IOWA WATCH

THE CENTER FOR GLOBAL AND REGIONAL ENVIRONMENTAL RESEARCH

FALL 2005

Retrospective

In 1989, UI President Hunter Rawlings wrote, "It is especially frightening that molecules of some of the gases we are now releasing will still be influencing our atmosphere 500 years from now . . . I hope that the University of Iowa can place itself in position to provide national leadership in this area." With this letter to Professor Greg Carmichael, he validated the efforts of a dozen or so professors who had begun meeting to discuss Earth's stressed and changing environments.

This "Global Group," as it called itself, consisted of professors from several science and engineering departments, as well as public policy, all focusing on some aspect of earth science. Proactive and energetic, the Global Group was already organizing a UI-ISU climate change symposium and UI-funded seminar series. Then, with the endorsement of President Rawlings and Governor Terry Branstad (both of whom attended the symposium), the Global Group went one step further. It proposed the formal establishment of a UI global studies center. The purpose of this center would be "multidisciplinary research activities necessary for the development of a predictive understanding of the effects and impacts of environmental changes on regional scales."

When Iowa's State Board of Regents endorsed this center proposal in February 1990, it must have been acting on sheer faith, for no funding was in sight. Or perhaps the Regents were responding to Professor Carmichael's sentiments, expressed in an earlier letter to an Iowa legislator. That letter described global warming's effects as "potentially devastating. I feel that global change must begin to be factored into governmental and corporate planning," an effort he felt would be aided by the center's research on Earth's systems.

The following year saw the fortuitous passage of Iowa's Energy Efficiency Act (EEA). Among other things, the EEA required an assessment of 0.1% of the total gross operating revenues of Iowa's gas and electric public utilities. Fifteen percent of that assessment—0.015% of the utilities' revenues—was

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This issue of IoWatch summarizes the history and accomplishments of CGRER's first fifteen years.

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designated for support of the UI's global warming center. CGRER—the UI-based Center for Global and Regional Environmental Research—was off and running. CGRER continues to receive proportionally the same EEA funding, although the total annual grant has increased about 50% (from $363,796 in fiscal 1991-92, to $539,750 in fiscal 2004-05).

This secure financial backing has freed CGRER to focus on its primary function: facilitating interactions and efforts of diverse researchers, and thus helping Iowa, and Iowans, adapt to changing climates and environments. Stable financing has shaped CGRER's structure and function, allowing it to offer Seed Grants, support students, and supply logistical support without threat of interruption. Stable funding also has strengthened CGRER's ability to promote diverse, creative efforts and ideas that may otherwise have floundered—for example to support student travel to sustainability conferences, a 1997 workshop on numerically modeling tree migration, and the 1998 project to put the UI's herbarium online.

That said, what has CGRER accomplished since its establishment? Has it lived up to its promises? Initial descriptions of CGRER proposed five discrete goals. The following paragraphs recount these goals, and elaborate upon how CGRER has addressed each one during its first 15 years.

Footnote - *Content and quotations taken from letters and papers in CGRER's archival files, CGRER newsletters and annual reports, and personal communications with co-directors G Carmichael and J Schnoor, and CGRER administrator J Frank.*

TIMELINE

1989 Global Group starts meeting, hosts global change symposium and seminar series, proposes formal Center

1990 CGRER formally established by State Board of Regents

1991 CGRER receives first state funding (ongoing)

1992 CGRER hires current Administrative Assistant Jane Frank and establishes formal office, first in Jessup Hall, then at IATL

1993 CGRER Advisory Board established (ongoing)

2002 CGRER facilities consolidated on fourth floor of IATL (ongoing)

Goal 1

Establish a center of excellence in global change that promotes interactions among researchers interested in its effects

CGRER's major goal—and its main accomplishment—lies in facilitating interactions among researchers who are focused on global change issues. To this end, CGRER has utilized diverse mechanisms to bring together faculty and students of different disciplines, outlooks, institutions, and nationalities to share problems, programs, and creative ideas. By mid-2005, CGRER had:

- Hosted 4 symposia on environmental change
- Published 15 newsletters and 8 Annual Reports
- Sponsored 134 seminars, with speakers coming from 16 countries
- Welcomed and worked with 70 visiting scientists and about 10 post-doctoral research associates
- Joined 3 multi-institutional alliances

CGRER has used its influence and funds to attract and retain faculty at the UI. It has also promoted alliances between the UI and foreign institutions such as Nepal's Himalayan Climate Center, with which CGRER has exchanged research personnel, equipment, and educational programs.

