



Institute of the Environment Framing Document

Strengthening Interdisciplinary Environmental Sciences at Montana State University

Planning Committee for Reshaping Environmental Sciences at MSU

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Executive Summary

Our goal is to enhance MSU's land grant mission by leading interdisciplinary environmental research, education, outreach, and partnerships for the benefit of Montana. The Institute of the Environment will build upon existing MSU disciplinary strengths by providing broader coordination, facilitation, and focus.

Benefits to Montana: The Institute will (1) build statewide partnerships that address pressing environmental issues and opportunities; and (2) provide relevant information, education, and technology to a region that has unparalleled natural resources but faces an uncertain environmental future.

Benefits to students: The Institute will strengthen learning and engagement opportunities in interdisciplinary environmental sciences, a topic in great demand among today's students and a critical issue for tomorrow's leaders.

Current situation:

- Environmental sciences are one of MSU's primary strengths, but efforts are distributed across departments and colleges, with few structures or incentives to support interdisciplinary collaboration.
- MSU has a new PhD program, Ecology and Environmental Sciences, but it lacks the coordination necessary to recruit and train the nation's best students in interdisciplinary areas.
- Undergraduate courses in environmental sciences are offered across campus, but curriculum and research experiences are not coordinated.
- Research in environmental sciences is a significant part of MSU's research funding, but it is difficult for faculty across campus to address large interdisciplinary initiatives needed for Montana's future.
- MSU scientists and educators have active relationships with federal and state agencies, other universities and colleges, NGOs, businesses, and communities, but there is no central contact to build and support larger partnerships.

In order to focus and shine light on this important area of the university's work, MSU seeks a new structure that integrates and coordinates the activities underway within departments, colleges, and campuses, and also builds collaborative relationships across the MUS system, state, and region.

The proposed Institute of the Environment will

- Increase MSU's visibility and provide a collective voice in environmental sciences;
- Help MSU succeed in new interdisciplinary research areas;
- Develop a nationally competitive program in interdisciplinary education focused on our distinctive natural setting;
- Provide environmental outreach that effectively addresses the needs of the citizens of Montana; and
- Strengthen interdisciplinary partnerships with federal and state agencies, regional universities, non-governmental organizations, businesses, and communities.

In this document, we describe

- the need for a new entity to coordinate interdisciplinary environmental sciences, education, and outreach at MSU;
- the benefits and strategic opportunities offered by the Institute;
- a draft governance structure; and
- the advantages that the Institute would bring to faculty, students, administration, external partners, and the state of Montana.



Environmental Science as a National and Regional Imperative

The U.S. is moving into a period that requires rapid and informed decision making on environmental issues. For decades, environmental science research projects have been descriptive, relatively small and short in scale, even as the intent has been to improve predictions and reduce uncertainties. Now, the challenges of climate change, biodiversity loss, and sustainability demand new transformative approaches that incorporate multiple scales of observation, new analytic tools and technologies, and interdisciplinary thinking that couples natural and human systems. New education mandates seek to ensure that individuals and communities understand the essential principles of environmental science in ways that allow them to make informed and responsible decisions. Higher education is asked to provide state-of-the-art training in interdisciplinary fields and work with an array of federal, state, and local partners to deliver scientifically-credible information to a diverse audience.

In Montana and the Rocky Mountain region, environmental issues and opportunities concern wildlands, agricultural and multiple-use lands, and the goods and services such areas provide. Current and future environmental changes will impact every sector of our economy. For example, even though the causes of climate change are global in origin, Montanans will face its consequences: rising temperatures, changes in snowpack and water availability, increased non-native species invasions, more frequent and intense wildfires, and uncertainty about vital ecosystem goods and services (e.g., clean air and water, food and fiber, recreational and tourism amenities, native biodiversity, biogeochemical cycling). In contrast to the disciplinary organizational structure within most universities, environmental issues, such as climate change, require interdisciplinary solutions that engage natural and social scientists, engineers, applied mathematicians, land managers, policy makers and communities. Effective communication and public outreach must support this effort, and the existing educational infrastructure must be retooled to equip

students with the necessary training to address real-world problems. These challenges are especially important for Montana State University and other land-grant institutions, which strive to provide unbiased research-based resources, educate students, and address the practical needs of citizens within a region.

