**Renewal Proposal for the**

**Penn State Center for Climate Risk Management (CLIMA)**

Submitted to the Earth and Environmental Systems Institute

By

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and

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## Summary

The Center for Climate Risk Management was established three years ago with broad support across colleges and institutes to catalyze interdisciplinary research and education in the area of climate risk management. CLIMA has achieved these goals by four main activities: (i) providing new tools (e.g., a new Integrated assessment model of climate change), (ii) community building (e.g., through seminar series and an email list), (iii) outreach (e.g., a professionally designed and maintained webpage clima.psu.edu), and (iv) leveraging external funding (the ratio of new external research grants with sizeable inputs from CLIMA scientists to the PSU investment exceeds a factor of 100). Here we request continued administrative and financial support to expand the center's scope and scale. Specifically, we propose to broaden the contributions from the social sciences, expand the ethical analysis of climate change adaptation and geoengineering strategies, and start a formal summer student internship program.

We request EESI funds of $15k/yr. These funds are leveraged by existing external research grants and by already committed financial support from the College of Liberal Arts Rock Ethics Institute ($29k/yr, averaged), the Penn State Institutes of Energy and the Environment ($20 k/yr), and the College of Agricultural Sciences' Environment and Natural Resources Institute ($2k/yr).

CLIMA-supported research and education will increase Penn State's ability to compete for new external grants in the rapidly growing field of climate risk management. CLIMA also addresses a question of increasing importance to the University's Energy Initiative (as well as federal and industry funding programs) and provides a tool for recruiting top-quality students and faculty.

**List of current CLIMA Associates, their Departments, and Colleges**
**(Co-) Directors in bold font**

| | |
|---|---|
| Dave Abler | Agricultural Economics and Rural Sociology, Agricultural Sciences |
| Richard Alley | Geosciences, Earth and Mineral Sciences |
| Seth Blumsack | Energy and Mineral Engineering, Earth and Mineral Sciences |
| Jamison E. Colburn | Dickinson School of Law |
| Ken Davis | Meteorology, Earth and Mineral Sciences |
| Darryl Farber | Science, Technology, and Society, Engineering and Liberal Arts |
| Jenni Evans | Meteorology, Earth and Mineral Sciences |
| **Karen Fisher Vanden** | **Agricultural Economics and Rural Sociology, Agricultural Sciences** |
| Chris Forest | Meteorology, Earth and Mineral Sciences |
| **Murali Haran** | **Statistics, Science** |
| Armen Kemanian | Agricultural Economics and Rural Sociology, Agricultural Sciences |
| **Klaus Keller** | **Geosciences, Earth and Mineral Sciences** |
| Andy Kleit | Meteorology, Earth and Mineral Sciences |
| Michael Mann | Meteorology, Earth and Mineral Sciences |
| Patrick Reed | Civil and Environmental Engineering, Engineering |
| David Pollard | Earth and Environmental Systems Institute |
| Mark Roberts | Department of Economics, Liberal Arts |
| Jim Shortle | Agricultural Economics and Rural Sociology, Agricultural Sciences |
| **Janet Swim** | **Psychology, Liberal Arts** |
| Anne Thompson | Meteorology, Earth and Mineral Sciences |
| Petra Tschakert | Geography, Earth and Mineral Sciences |
| **Nancy Tuana** | **Philosophy, Liberal Arts** |
| **Thorsten Wagener** | **Civil and Environmental Engineering, Engineering** |
| Brent Yarnal | Geography, Earth and Mineral Sciences |

**The Problem**

Unmanaged anthropogenic climate change poses serious risks. One vital question to be addressed is how to manage these climate risks in a scientifically sound, economically viable, socially accepted, and ethically defensible approach. Funding agencies increasingly recognize the importance of mission-oriented basic science to inform this question. Recognition of the need for interdisciplinary research in this area translates into new and expanding funding availability, combined with an increase in the complexity and interdisciplinary nature of the research. Consider, as examples, the recent increase in publications (as well as private and public funding) in areas such as adaptation to sea-level rise or drought, or climate mitigation through carbon sequestration, or geoengineering. Analyses of these issues that neglect the interdisciplinary interactions (e.g., between scientific uncertainty, public understanding and response, as well as the economic and ethical implications) necessarily miss key aspects of the problem. Strong institutional support for interdisciplinary research is one compelling competitive advantage of Penn State. In addition, Penn State has the critical mass of researchers with the expertise to analyze and support climate change decision-making.

**What does CLIMA do?**

CLIMA:

(i) promotes interactions in a growing interdisciplinary field
through a seminar series as well as access and support for tools such as Integrated Assessment Models;

(ii) secures funding for interdisciplinary and multi-PI projects
by supporting grant writing, providing tools, and supporting exploratory research that produces preliminary results that considerably improve grant proposals; and

(iii) promotes inter-disciplinary and inter-college interactions in a cutting-edge field
by linking researchers from four colleges within Penn State and by enabling Penn State to take a leading role worldwide in the critical emerging field of climate risk management.

**What has CLIMA achieved in the last three years?**

CLIMA moved from the spin-up phase with a primary focus on community building to an expansion phase with a primary focus on growing external research support. Key examples of the past achievements are enumerated below.

**(i) Securing external funding:** CLIMA researchers are key players in several external research grants with funding in the millions of dollars.

**(ii) A Penn State Integrated Assessment Model:** We have build a new integrated assessment model (FRANC, Framework for Risk Analysis of Abrupt Climate Change) and released a beta version on the web (see http://clima.psu.edu/resources/franc.php). Several research groups are currently planning or executing joint projects with CLIMA scientists that use this tool.