These types of efforts have pulled researchers in new directions and promoted unlikely interdisciplinary alliances. Resulting collaborations have nurtured Goals 2 through 5. Through CGRER, chemists have worked with atmospheric scientists; climate change researchers have mentored students in public health; new equipment has stimulated paleoclimate research; and engineers have been drawn into policy negotiations and worked collaboratively with Iowa's energy utilities.

Fertile interactions were expected to produce a "center of excellence" whose efforts and influence reached far beyond Iowa's borders. This has occurred with CGRER's atmospheric modeling research, which has generated international awareness of Asia's impact on global air quality and has catalyzed new research programs at EPA and NOAA. CGRER's models are now integrated into multinational studies of weather patterns and air pollutants circulating the globe, and are moving researchers toward "chemical weather (pollution) forecasts." CGRER's modeling efforts have influenced

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TIMELINE

1989 UI's "Global Group" organizes *Preparing for Climate Change: A Midwest Perspective* symposium (joint UI - ISU), also seminar series

1992 CGRER starts series of regular seminars (ongoing)

1993 CGRER elected to UCAR (ongoing)

CGRER hosts first Visiting Research Scientist (ongoing)

1994 CGRER holds symposium, *Global Change II: A Midwest Perspective*

First CGRER newsletter (*IoWatch*) published (ongoing)

1995 CGRER's *Preparing for Global Change: A Midwestern Perspective* (proceedings of 1994 symposium) published by SPB Academic Publishing, The Netherlands

CGRER joins the UCGIS (ongoing)

1996 CGRER establishes web site (ongoing)

CGRER organizes UI interdisciplinary seminar series, *The Effects of Global Climate Change on Human Health*

1998 First CGRER annual report published, for 1997 (ongoing)

1999 CGRER holds *The Science of Global Climate Change: A Symposium on the State-of-the-Science* as part of Iowa UNA program

CGRER's Fulbright-Hays grant takes 12 UI faculty and students to Nepal for a month to study water issues; outgrowth of broader collaborations with Nepal

2001 CGRER organizes *UI Global Environmental Politics Colloquium-Seminar Series*

2002 CGRER hires 2-year postdoctoral fellow, Meredith Gooding, to help establish *Health and Environment Initiative* on campus

CGRER joins Upper and Middle Mississippi Valley CESU

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Asian policy and economic decisions; broadened to encompass health, development, and ecological questions; and been incorporated into training and application packages for foreign planners and officials.

CGRER's influence has been demonstrated by the impact of its members on national and international agendas, as they edit numerous professional journals; guide committees of the WMO, UNEP, NIH, IGBP, EPA, NSF, the NRC , and other influential bodies; and consult with foreign governments on climate and environmental-change matters.

TIMELINE

2003 CGRER cosponsors *The Green Awakening—Redefining Prosperity symposium* at UI

2004 CGRER sponsors NSF-funded workshop for CLEANER project

2005 CGRER plans NSF-funded *Environmental Observatories Workshop*, with joint participation of CLEANER and CUAHSI projects

Goal 2

Pursue funding for multidisciplinary projects from federal, state, and private sources

CGRER's efforts have generated generous research funding. By mid-2005, CGRER had directly received 50 grants and contracts, totaling $14,215,793. Grant numbers and dollar amounts would be multiplied many times if grants and contracts received by CGRER members (but not channeled through the Center) were counted.

Many CGRER-initiated projects have blended disciplines and colleges. One highly successful effort has integrated chemical engineering, chemistry, and physics to constitute a new research field, heterogeneous atmospheric chemistry, which focuses on synergisms between gases and mineral dust in the troposphere. CGRER's research helped establish this scientific field and has led to major new NSF and DOE funding initiatives. More recently this initiative has stimulated formation of IPART—a multi-college consortium of UI researchers interested in multi-disciplinary studies of particles and aerosols.