As a result of national and regional imperatives, the funding landscape in environmental sciences has changed in recent years. Successful proposals for competitive research and education funding are commonly multi-investigator, multi-institutional, and multidisciplinary. New initiatives coming from the National Science Foundation (NSF), the National Oceanic and Atmospheric Administration, National Aeronautics and Space Administration, and other funding agencies seek relevant applications of fundamental science and interdisciplinary approaches and structures as well as require significant public outreach. Solicitations, such as NSF's Coupled Natural Human Systems Program (CNHS), the Partnership in Research and Education (PIRE), and Integrated Graduate Education and Research Traineeship Program (IGERT), require complex approaches that are difficult, if not impossible, from single investigators or traditional disciplinary perspectives. Moreover, proposals to NSF and other agencies must now explicitly address the broader impacts of research investigations, provide mentoring plans for postdoctoral researchers, and include metrics of assessment.

Status of Environmental Sciences at MSU

In both 1999 and 2009, external advisory committees composed of leading educators and scholars reviewed MSU's ecology and environmental sciences programs. In their reports, the committees commended MSU for recent accomplishments in both fundamental and applied areas of environmental sciences as well as for its important land-grant mission. Their recommendations have been insightful as we move forward.

Efforts to strengthen and catalyze environmental sciences at MSU began two decades ago, with the creation of the Center for High Elevation Studies/Yellowstone Center for Mountain Research in 1989, then the Mountain Research Center in 1998, and the Big Sky Institute (BSI) in 2001. Since 2001, the university has made significant investments in faculty and resources in natural resources, ecology, earth sciences, environmental engineering, and computational sciences. In 2009, over 60 faculty members defined their scholarly interests as focused on the environment. Recent hires bring new strengths in climate change science, snow science, watershed modeling, biogeochemistry, land-atmosphere interactions, aquatic ecology, plant ecology, optical sensors, ecological and environmental statistics, environmental microbiology, and environmental education. Current research in environmental sciences accounts for about one third of MSU's annual research funding, and faculty have received national awards for excellence in environmental research and education. Research at MSU takes advantage of the unique opportunities and natural laboratories available in Montana and the Greater Yellowstone Area (e.g., we have more research in Yellowstone National Park than any university in the country), but our focus on the environment extends to all continents.

The university's investment in environment-related fields recognizes Montana's economic dependence on natural resources and agriculture and the research and education opportunities offered by our location amidst some of the nation's premier national parks, forests, and waterways. Outreach activities underway in all colleges focus on providing information and learning opportunities relevant to a sustainable future. Investments from NSF's Experimental Program to Stimulate Competitive Research (EPSCoR), the presence of state and federal agency partners on campus, the participation of agricultural producers in research activities, and the involvement of local communities and businesses speak to MSU's commitment to environmental science and education in Montana and beyond.

New partnerships and funding opportunities have emerged in recent years. For example, a pending EPSCoR Track 1 grant focuses on environmental sciences and energy and will be managed through Montana Consortium of Researchers in Environmental and Energy Sciences and Technology (MtCRE²ST), a

new collaboration with MSU, University of Montana and other academic institutions in the region. A new NSF Partnerships in Research and Education (PIRE) grant explores the linkages between climate change, fire, and land-use change in Montana, Tasmania, and New Zealand. The Big Sky gala, hosted by the Big Sky community on behalf of BSI, has raised over \$1 million in the last five years to support environmental education, research, and outreach in the Greater Yellowstone Area (GYA), and the potential to increase fund raising in environmental sciences is high.

