

Montana Institute on Ecosystems

I. Purpose

A new statewide, Montana University System-based Montana Institute on Ecosystems (IoE) will provide an umbrella framework to support integrated exploration of fundamental issues in ecosystem science, create new learning experiences to inspire and educate, and develop partnerships around relevant science topics to address the needs of Montana, the region, and the nation. This new institute is well positioned to become a center of excellence with national and international visibility for several reasons. First, we have outstanding faculty members and research activities across the Montana University System. Second, Montana and the region provide one of the best and most visible natural laboratories on Earth for science on ecosystems. Third, the institute's innovative approach is a model of how universities and partners in a low-population state can work together to achieve broad research, education, and engagement goals for the benefit of the state.

Ecosystem and Environmental Science is one of five major research areas identified in the January 2011 Montana University System (MUS) Science and Technology Plan [see <http://mus.edu/che/arsa/Research/MUSSTACplan.pdf>]:

“Montana is in a unique position of having one of the most pristine environments in the nation while exhibiting significant signs of environmental stress from our history of dependence on an extractive economy. This provides both the opportunity and the responsibility to conduct leading research on our own and similar environments around the world. The challenge will be to capitalize on what the environment has to offer while preserving for generations to come the lifestyle that has become a standard of Montana living.”

The Montana IoE will provide MUS-wide leadership in environmental and ecosystem science to (1) facilitate and promote interdisciplinary research and technological innovation; (2) serve as a bridge and catalyst across disciplines, programs, and institutions; (3) foster and sustain partners from the public and private sectors; and (4) seed research and educational initiatives that will help solve important environmental problems, identify economic opportunities, and train the next generation of scientists, decision makers, and informed stakeholders. With focal administrative hubs at Montana State University-Bozeman and The University of Montana-Missoula, the Montana IoE will leverage capacity across the MUS to better link science and technology with policy and decision-making. It will provide an intellectual umbrella to foster better communication and collaboration within the MUS as well as with tribal colleges; federal, state and local agencies; non-governmental organizations; businesses; and communities.

Today's ecosystem problems are complex, and most of the solutions require interdisciplinary approaches. In the coming decade and beyond, national research agendas and funding initiatives will require collaboration across disciplines that have traditionally worked in isolation. The UM and MSU, and their respective affiliated campuses, currently offer a diverse array of ecosystem and environmental science programs, which account for a significant amount of the sponsored research and student interest on both campuses. Although the MUS as a whole has a strong commitment to ecosystem and environmental science research and education—in climate science, environmental microbiology, fisheries and wildlife management, sustainable agriculture, forestry, fire science, watershed hydrology, invasive species, land-use change, environmental statistics, snow sciences, geosciences, environmental engineering, science

communication, and social sciences related to the environment—efforts are often confined to departments, colleges, and campuses. Few mechanisms or incentives currently support broad interdisciplinary initiatives or inter-institutional collaborations that bridge the traditional silo-style academic structure. The Montana IoE is an opportunity to break down some of these barriers and, in the process, achieve greater visibility for areas of excellence at both universities.

This new statewide institute is critical for Montana. We are moving into a period that requires rapid and informed decision-making and public engagement on a range of ecosystem and environmental issues. Sustainable pathways for Montana must consider the future of wildlands, agricultural lands, tribal lands, multiple-use lands, and growing urban areas, as well as the vital goods and services that these environments provide. By harnessing the scientific, technological and educational strengths of our universities and by drawing on the expertise of a diverse array of regional partners and stakeholders, the Montana IoE can advance proactive rather than reactive solutions for current and future ecosystem and environmental challenges, and at the same time provide cutting-edge education and training necessary for development of a modern workforce.