CGRER's Seed Grant program, which through 2005 had awarded $1,367,704 to 78 projects, is intended to jump-start research efforts. Funding, typically between $15,000 and $25,000, is awarded to global-change-related projects that are likely to lead to larger awards from other sources. Successes have been common. For example a 1996 Seed Grant to geologist Greg Ludvigson and colleagues helped initiate studies, now funded by NSF, of hydrological regimes in the Cretaceous "Greenhouse World." These studies are significant in predicting the near-future effects of increasing greenhouse gasses.

Many of CGRER's projects have brought together a few investigators or disciplines. CGRER continues to strive to attract a major "center grant" that would coalesce efforts of a dozen or more investigators and disciplines. The recent reception of two NSF-funded CLEANER planning grants may achieve this goal. This inter-institutional award, received jointly with the UI's IIHR-Hydroscience & Engineering, will enable CGRER to assist in forming a consortium of environmental researchers to design a National Environmental Observatory to monitor, analyze, visualize, and forecast widespread environmental problems.

TIMELINE

1992 CGRER receives its first grant

CGRER awards first round of Seed Grants (ongoing)

1997 CGRER receives Dreyfus Foundation grant for hiring a postdoctoral research associate in heterogeneous atmospheric chemistry

CGRER replaces Seed Grants with Iowa's Environmental Future grants

1998 CGRER performs some of first research in heterogeneous atmospheric chemistry, studying interactions of aerosolized mineral surfaces and organic molecules

1999 CGRER reinstitutes Seed Grant program

2004-2005 CGRER joint recipient of NSF-funded CLEANER planning grants

Goal 3

Attract highly qualified students . . . who are interested in environmental change; provide personnel for careers in environmental-change science and policy

Students are the major product of any university program. CGRER focuses on attracting and educating students with a flair for reshaping environmental research, policies, and ideas, trusting that they will become the future's wellspring of global change efforts. Many of the dozens who have received CGRER research assistantships or been housed at CGRER, and the hundreds more who have been mentored by CGRER members, have gone into professorships and environmental agency careers around the globe. Some have entered uncommon positions: for example, Jim Yienger, upon graduation, went from CGRER to heading up India's Cities for Climate Protection Program.

CGRER-affiliated graduate and undergraduate students benefit from several concrete amenities: office space and use of high-powered computers; training and assistance in modeling; access to field facilities and other technical support; and research assistantships, research-travel grants, and crucial stipends for other efforts. They are afforded enhanced opportunities: capitalizing on their CGRER connections, students have applied successfully for a number of competitive fellowships and summer internships, sponsored for example by NASA, NCAR, UCAR, and IIASA. Students also benefit from CGRER-organized courses and programs, as do younger students, teachers, and policy-makers worldwide.

CGRER students also profit significantly from day-to-day contact with others passionate about sustainability and global change issues. CGRER's lively mixture of students, visitors, and professors from different disciplines sometimes produces sterling results. Such was the 2003 creation of ESF (now ESW), formed by proactive students who immediately proceeded to organize a UI Progressive Career Fair, promote educational efforts here and in Mexico, attend conferences, and activate other efforts focused on sustainability and social justice. These types of student activities are helping redirect the UI curriculum and campus toward sustainability, while simultaneously attracting new students and research grants.

TIMELINE

1992 CGRER receives NASA-funded Earth Systems Science Education grant to develop curriculum materials for earth systems science education

1996 - CGRER sponsors Atmospheric Chemistry and Transport, innovative UI-ISU class using Iowa Cable Network, email, and class web page

2000 CGRER commences 3-year NSF-funded Research Experience for Undergraduates training program (total 39 participants)

CGRER establishes Graduate Student Travel Award grant program (ongoing; 37 awards totaling $34,000 offered through 2005)

2002 CGRER sponsors Sustainable Futures for Iowa writing program for college students through Iowa UNA; 6 participants and CGRER members attend UN's World Summit for Sustainable Development

CGRER helps World Bank create online course, Urban Air Quality Management, for worldwide use

2003 CGRER students organize ESF, activist organization focusing on environmental sustainability and social justice

CGRER joins Iowa DNR in organizing new UI engineering course, Sustainable Systems, first taught 2004 (ongoing)