The Future of Environmental Sciences at MSU

Although environmental sciences at MSU have a past track record of success, new interdisciplinary opportunities for funding and increasing demand for training in contemporary environmental themes require greater levels of coordination, faculty participation, and investment. To reach our full potential in competitive interdisciplinary areas requires that we take steps to improve in six areas:

Identity. Despite meritorious productivity and strength in environmental sciences, MSU is not recognized nationally as a leader in environmental education and research. An integrated vision and structure for environmental sciences is lacking at MSU, and this reduces faculty resources and visibility. A widely shared perception on campus is that MSU would be nationally ranked in environmental sciences were its disparate activities considered as a whole. We need a strong and collective voice for environmental sciences at MSU.

Cooperation. Environmental research is generally undertaken by individual faculty and small groups. The difficulty in forming teams across disciplinary and organizational boundaries has resulted in missed opportunities, redundancy of services, and faculty and student frustration. The challenge is to build incentives and structures that strengthen interdisciplinary areas in ways that enhance, not compete with, disciplinary research and educational activities. This requires coordinated planning, better communication, new levels of trust, and creative funding models.

Rewards and incentives. To bring faculty together across traditional disciplinary boundaries requires clear articulation of the benefits of moving in new interdisciplinary directions and appreciation for the value of these activities in promotion and tenure decisions. Incentives need to be transparent and well articulated at all levels of the university, including the intellectual and financial rewards of (1) collaborative research, (2) participation in a community of environmental scholars, (3) access to shared services, and (4) well-functioning graduate and undergraduate programs.

Graduate education. The establishment of a Board of Regents-approved PhD program in Ecology and Environmental Sciences (EES) in 2006 was an important step in interdisciplinary environmental education, one that allows students to develop faculty committees and programs across campus. EES students report to the home department of their major advisor, so the EES PhD option is intended to enhance, not compete with, departmental PhD options. With the emergence of new sub-disciplines like road ecology, agroecology, snow sciences, and environmental statistics, the EES program now requires additional leadership and coordination to be truly effective and nationally prominent.

Undergraduate education. MSU is nationally recognized for the research opportunities it offers undergraduates through hands-on experiences in the classroom, laboratory, and field. Given the natural laboratory of Montana and the Yellowstone region, a coordinated curriculum and expanded research opportunities on environmental topics are needed to enhance recruitment and retention of undergraduate students. Strengthening interdisciplinary environmental programs for undergraduate education is also an important piece of MSU's identity as the "University of the Yellowstone", and we must recognize the diverse pool of students interested in a college education with new technologies and pedagogical approaches.

Outreach. MSU has outstanding examples of environmental outreach (e.g., MSU Extension, Museum of the Rockies, Thermal Biology Institute, Western Transportation Institute, MSU Extended University,

Montana Water Center, Center for Invasive Plant Management, Center for Entrepreneurship of the New West, and MFA Science and Natural History Filmmaking Program). Nonetheless, these efforts are not coordinated and widely shared. In addition, over the past decade, BSI has been a GYA leader in community and partnership-based environmental education and outreach. MSU needs to extend these activities to better provide Montanans with relevant information and decision-making tools that address environmental topics of concern. We need to consider both informal and formal education as learning tools for underserved communities and professional training.

Achieving success in these six areas requires broad faculty and administrative support as well as faculty leaders who recognize and can build our current strengths. We believe that a new administrative entity is needed to move current environmental education and research at MSU to the next level.

MSU Institute of the Environment

The proposed Institute of the Environment will act as an umbrella institute designed to help MSU (1) increase visibility and provide a collective voice in environmental sciences; (2) succeed in new interdisciplinary research areas; (3) develop a nationally visible program in environmental education that utilizes our distinctive setting; (4) provide environmental outreach that addresses the needs of the citizens of Montana; and (5) strengthen interdisciplinary partnerships with federal and state agencies, regional universities, non-governmental organizations, businesses, and communities. Success for the Institute requires a sustained base investment from MSU, new external funding in interdisciplinary research areas, and charitable support from foundations, corporations, and citizens. We envision an Institute that will function like a School of the Environment at other institutions, recognizing the unique broad umbrella mission proposed. The work of the Institute will be organized around pressing environmental issues, such as climate impacts and energy; water, snow & ice; food, land & ecosystems; biodiversity and conservation; and sustainability in the New West. Although themes will change over time with faculty strengths and university priorities, we propose an initial set to structure and communicate our scholarly work and help shape interdisciplinary education and outreach programs. Focused on the above themes the Institute will provide support in five broad functional areas that benefit faculty, students, administration, partners, and the citizens of Montana.