II. Objectives

In its first five years, the Montana IoE's objectives include:

1. Increase state and national visibility for the MUS's ecosystem and environmental science research and education programs by showcasing the strengths within and across institutions.
2. Increase MUS capacity to recruit and retain nationally competitive faculty, graduate students, and undergraduate students in critical areas.
3. Expand opportunities for students to participate in basic and applied research, develop critical thinking and communications skills, and receive state-of-the-art education to increase their competitiveness in the workforce.
4. Strengthen connections with regional, national, and international partners to create new opportunities for interdisciplinary collaboration and innovation in ecosystem and environmental science and education.
5. Facilitate broad engagement and communication to better support informed decision-making on ecosystem and environmental issues and opportunities.
6. Foster a community of scholars in Montana who share common interests in addressing complex ecosystem and environmental opportunities and challenges.
7. Ensure effective coordination of strategically allocated funding and new fundraising efforts.
8. Create a collaborative administrative framework that will advance interdisciplinary ecosystem and environmental science research and education across the MUS.

The Montana IoE will capitalize on opportunities of place and on current state investments in research and education, significantly expand opportunities to tackle new funding initiatives, and support enhanced economic and workforce development in critical interdisciplinary areas. Thus, by harnessing the existing strengths within the MUS, the proposed Montana IoE offers an exciting opportunity for Montana to become a national leader in ecosystem and environmental science research, education, and engagement.

III. Anticipated Activities

The activities of the Montana IoE center around (1) building new faculty and student opportunities through interdisciplinary collaboration, coordination, and facilitation; and (2) providing statewide engagement on topics related to ecosystem and environmental stewardship and sustainability. The IoE will coordinate and facilitate interdisciplinary activities in ecosystem and environmental science research, education, and engagement efforts within the MUS, provide linkages to related activities underway on tribal colleges, and draw on the expertise and experience of diverse partners outside the MUS. Multidisciplinary and inter-institutional, the Montana IoE will bring together faculty, students, and non-university partners to focus on pressing environmental challenges and opportunities relevant to Montana, the region, and the nation. Montana IoE's programmatic activities might include collaborative research grant submissions and other fundraising initiatives, shared research facilities, faculty exchanges and development opportunities, cross-institutional seminars, team-taught courses, degree minors, and certificate programs, inter-institutional graduate training, coordinated science communication and broader engagement, and business partnerships.

Over the first five years, the Montana IoE will pursue the following strategic activities: (1) establish the two administrative hubs, including governance, faculty affiliation, staffing, and base funding; (2) implement and coordinate NSF EPSCoR (Experimental Program to Stimulate Competitive Research) RII Track 1 and 2 research and education activities; and (3) develop and implement a strategic plan, which will identify future activities, including metrics of success, over a five-year time frame.

IV. Agencies, organizations and/or institutions involved and advisory council

Below is a partial list of existing initiatives, programs, and other activities within the MUS and across Montana that will contribute to the Montana IoE:

Statewide Ecosystem and Environmental Sciences programs and linkages:

- The Montana IoE will execute the NSF EPSCoR science initiatives and activities in the state.
 - NSF-EPSCoR RII Track 1; beginning autumn 2011, Ecosystem Science is the focus of the MUS EPSCoR award with a monetary award of \$20M and state match of \$4M over 5 years. This award specifically calls for the development of consortium linkages and collaborations between Montana's universities in the research area of climate change and ecosystem response.
 - NSF-EPSCoR RII Track 2; begun in autumn 2009, Ecosystem and Environmental Science was the focus of a collaboration grant between UM and MSU and the EPSCoR-state of Kentucky. The program award of \$6M over 3 years has led to the development of a Virtual Observatory and Ecological Informatics System for deploying field sensors and managing vast quantities of observatory data.
- Regional, national, and international initiatives with state and federal agencies focused on climate and environmental change (e.g., DOI Great Northern Landscape Conservation Cooperative, USGS North Central Climate and Pacific Northwest Science Centers, USGS Northern Rocky Mountain Science Center).