2004 CGRER develops air pollution models for training Brazilians about assessing regional air quality

ESF broadens beyond CGRER, becomes UI's ESW chapter that continues to stimulate diverse sustainability efforts in campus planning, financing, purchasing, etc. (ongoing)

CGRER cosponsors Teacher at Sea internship, training high-school teacher about atmospheric research

2005 CGRER students receive a "P3" EPA grant to fund cross-cultural pollution-training efforts; establish a weekly radio show, Environment at Iowa; remain active in UI Green Campus Initiative (ongoing)

Goal 4

Acquire state-of-the-science equipment and facilities essential to the conduct of global change research

CGRER was initially envisioned as a "virtual center," where researchers would come together to manipulate and visualize complex environmental data in computer laboratories. In 1990, the GIS tools for doing so were expensive, complex, and out of reach of most departments. CGRER played a seminal role in bringing these tools to the UI campus, when it established a GIS Computer Laboratory in the Engineering Building, using grant funds from the UI President's Strategic Planning Initiative and individual investigators, and equipment donations from Hewlett-Packard.

CGRER's state-of-the-art GIS Computer Laboratory, technical support services, and training programs have remained near the center of its functions. However, GIS programs today can be operated on desktop computers anywhere on campus, and CGRER has continually upgraded to provide other types of computer facilities. For example CGRER now provides its members and students with ready access to the high-performance computing required for complex simulations and modeling, as well as mass storage of large data sets.

CGRER has meanwhile offered additional otherwise-unavailable research tools: mapping-quality GPS equipment, rural field research stations, and Seed-Grant-funded equipment for specific research projects. CGRER provided the financial, moral, and administrative support necessary for establishing the Paul H. Nelson Stable Isotope Laboratory in the UI's Geoscience Department. This in-house facility was crucial to broadening the scope of the paleoclimate research group on campus. In the last few years, CGRER has helped fund two environmental monitoring towers: one for continuously recording wind data, and a second for continuously monitoring greenhouse gases. Both provide data for graduate research efforts.

TIMELINE

1990 CGRER establishes GIS Computer Laboratory in Engineering Building

1992 CGRER hires first Data Systems Coordinator, Mark MacLennan

GIS Computer Laboratory moved to IATL

1997 CGRER provides mapping-quality GPS equipment to Office of the State Archaeologist

Data Systems Coordinator Mark MacLennan replaced by Glenn Larson

1998 CGRER obtains an ImmersaDesk, GIS-based virtual reality visualization research tool with high-resolution stereoscopic screen

Paul H. Nelson Stable Isotope Laboratory (partially funded by CGRER) opens in UI Geoscience department (ongoing); official grand opening, 1999

1999 CGRER Seed Grants help establish Iowa Atmospheric Measurement Station and Atmospheric Reaction Chamber at UI

CGRER's present computer consultant, Jeremie Moen, hired

CGRER helps purchase university-wide ESRI site license, becomes 1 of UI's 4 sites for training faculty and students in use of GIS software (ongoing)

2001 CGRER initiates research-oriented Iowa Weather Forecasting System website (ongoing)

2002-2004 CGRER installs enhanced computing capabilities at rate of one Linux cluster per year

2004 CGRER Seed Grants help fund Aerosol Flow-Absorption Cell

CGRER funds wind-data tower

2005 CGRER partially funds greenhouse-gas-monitoring tower

Goal 5

Assist the state and its industries in their activities related to the effects of environmental change

CGRER pledged to use its skills to help Iowa agencies and industries adapt to changing environments. It has done so through conducting research and guiding state-based programs in energy production, reduction of greenhouse gas emissions, and carbon sequestration. Through such efforts, CGRER addresses climate change and nudges Iowa toward sustainability.

CGRER's efforts commenced in 1994 with the EPA-funded *Iowa Greenhouse Gas Action Plan* project, completed for the Iowa DNR. CGRER developed options for reducing greenhouse gas emissions that were specific to Iowa, and quantified the results of each of 16 major recommendations. This effort stimulated several carbon sequestration research projects at ISU and the UI.