Community of Scholars focused Environmental Research and Education. Successful interdisciplinary research requires honest communication, trust, transparency, and collegiality to encourage faculty, departments, and colleges to work across traditional boundaries. It also requires faculty willing to play leadership roles in interdisciplinary research and education. The Institute will provide the matrix for interdisciplinary environmental sciences at MSU and offer interdisciplinary seminars, updates and information via newsletters and online platforms; facilitate early-career mentoring and training; and host relevant events. This type of community building has proven vital for faculty recruitment, retention, and promotion at universities across the country, and has been missing at MSU.

Interdisciplinary Environmental Research. The Institute will facilitate interdisciplinary research by identifying new opportunities and collaborations and providing coordinated grant-related and project services. It will coordinate support for broader impacts and host theme-related workshops. It will also support environmental informatics (e.g., the collection, processing, management, and retrieval of environmental information underway in the current EPSCoR Track 2 grant and in BSI partnership programs with the US Geological Survey) and technology applications that overwhelm many projects.

Graduate and Undergraduate Education on the Environment. The Institute will assume leadership of the EES PhD graduate program and possibly add a master's option in the future. This step will have huge impacts on research and graduate education in environmental sciences at MSU and help place students in the growing environmental job market. Successful graduate education in environmental areas will be measured by recruitment of Montana and the nation's best students; enhanced graduate stipends and research support; transformative interdisciplinary courses and training; an easily navigated graduate

curriculum, including cross-listed and team-taught courses; and new networking and distance-education opportunities within and outside the university. The Institute will help coordinate undergraduate curriculum in environmental fields, including freshman seminars that take advantage of our spectacular natural laboratory and bring real meaning to the “University of Yellowstone” concept. It will seek external funding to support research experiences for undergraduates (REUs), as well as scholarships in environmental sciences. Additionally, the Institute will work with other education programs, including those in individual colleges, the Extended University MSSE program; the Museum of the Rockies, and the MFA program in Science and Natural History Filmmaking to broaden our educational footprint through distance education, K-12 curriculum development, professional training, and film-making partnerships.

Science Outreach, Informal Education, and Communication on Environmental Issues. The Institute will expand current GYA activities underway in the Big Sky partnership, and promote and coordinate environmental outreach efforts underway across campus in individual colleges, centers, and institutes. We will participate in new educational approaches and technologies in environmental sciences to better serve our mission as a land-grant institution. In the process, faculty and students will gain greater visibility for their research through access to a portfolio of outreach activities, and outreach opportunities will better promote a general public understanding of scholarly activities. Compelling outreach products and activities will also enhance fund-raising opportunities.

State, Regional, and National Partnerships on the Environment. The Institute will provide a point of contact for collaborations with other MUS institutions (including other MSU campuses, University of Montana, and tribal colleges), state and federal agencies (including USGS Northern Rocky Mountain Science Center, Yellowstone National Park, Gallatin National Forest), nongovernmental organizations (World Wildlife Foundation, Wildlife Conservation Society, Greater Yellowstone Coalition), MSU Extension, communities, small businesses, corporations and foundations, and private citizens. The benefits to faculty will be new collaborations and funding sources.

Institute of the Environment Governance

Governance will be transparent and coordinated across colleges and departments. Participation in the Institute will be open to all interested faculty and students. We envision a slim and efficient governing structure, consisting of a Managing Team, an Executive Committee, and an External Advisory Board.