- Non-governmental organizations and small businesses concerned about regional sustainability, which provide opportunities for faculty and student engagement and broad outreach.
- MUS Montana Water Center, which facilitates water research, educates future water professionals, and develops training materials for working water professionals; the organization was authorized by Congress through the Water Resources Research Act of 1964, and is one of 54 located at land-grant universities in each state.
- Rocky Mountain Cooperative Ecosystem Studies Unit (RM-CESU), which facilitates cooperative ecosystem research and technical assistance between federal agencies and university researchers.

Montana State University brings:

- Montana State University (MSU) is a land-grant university system with four affiliated campuses (Bozeman, Billings, Great Falls, and Havre) and home of the Montana Agriculture Experiment Station and Montana Agricultural Extension Service, providing service to the state, nation, and globe.
- Extensive MSU-Bozeman faculty interest and participation in ecosystem and environmental science research and education with members across colleges of Agriculture; Arts & Architecture; Business; Education, Health & Human Development; Engineering; Letters & Science; and Nursing resulting in approximately one-third of the university's total annual grant and contract productivity.
- Synergy with existing MSU institutes, centers, and laboratories, including the Agriculture Experiment Station network, MSU Extension, Extended University, Museum of the Rockies, Energy Research Institute, Thermal Biology Institute, Center for Computational Biology, Spatial Sciences Center, Center for Invasive Plant Management, Western Transportation Institute, Optical Technology Center, Center for Entrepreneurship for the New West, Montana Cooperative Fishery Research Unit, Snow Science Program, Subzero Science and Engineering Research Facility, Imaging and Chemical Analysis Laboratory, Paleoecology Laboratory, Watershed Hydrology Laboratory, and Solar Physics Group.
- The Montana IoE will leverage two decades of MSU-Bozeman interdisciplinary investments in place-based scholarship and education on ecosystems and the environment (e.g., Center for High Elevation Studies, Mountain Research Center, Big Sky Institute) and recent faculty-led interest and planning to establish a new MSU institute or school of the environment (see MSU faculty planning committee framing document at http://environment.montana.edu/sites/default/files/resources/IoE_framing_document_070611_0.pdf).
- Ecology & Environmental Sciences PhD program, which allows students to develop a graduate program across departments and disciplines focused on basic ecology and environmental topics.
- Undergraduate degree programs in agriculture, earth sciences, environmental science, ecology, engineering, microbiology, and snow science. Programs focused on sustainability include the Sustainable Foods and Bioenergy degree program; the Water Sciences minor, Engineers without Borders, certificate options, and in-service learning opportunities that address growing student interest in sustainability issues.

- Master of Science in Science Education Program designed for elementary, middle, high school, and other science educators and led by experienced science, science education, and mathematics faculty with the collaboration of outstanding classroom teachers.
- WildFIRE Partnership in International Research and Education program, a \$3.85M NSF PIRE award focused on the impacts of climate change on fire regimes around the world. The partnership brings together scientists and students from the U.S., Australia, New Zealand, Chile, and Argentina as well as partnerships with the U.S. Forest Service and Salish-Kootenai College.
- Statewide outreach including the Extended University and the Master of Fine Arts Program in Science and Natural History Filmmaking.

The University of Montana brings:

- The University of Montana (UM) affiliation unites 4 campuses (Missoula, Butte, Dillon, and Helena) and is home to the College of Arts and Sciences, the College of Forestry and Conservation, School of Law, School of Journalism, College of Health Professions and Biomedical Sciences, College of Visual and Performing Arts, the Flathead Lake Biological Station, and the Forest and Conservation Experiment Station.
- Extensive UM-Missoula faculty interest and participation in ecosystem and environmental science research and education with members distributed across the university in the colleges, schools, and research and experiment stations.
- Synergy with other institutes, centers, and laboratories at UM including: the Avian Science Center, Center for Environmental Health Sciences, Center for Riverine Science and Stream Re-naturalization, Lubrecht Experimental Forest, Center for the Rocky Mountain West, Environmental Writing Institute, Montana Cooperative Wildlife Research Unit, Wilderness Institute, the National Center for Landscape Fire Analysis, Center for Natural Resources and Environmental Policy, Bandy Experimental Ranch, Bolle Center for People and Forests, Institute for Tourism and Recreation Research,,and the Center for Environmental Health Sciences.
- Flathead Lake Biological Station, founded in 1899, an MUS Center-of-Excellence “biostation” with a dynamic research program on the Flathead Lake/River Ecosystem and founder of the Salmon River Observatory Network (SaRON) with field stations around the North Pacific-rim (e.g., Kamchatka, Alaska, British Columbia, Idaho and Montana).
- The Numerical Terradynamic Simulation Group (NTSG), which models and monitors ecosystem function at multiple scales and pioneers new approaches for landscape ecological and hydrologic analysis.
- Systems Ecology MS and PhD program, an inter-college program that allows students to focus on large-scale, ecological/ecosystem, interdisciplinary research.
- Undergraduate degree programs in forestry, resource conservation, wildland restoration, wildlife biology, parks, recreation and tourism, field ecology, ecology and organismal biology, geosciences, and environmental studies.
- Environmental activities within the School of Law in environmental law and a master's program in Environmental Science and Natural Resource Journalism, which directly engage with environmental sciences to provide direction for environmental policy and outreach to the broader public.

- Environmental outreach through the “SpectrUM Discovery Area”, a hands-on learning science center for all ages that provides K-12 science outreach through both focused and traveling programs across the state.

Advisory Council

The current Montana EPSCoR advisory board will serve as the initial advisory council for the Montana IoE. After completion of a strategic plan, the Montana IoE will convene a new advisory board composed of leading ecosystem scientists, educators, and practitioners.

V. Organizational structure within the institutions

The Montana IoE will be an MUS institute with co-equal hubs. Each hub will function within the framework of the academic environment and culture of the campuses at MSU-Bozeman and UM-Missoula. Each hub will have an Institute co-Director and supporting staff. The two co-Directors will be responsible for the direction and oversight of their respective hubs with reporting lines through the Vice President for Research and the Provost on the respective campuses. The Administrations at UM-Missoula and MSU-Bozeman will support and maintain their respective hubs. The two hubs will service the needs of the main research universities and their affiliated campuses while at the same time working cooperatively and collaboratively to build bridges between the universities and with tribal colleges; federal, state, and local agencies; non-governmental organizations; businesses; communities; and foundations. Leadership for IoE programs will be drawn from an MUS council of faculty and partner affiliates.

VI. Interrelationships

Montana State University mission

The mission of Montana State University is to provide a challenging and richly diverse learning environment in which the entire university community is fully engaged in supporting student success. To provide an environment that promotes the exploration, discovery, and dissemination of new knowledge. To provide a collegial environment for faculty and students in which discovery and learning are closely integrated and highly valued. To serve the people and communities of Montana by sharing our expertise and collaborating with others to improve the lives and prosperity of Montanans. In accomplishing our mission, we remain committed to the wise stewardship of resources through meaningful assessment and public accountability.

The University of Montana mission

The University of Montana pursues academic excellence as demonstrated by the quality of curriculum and instruction, student performance, and faculty professional accomplishments. The University accomplishes this mission, in part, by providing unique educational experiences through the integration of the liberal arts, graduate study, and professional training with international and interdisciplinary emphases. The University also educates competent and humane professionals and informed, ethical, and engaged citizens of local and global communities; and provides basic and applied research, technology transfer, cultural outreach, and service benefiting the local community, region, State, nation and the world. The University of Montana will lead as a globally focused public research university that serves the state, nation, and world. Intrinsic to this mission are the underlying values of leadership, engagement, diversity, and sustainability.