One major recommendation involved the growing of biofuels. In 1998, CGRER participated in the DOE-funded *Chariton Valley Biomass Project* to investigate environmental and economic advantages of co-burning switchgrass with coal. Trial burns of switchgrass in Alliant's Ottumwa Generating Station were highly successful, but economics have prevented the project's implementation.

Such investigations stimulated the co-burning of Quaker Oats waste oat hulls in the UI's Power Plant, a project furthered by CGRER's evaluation and research, and one that in 2003 started saving the UI a half-million dollars annually while reducing its greenhouse gas emissions.

These energy projects have brought state awards to both CGRER and the UI. Their results have been shared at conferences and through teacher workshops and publications. CGRER's energy expertise has guided UI policy while reducing the university's expenditures and environmental impacts: in 2004, with CGRER's encouragement, the UI joined the Chicago Climate Exchange (for trading greenhouse gas credits) and formed an Energy Conservation Advisory Council (staffed partially by CGRER members). In 2005, the UI became an Energy Star partner and held its first Energy Awareness Month.

TIMELINE

1994 CGRER initiates work on *Iowa Greenhouse Gas Action Plan*

1996 CGRER writes first *Iowa Greenhouse Gas Action Plan* report (with Public Policy Center)

1997 CGRER funds workshops on greenhouse gas issues for Iowa public school teachers, farmers, and others

1998 CGRER receives Iowa DNR's *Iowa Energy Leadership Award* for contributions to Iowa's energy efficiency and renewable energy

CGRER initiates studies on using switchgrass as biofuel for the *Chariton Valley Biomass Project* (for Chariton Valley RC&D, Inc.)

2001 CGRER publishes *Iowa Greenhouse Gas Action Plan* final report, *Greenhouse Gas Phase III—Carbon Storage Quantification and Methodology Demonstration*

Ottumwa Generation Station reports successful test burns of switchgrass for the *Chariton Valley Biomass Project* (completed 2004)

CGRER publishes *Greenhouse Gas Emission Impacts of Substituting Switchgrass for Coal in Electric Generation: The Chariton Valley Biomass Project*

2002 CGRER facilitates trial burns of waste oat hulls by UI power plant

2003 CGRER cosponsors Alliant Energy's *Energy Policy and Global Climate Change: A Path Forward* conference

UI Power Plant implements co-burning of waste oat hulls (ongoing)

2004 UI Power Plant receives two *Iowa Environmental Excellence Awards*

2005 UI policy continues to incorporate diverse CGRER recommendations for energy conservation (ongoing)

Conclusion:

CGRER was established to address complicated and pressing issues about human actions and changing environments. But doing so has sometimes been like shooting at a moving target. Since CGRER's establishment in 1990, our understanding of the problems we face and our responses to those problems have evolved. Consider global warming. In the 1980s, researchers understood it as theory, but many disputed its actual existence. Come the 1990s and the existence of global warming came into clearer focus, but many questioned its relationship to human activities such as the burning of fossil fuels. By the early 21st century, both researchers and the general public accepted that global warming and human activities are closely linked.

Earth continues to teach us that security of our homeland depends on nature's health. We see global warming's results in shrinking polar ice caps, melting permafrost, and rising ocean temperatures. But what are the implications of such changes? How do they interact to redefine Earth's ecological functions? How will they impact civilization? And how can we cope with global warming and its effects in an effective and socially acceptable manner? In a sense, we are seeking an essential prescription for the future, even as the patient's illness remains partially veiled.

