



Amphibian monitoring in Yellowstone National Park

Montana passes 35 years as an NSF EPSCoR state

Did you know? Montana was one of the original five EPSCoR states when the program was established by the National Science Foundation in 1979 to help build science and technology infrastructure in the states that, at that time, received the least federal research and development funding. The goal was to give broader geographic distribution of federal funding, which had been concentrated in a relatively few number of states. The experiment was a huge success, and Montana has received EPSCoR funding ever since. The program, which was centered at MSU-Bozeman, has grown to include all Montana University System four-year institutions and tribal colleges. The current research focus for NSF EPSCoR Track 1 funding is on climate and ecosystem linkages from microbes to landscapes.

The following was written by **Dr. Bob Swenson**, emeritus vice president for research at Montana State University. This account is, in Dr. Swenson's words—a "memory, not a history." Swenson was at MSU at this critical juncture, and we appreciate this documentation. A second installment will appear in the Spring 2015 issue.



THE ORIGINS OF NSF EPSCoR

In 1978 Congress authorized the "Experimental Program to Stimulate Competitive Research" (EPSCoR) in the National Science Foundation, seeking to disrupt a dichotomy between the "haves" and the "have-not" states, in terms of federal research and development funds.

NSF soon identified the "least competitive" seven states, based on a composite formula that measured federal R&D dollars on a per capita and per scientist basis. Montana

received a planning grant and was one of five states to win a \$3M EPSCoR Implementation Grant. Although excellent faculty were in the university system at that time, major changes were needed to meet NSF's requirements in order to provide time, facilities, instrumentation, and infrastructure for research, and to provide graduate student support. MSU's Research Park was established at that time.

Montana's original proposal, Montanans On a New Track for Science (MONTS), was lead by **Gary Strobel** and was run as a "mini NSF." Faculty wrote proposal for MONTS funding, which were reviewed by a state-wide committee. Mentors, peer reviewers and guest speakers were all part of this growing program.

Every NSF dollar required a state match, which required substantial dialog among university personnel, the Governor's Office, the Legislature, and the private sector. MSU President **Bill Tietz** and Vice President **John Jutila** played key roles in acquiring these match dollars to hire new faculty and purchase major equipment. Additionally, a state science committee was formed; its role was



Gary Strobel, an original leader of Montana's fledgling EPSCoR project, is still an active researcher and faculty member on the Montana State University campus.

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Students support NPS with ecological inventoring

by Kristen Legg

Since 2012, six student interns from the Montana Institute on Ecosystems have teamed up with the Greater Yellowstone Inventory and Monitoring Network of the **National Park Service**. Interns collect field data from a sample of whitebark pine trees spread across nine million acres of federal land, systematically survey wetlands in **Grand Teton** and **Yellowstone** national parks for evidence of frog habitat, and help in the office to describe and manage scientific data and publications. In 2000 the National Park Service established 32 networks of parks across the country to repeatedly collect scientific data on specific natural resources over a long period of time. Results from this long-term monitoring help park managers and the public track the health of these vital natural resources, which in turn supports science-based management of national parks. In collaboration with federal, academic and other partners, the Greater Yellowstone Network collects information on amphibians and wetlands; grass and shrub vegetation; rivers, streams and springs; and whitebark pine trees in and around Grand Teton and Yellowstone National Parks and in **Bighorn Canyon National Recreation Area**. We also use climate data to better understand whether and how any changes detected from long-term

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At top: Bryan Cossairt (center with cowboy hat), Institute on Ecosystems 2013 summer intern, assisting with amphibian monitoring in Yellowstone National park (2013, NPS Photo).



PEOPLE AND EVENTS

UPCOMING EVENTS

January – April 2015. Rough Cut Science. Join us each Wednesday at noon MST on the MSU campus or online to hear talks from IoE faculty and affiliates. IoE Rough Cut Science Series talks are designed to showcase and connect NSF EPSCoR and IoE researchers and affiliates through informal talks and open discussion. Live talks are Webcast at <http://montana.adobeconnect.com/roughcutsience/>. An archive of past talks is at <http://montanaioe.org/outreach>

March 26-27. Montana NSF EPSCoR RII Track-1 All-Hands Meeting. Missoula, Montana

March 28. NanoDays – Missoula (spectrUM Discovery Area). This science outreach program for youth and adults is part of the NSF-funded Nanoscale Informal Science Education Network.

