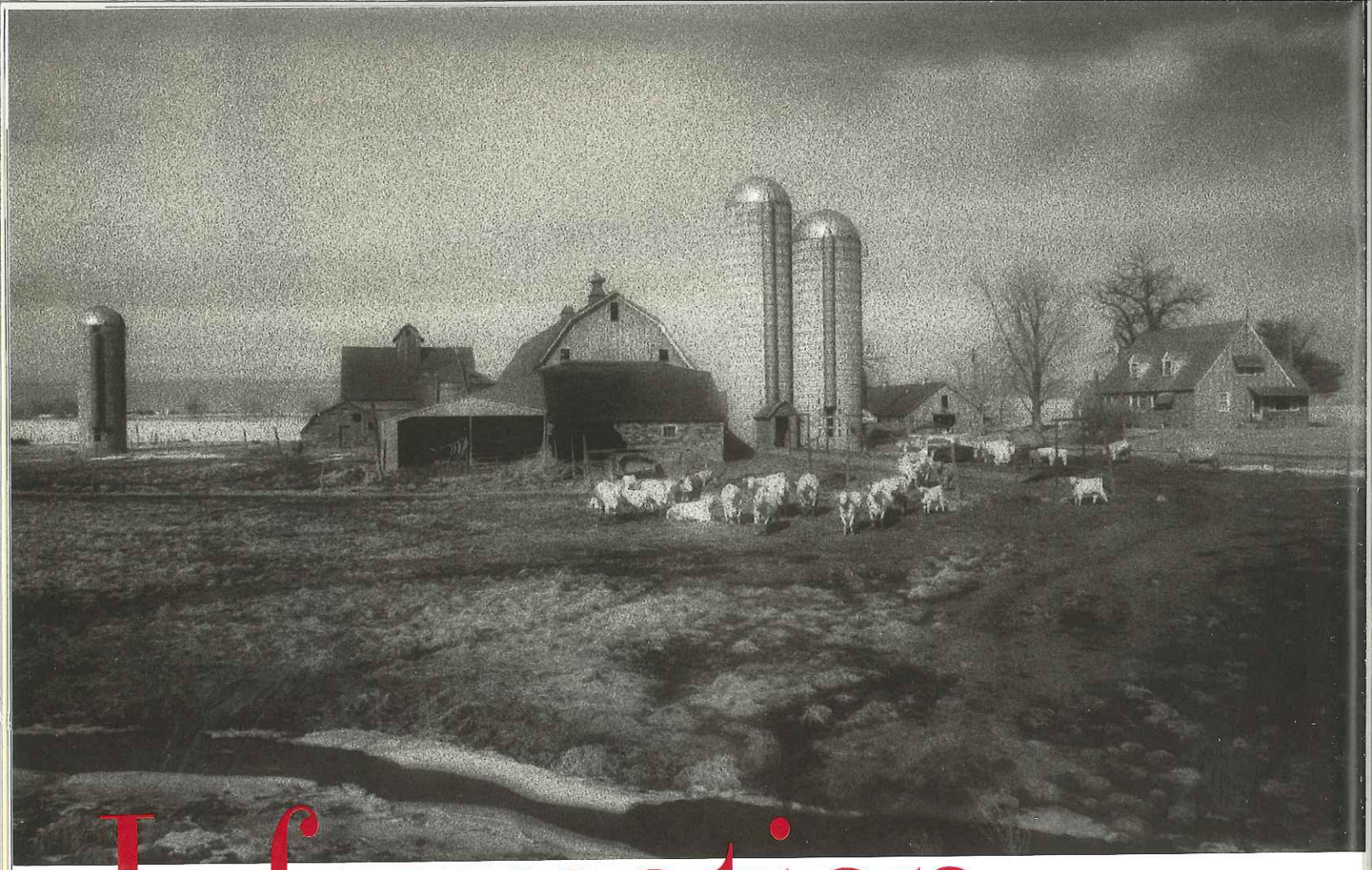
The Iowa Advanced Technology Laboratories on the University of Iowa campus continue to provide office, meeting, and laboratory space to CGRER members. CGRER also continues to update its computer and visualization equipment, and to make it and global positioning system (GPS) equipment available to CGRER researchers and their students. In 2000, CGRER's computer laboratory purchased two new scanners and five new computers. Purchase of an AutoRAID, a disk array file storage system, has greatly magnified the amount of available disk space. CGRER is continuing to function as a campus-wide GIS (geographical information system) software distributor through its site license with the Environmental Systems Research Institute (ESRI), and is continually receiving new upgrades for its ESRI suite of GIS software.