Managing Team

1. Institute Director (TBA, senior faculty member with university, regional, and national standing in environmental sciences), reporting directly to VPR and Provost
 - a. Responsible for budget, annual work plans, administration, reporting, and fund raising
 - b. Research, education, and outreach leadership
 - c. MtCERE co-Director for MUS EPSCoR activities
2. Associate Director: Lead EPSCoR science activities at MSU
3. Thematic, Education, and Outreach/Partnership Team Leaders
4. Operational Managing Director and Administrative staff positions

Executive Committee

1. Ensure coordination among colleges, departments, and institutes
2. Advise on overarching Institute goals and new opportunities
3. Membership composed of Managing Team (above), Provost and VPR, and additional faculty and administrative leaders determined by Director, VPR, and Provost

External Advisory Board

1. Membership (3-year terms) will include regional and national leaders in science and business
2. Proposed role includes strategic and programmatic advice, opening the door to opportunities, creating new partnerships, and fund raising

Work Plan for Institute of the Environment in Year 1 (AY11-12)

Needs and Opportunities	Institute Goals	Tasks
Launch the Institute of the Environment	Redirect BSI funding and activities toward the goals of the new Institute Create Institute in Spring 2011; public announcement	Appoint Institute Director, Associated Director and Managing Team for new IoE Develop IoE capacity and staffing to support <ul style="list-style-type: none"> ▪ New interdisciplinary proposals ▪ Public science outreach coordination and services ▪ Fiscal and event support and project coordination ▪ Collaborative technology services with Research Computing Group ▪ Communications and grant writing Host grant-funded activities, including those in: <ul style="list-style-type: none"> ▪ NSF EPSCoR Track 1 and Track 2 ▪ Partnerships in International Research and Education ▪ NPS and USGS partnership science projects ▪ Former USGS NBII Informatics activities ▪ Big Sky Carbon Atlas ▪ Yellowstone Lake Biodiversity/Bioprospecting
Need to create increased visibility and a collective voice in environmental sciences	Create a community of scholars in environmental sciences that engages MSU faculty and external partners	Identify and engage affiliated faculty through campus wide discussions Assemble executive committee Engage MSU Foundation Design External Advisory Board Design funding model and collaboration Plan for new interdisciplinary seminar series Design plan of incentives and structures for enhanced collaboration
Need for collaborative structure to succeed in interdisciplinary research initiatives that address pressing environmental issues	Increase interdisciplinary environmental sciences research	Identify interdisciplinary thematic science teams Assess interdisciplinary proposal opportunities Support EPSCoR activities, including new faculty lines, block grants, workshops Implement research components of NSF PIRE grant, EPSCoR Track 1 and Track 2 grants
Need for interdisciplinary education to strengthen learning and engagement opportunities	Strengthen graduate and undergraduate programs in environmental areas	Assess existing EES PhD program and faculty, including recruitment needs Assess undergraduate curriculum in environmental fields in different colleges Develop proposal to NSF Research Experiences for Undergraduates (REU) program Implement graduate and undergraduate education components of NSF PIRE grant, EPSCoR Track 1 and Track 2 grants
Need for interdisciplinary science outreach, informal education and communication to stakeholders	Strengthen partnerships and public outreach	Discuss outreach coordination with Extended University, MT Water Center, Science and Natural History Filmmaking, MSU Extension, Museum of the Rockies, Center for Invasive Plant Management; Center for Entrepreneurship of the New West, and other programs Assess Big Sky partnership to better support institute goals
Need for strengthened interdisciplinary partnerships	Increase collaborations with partners in government, industry, and non-governmental organizations	Work with outreach partners Assess ways to better engage external partners in federal and state agencies, including US Geological Survey, National Park Service, MT Fish and Wildlife, and National Forest Service

Funding the Institute of the Environment

Base funding of the Institute will be negotiated with the President, Provost and Vice President for Research. However, we suggest a diversified model that provides sustained base investment in administration and leadership, operations, and student support. Initially, we propose using the current MSU base support for the Big Sky Institute for a multi-year commitment. Full Institute support would build on that base investment and potentially come from sources such as (1) direct grant funds, (2) F&A support, (4) MSU Foundation fund raising, and (5) Division of Graduate Education support of the EES Graduate Program. This investment and diversified funding model will lead to creation of a robust Institute with substantial return on investment from targeted fund raising and strategic growth in University-wide interdisciplinary environmental sciences grant activity.