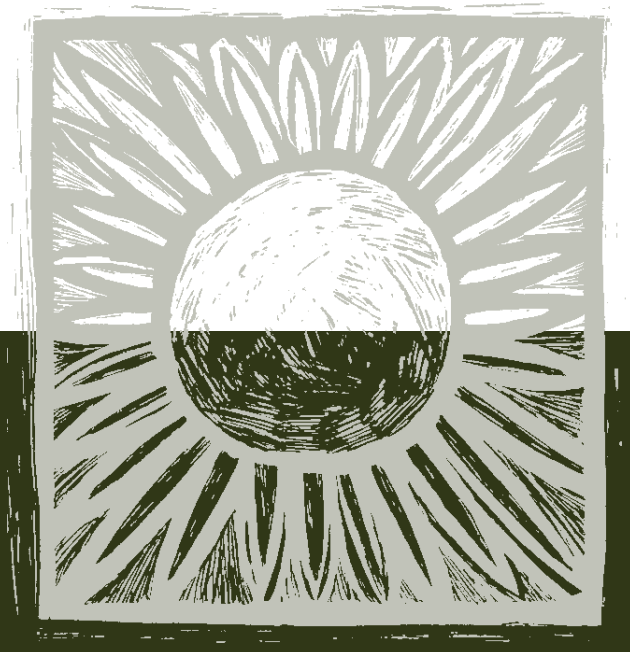
In the midst of this challenge, while environmental changes accelerate and Earth's responses shift, CGRER continues to provide a stable base for operation. CGRER's primary mission remains firm: to promote interactions among diverse researchers and students, in hopes of producing creative new solutions to evolving problems. Through its logistical and financial support, CGRER helps empower its members' efforts to observe and model changing environments, and to move toward predictability. Once that goal is reached, CGRER and other global change centers across the country can close their doors. But at the present, CGRER's continued efforts and energetic investigations remain a necessity.

TIMELINE

2005
2006
2007
2008
2009
2010
2011
2012

CGRER continues to organize symposia and offer seminars, coordinate a GIS Computer Laboratory and other research tools, host visiting research scientists, organize classes and train students, fund Seed Grants and Graduate Student Travel Awards, publish *IoWatch* and annual reports, receive diverse research grants, house and encourage students, and otherwise promote interactions and diverse research and educational efforts addressing global change issues (ongoing)

glossary



CESU:
Cooperative Ecosystem Study Unit

CLEANER:
Collaborative Large-Scale Engineering Analysis Network for Environmental Research

CUAHSI:
Consortium of Universities for the Advancement of Hydrologic Sciences, Inc.

DOE:
Department of Energy

DNR:
Department of Natural Resources

EPA:
Environmental Protection Agency

ESF:
Engineers for Sustainable Futures

ESRI:
Environmental Systems Research Institute

ESW:
Engineers for a Sustainable World

GIS:
Geographic Information System

GPS:
Global Positioning System

IATL:
Iowa Advanced Technology Laboratories

IGBP:
International Geosphere-Biosphere Programme

IIASA:
International Institute for Applied Systems Analysis

IPART:
Iowa Particle and Aerosol Research and Technology program

ISU:
Iowa State University

NASA:
National Aeronautics and Space Administration

NCAR:
National Center for Atmospheric Research

NIH:
National Institutes of Health

NOAA:
National Oceanic and Atmospheric Administration

NRC:
National Research Council

NSF:
National Science Foundation

P3 (EPA grants):
People, Prosperity, and Planet

RC&D:
Resource Conservation and Development

UCAR:
University Corporation for Atmospheric Research

UCGIS:
University Consortium for Geographic Information Science

UI:
University of Iowa

UNA:
United Nations Association

UNEP:
United Nations Environment Programme

WMO: World Meteorological Organization

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The University of Iowa

IOWA WATCH

THE CENTER FOR GLOBAL AND REGIONAL ENVIRONMENTAL RESEARCH

The University of Iowa's Center for Global and Regional Environmental Research (CGRER) promotes interdisciplinary efforts that focus on the multiple aspects of global environmental change, including its regional effects on natural ecosystems, environments, and resources, and on human health, culture, and social systems. Center membership is composed of interested faculty members at any of Iowa's colleges and universities.

Center goals are promoted by encouraging interdisciplinary research and dialogue among individuals whose disciplines touch upon any of the multifaceted aspects of global change. More specifically, the Center awards seed grants, fosters interdisciplinary courses, provides state-of-the-art research facilities and equipment, and holds seminars and symposia. The Center encourages students to broaden their studies and research through considering the multidisciplinary aspects of global and regional environmental problems. Through such activities, the Center attempts to assist Iowa's agencies, industries, and citizens as they prepare for accelerated environmental change that may accompany modern technologies.

Housed in the Iowa Advanced Technology Laboratory at the University of Iowa, the Center was established by the State Board of Regents in 1990 and received funding from a public utility trust fund, as mandated by the State of Iowa's Energy Efficiency Act.

IoWatch is published each fall. Comments, questions, and requests for additional copies should be directed to:

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