Additional Faculty Honors

CGRER members' contributions to ongoing global change research and dialogue are reflected in part in the accolades they receive. Following is a partial list of awards and honors received by members in year 2000:

- Richard Baker (UI, Geoscience): Elected Member of the American Quaternary Association Council
- E. Arthur Bettis (UI, Geoscience): Elected Fellow of the Geological Society of America
- Gregory Carmichael (UI, Chemical and Biochemical Engineering and Co-Director, CGRER): Received Distinguished Guest Professor Award, Japanese Ministry of Education and Culture, three months collaborative research at Disaster Prevention Research Institute, Kyoto University, Japan (summer 2000); First recipient, Recognition Award from Sixth International Conference on Atmospheric Sciences and Applications to Air Quality
- William Eichinger (UI, Civil and Environmental Engineering): Received Collegiate Teaching Award, U.I. College of Engineering
- David Forkenbrock (UI, Public Policy Center), Received Award for Excellence in Transportation from Iowa State University and Iowa Department of Transportation; Appointed Chair of Transportation Economics Committee of Transportation Research Board, National Academy of Sciences
- Keri Hornbuckle (UI, Civil and Environmental Engineering): Appointed Liaison, Canada and the U.S.'s International Joint Commission's (IJC's) International Air Quality Advisory Board; Reappointed Member, IJC's Science Advisory Board
- Diana Horton (UI, Biological Sciences): Appointed Member of National Science Foundation Review Panel for International Research; Member of Botanical Society of America Conservation Committee
- Witold Krajewski (UI, Civil and Environmental Engineering): Selected as Associate Editor of the *Journal of Hydrologic Engineering*
- Lou Licht (UI, Civil and Environmental Engineering): Received (with Jay Brady, Stanley Consultants, Muscatine) Iowa Consulting Engineers Council first place award for design of a landfill cap at the Great River Regional Waste Authority, Fort Madison, Iowa
- David McGinnis (UI, Geography): Elected Secretary-Treasurer, Climate Specialty Group, Association of American Geographers
- Gene Parkin (UI, Civil and Environmental Engineering): Reappointed to National Research Council's Environmental Remediation at U.S. Naval Facilities Committee
- Michelle Scherer (UI, Civil and Environmental Engineering): Received National Science Foundation CAREER Award, $200,000 award to carry out research on Reactivity of Green Rust Minerals in Natural and Engineered Systems for four years
- Jerald Schnoor (UI, Civil and Environmental Engineering and Co-Director, CGRER): Received Hancher-Finkbine Medallion, University of Iowa; Appointed Member, Executive Committee of the Science Advisory Board, U.S. Environmental Protection Agency; Appointed Chair, Office of Research and Development Board of Scientific Counselors, U.S. Environmental Protection Agency
- Theodore Smith (UI, Mechanical Engineering): Received U.I. College of Engineering Service Award
- Peter Thorne (UI, Occupational and Environmental Health):Named Co-Director, University of Iowa's Environmental Health Sciences Research Center; to become Director 4/2001

CGRER MEMBERS' CONTRIBUTIONS TO ONGOING GLOBAL CHANGE RESEARCH AND DIALOGUE ARE REFLECTED IN PART IN THE ACCOLADES THEY RECEIVE.



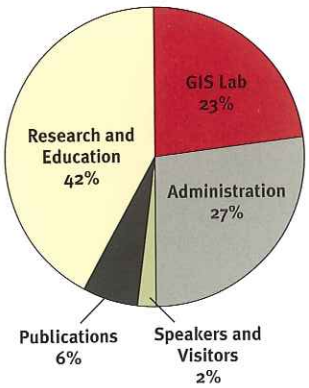
Information

Budget

In fiscal year 2000 (July 1, 1999 – June 30, 2000), nearly three-fourths of CGRER's $445,727 of funding was spent on research, education, and outreach directed toward global change issues (Figure 1). Administrative costs consumed the remaining quarter of the budget.

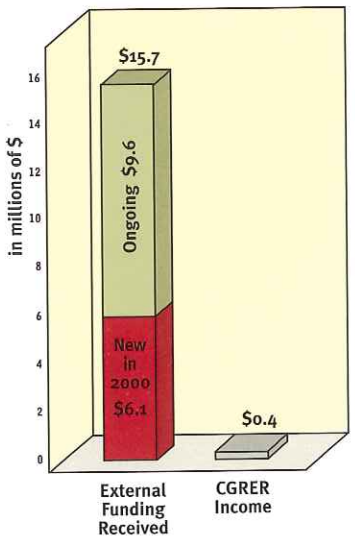
This funding, received in total from an assessment on Iowa's gas and electric utilities through the State Department of Commerce, was magnified many times in the millions of dollars of external grants and contracts awarded to CGRER members (Figure 2). In calendar year 2000, CGRER members were performing research that brought in a total of $15.7 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, $6.1 million was new funding that was initiated in 2000, while the remaining $9.6 million came from ongoing projects.

Figure 1.
CGRER'S Expenses*



* Applies to Fiscal Year 2000

Figure 2.
2000 Leveraging of CGRER'S Income*



* Applies to Calendar Year 2000

Administration and Membership

CGRER is directed by University of Iowa professors Gregory Carmichael (Department of Chemical and Biochemical Engineering) and Jerald Schnoor (Department of Civil and Environmental Engineering). Center activities are guided by an elected Executive Committee that consists of eleven members plus the two co-directors. The Executive Committee meets monthly to plan initiatives and chart CGRER's course. An Advisory Board of eight members from outside the academic community meets annually to lend oversight to CGRER's activities (see page 3 for Advisory Board members).

Since 1992, CGRER has employed two full-time staff members. Administrative assistant Jane Frank oversees office operations. Jeremie Moen manages CGRER's computer facilities with the aid of services contracted from the Iowa Computer Aided Engineering Network. CGRER reports directly to the UI's Vice President for Research, Dr. David Skorton.

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