**(iii) Capacity building on campus:** CLIMA runs a roughly monthly seminar series to bring people together and catalyze new collaboration. CLIMA is also leveraging other funds by co-sponsoring speakers with topics relevant to climate risk management. In addition, CLIMA participants lead a proposal for a strategic PSIEE investment in the area of "Climate Science, Policy, and Adaptation". Last, but not least, the CLIMA webpage has been redesigned (with tremendous help from Patty Craig, Debbie Lambert, and Margaret Hopkins) to be more user-friendly (see http://clima.psu.edu).

**(iv) Education:** CLIMA has supported several graduate and undergraduate students with small fellowships to initiate research projects. In addition, CLIMA researchers are part of education-focused proposals and projects active in a planned climate science dual degree program.

**(v) Outreach:** Besides the standard invited talks, web page, etc., CLIMA researchers focused on interactions with actual decision-makers faced with the task of climate change adaptation.

**(vi) Hosting of visitors:** CLIMA has hosted international researchers for weeks to months to kick off new projects.

## What are funding opportunities?

There is a substantial and quickly growing support for mission-oriented basic science relevant to climate risk management. Research and education in the area of climate risk management is supported, for example, by NSF, NASA, DOE, NOAA, EPA, and private industry. The proposed activities will increase the competitiveness for these funding opportunities.

### Relationship to university-wide initiatives

The Penn State Institutes for Energy and the Environment is promoting university-wide energy research in response to the need for energy systems that both protect the global environment and provide for human welfare and economic development. Climate risk is one of the major factors motivating this need for new energy systems. The CLIMA-supported work on integrated assessment modeling and the new integrated assessment model provides infrastructure that can be used by faculty across campus to evaluate the impact of new energy systems on climate risk.

### Where do we go from here?

Research on climate risk management has gained considerable momentum at Penn State over the last few years. The strategic investments through CLIMA have enabled much of the community as well as the tool building that was crucial factors in this success. We plan to continue on this path by:

(i) pursuing larger and more complex research grants
(ii) expanding the scope to include research in the social sciences that can address public understanding of climate change,
(iii) expanding to more fully integrate ethical analysis of climate change adaptation and geoengineering strategies, and
(iv) expanding the scale by starting a formal summer student internship program (discussed below).

Karen Fisher-Vanden and Janet Swim have joined the co-director team and provide crucial input and expertise in the social-science areas of economics and psychology, respectively. Through their contributions, we will expand our speaker series to be more inclusive of social science perspectives. These discussions expand the breadth of our students' training and enable unique research opportunities in areas such as public perceptions, values and motivations, cultural contexts, group decision-making, and negotiations.

**Student Recruitment – A summer student internship program**

CLIMA enables unique and compelling student research projects. Students interested in studying Earth and environmental sciences are often motivated by broad societal problems such as climate change, but are sometimes unable to address broad interdisciplinary questions about the impacts of climate change and potential adaptation strategies in a rigorous fashion without assistance. CLIMA supported tools along with the proposed summer internship program will provide students with a framework and support base to pose and analyze such ambitious interdisciplinary questions.

We propose to start an internationally advertised summer student internship program on climate risk management. The requested support will allow summer students to construct plausible, engaging summer projects enable them to become familiar with questions relevant to climate risk management. Through these projects, students will discover the importance of the component research activities that are the essential to integrated analysis. Students will be able to appreciate the importance of critical physical science issues (e.g., the probability of Greenland ice sheet collapse, the potential for collapse of the North Atlantic meridional overturning circulation, and the probability of strong positive terrestrial feedback to climate change via albedo or carbon cycle changes) and social science issues (e.g., the role of conceptual models in communicating climate change information to the public) and the importance of intersecting these issues with ethical dimensions of climate change. This understanding will motivate students to pursue graduate studies in physical and social sciences. The summer experience will maintain their interest in graduate studies by showing them the relevance of their disciplinary work. CLIMA will also provide those students who go on to graduate studies a chance to integrate their disciplinary studies back into global climate risk assessments as a capstone for their graduate studies.

**Management**

The co-directors will meet twice a year to review center progress, gather news of related activities from across campus, and discuss upcoming center activities and initiatives. The center will expand (e.g., by including more information about social science relevant topics) and maintain a web site (clima.psu.edu), an email discussion list, and will contribute information about CLIMA-supported activities and facilities supported (e.g., access to the IAM, speakers, publications resulting from use of the IAM, student and faculty research opportunities) to the EESI web site.

**Center Needs / Budget**

We have already secured leverage from the College of Liberal Arts' Rock Ethics Institute ($29k/yr, average), the Penn State Institutes of Energy and the Environment ($20 k/yr), and the College of Agricultural Sciences' Environment and Natural Resources Institute ($2k/yr). Here we request EESI funds of $15k/yr. The projected fund allocation of the total available funds of $66k/yr (averaged) is shown in Table 1. In addition to these institutional resources, CLIMA is leveraging existing external funds of many millions of US$.

Table 1: Projected budget allocation (averaged over the three year funding cycle)

| **Activity** | **Amount [k$ per year]** |
|---|---|
| Postdoc co-funding | 29 |
| Summer student internships co-funding (three at 5k each) | 15 |
| Partial support for programmer | 13 |
| Travel to support proposal development | 3 |
| Seminar series and guest speakers | 3 |
| Materials and Supplies | 3 |
| **Total** | **66** |