The interrelationship between the missions of the MUS research universities and the Montana IoE is close and robust. The overarching goal of the Montana IoE is to foster interdisciplinary approaches to research, education and outreach focused ecosystem and environmental science and related disciplines. To enhance understanding and sustainability of the state's diverse landscapes, the institute will draw on the environmental and cultural diversity of the region as an opportunity for discovery, learning, and engagement. The Montana IoE creates a structure for the universities and affiliated campuses to involve the tribal colleges and the state's underserved communities in interdisciplinary research and educational collaborations. It also provides an umbrella for universities to work with partners to enhance the role of science in management, policy, and other decision-making, while at the same time providing students with real-world learning experiences and workforce opportunities.

VII. First year and continuing finances necessary to support it including the sources of funding

The Montana IoE is an initiative of the MUS award from the NSF-EPSCoR program. This \$20M/5-year award will be distributed in near-equal share between MSU and UM. These funds will provide administrative support; enhance and improve faculty hires to fill specifically identified gaps in ecosystem and environmental disciplines across the research universities; provide grants for enhanced interdisciplinary research infrastructure and development; facilitate new research funding; support graduate and undergraduate student research; and encourage outreach and public engagement in the area of ecosystem and environmental science and sustainability.

The Montana IoE will build on the initial foundation provided by NSF-EPSCoR to create a long-term program. In addition to new grant and partnership leveraged funding sources, we see a viable opportunity to pursue a substantive development campaign. A long-term sustainable funding model based on diverse sources of funds will be developed through a comprehensive strategic planning process during the first year.

VIII. Similar programs in the state and surrounding region

The Montana Institute of the Environment is unique in Montana and among the Rocky Mountain states. This will be the first institute designed to function across the MUS. As such, it is a grand experiment that is in keeping with the NSF-EPSCoR program. There are other related academic units across the country, especially at large and well-endowed universities (e.g., University of Minnesota, University of California – Berkeley, University of North Carolina-Chapel Hill; University of Wisconsin; Harvard University; Stanford University); however, to the best of our knowledge, the Montana IoE will be the first institute of its kind to serve an entire university system. Moreover, the globally renowned and institutionally complex landscapes of Montana and the northern Rocky Mountain region endow us with an unrivaled natural laboratory for ecosystem and environmental science and education. The scope of the Montana IoE will allow the MUS to form inter-university and external collaborations that would otherwise be difficult to develop in Montana. Drawing on the enhanced research and education capacity across the MUS, the Montana IoE will rival comparable programs at other major research universities. The Montana IoE will serve as a model for what other low-population states in the region and across the nation can achieve through pooled resources, common purpose, and collaboration.

IX. Faculty expertise and participation

Participation in the Montana IoE will be open to tenure-track and research faculty of all ranks and their graduate and undergraduate students. We expect faculty participation across virtually every college and school at the two research universities and from ecosystem and environmental science faculty at the affiliated campuses. The institute is designed to promote strong interdisciplinary collaborations and foster new research and education initiatives among MUS faculty and students as well as with partners at other institutions in the US and abroad. Based on initial inquiries of interest, we expect >100 faculty at both MSU-Bozeman and UM-Missoula to become faculty affiliates of the Montana IoE. We also expect interested faculty from the affiliated MSU and UM campuses and tribal colleges. Together, participants come from an exceptionally broad spectrum of disciplines including but not limited to geosciences, atmospheric sciences, forestry, chemistry, engineering, mathematics, biological sciences, environmental health, journalism, environmental economics, and environmental policy and law. Outside the MUS, partners who have expressed interest in affiliating with the Montana IoE come from federal, state, and local agencies, non-governmental organizations, and businesses.

X. Internal campus review and approval process

The concepts and principles associated with the development and sustaining of the Montana IoE were conceived during the proposal development and submission process to the NSF-EPSCoR program. This was done in cooperation with the Office of the Commissioner of Higher Education, the MUS Science and Technology Advisory Committee, and the administrations of The University of Montana and Montana State University. Following receipt of the NSF award that funds the development of the Montana IoE, this document was approved by their respective university administrations and faculty governance.