April 7 / April 14. Distinguished Visiting Scholar. Jodi Hilty from the Wildlife Conservation Society will talk April 7 at MSU and April 14 at UM. The title of Dr. Hilty's talk is "On the Road to Recovery: Grizzly bears, wolverine, and jaguar."

April 13. NanoDays / MicroDays - Bozeman This science outreach program for youth and adults is part of the NSF-funded Nanoscale Informal Science Education Network. <http://eu.montana.edu/nanodays>

Montana EPSCoR's Track I focus is on understanding the effects of climate change on sustaining healthy ecosystems and economic growth. The Institute on Ecosystems (IoE) is a statewide Institute based at the flagship research universities through which current Montana EPSCoR activities are implemented.

Montana EPSCoR
PO Box 173142
Bozeman, MT 59717-3142
406-994-7658
mus-epscoR@montana.edu

facebook.com/MontanaEPSCoR

[Twitter.com/MontanaEPSCoR](https://twitter.com/MontanaEPSCoR)

[Youtube.com/MontanaEPSCoR](https://youtube.com/MontanaEPSCoR)

EPSCoR webpage: mtnsfepscoR.org

IoE webpage: Montanaioe.org

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PEOPLE & EVENTS IN THE IOE

All-hands meeting will highlight accomplishments, set future course

The Montana EPSCoR RII Track-1 All-Hands Meeting set for March 26-27 at the University of Montana will bring researchers, staff and students together for updates, discussion and idea generation on the accomplishments, status and future of our EPSCoR-supported research projects and the Montana Institute on Ecosystems.

Participants include **Denise Barnes**, section head of NSF EPSCoR, who will join us from the national NSF offices in Washington, D.C., as well as **Bob Coyne**, our new program officer, an associate professor from the J. Craig Venter Institute, and **Julia Melkers**, our external evaluator who is based at Georgia Tech.

The meeting is designed with opportunities for EPSCoR/IoE participants to share ideas and accomplishments and to build collaborations for future work. This is also an excellent chance to meet new faculty hires and learn how they are bringing their expertise to the

overall research objectives.

The two-day meeting includes information about Education-Outreach-Diversity activities and the IoE's growing social science capacity and opportunities, including the Social-Ecological Systems Initiative and MtnSEON (see back page). We will also hear about initial work related to the development of a statewide climate assessment—a goal set out in our original EPSCoR proposal and one that has the potential to build partnerships with the U.S. Global Change Program, Montana agricultural organizations and NGOs, and partners across the state and nation.

Overall, the meeting will focus on how our existing science contributes to integrated project goals; the intellectual significance; what's needed for years 5-6 of the grant; and how is our work advancing science for the next decade.

EPSCoR Director Callaway named regents professor



Montana NSF EPSCoR director and University of Montana biology Professor Ragan "Ray" Callaway was recently named a UM Regents Professor of Ecology, the top rank awarded to faculty members in

the Montana University System. Regents Professors must demonstrate unusual excellence in instruction, scholarship and service, as well as distinctive impact through their work. The rank is awarded by the Board of Regents upon the recommendation of the University president.

Callaway was selected for a 2014 Reuters' list titled "The World's Most Influential Scientific Minds" for publishing the greatest number of highly cited papers between 2002 and 2012. "With exceptional work in all three areas of responsibility – teaching, research and service – Professor Callaway has become a model of productivity and impact," UM President Royce Engstrom said. "Rare are those faculty members who establish internationally renowned research programs and at the same time care deeply about students at all levels, and further, contribute to the well-being of their institution and profession through service. Ray is such a person."

He studies how plants function together in communities and ecosystems, and his research has taken him around the world. Callaway tracked knapweed back to its native range in Central Europe, researching how other plants in that ecosystem naturally keep knapweed in check.

He also has sought out low-lying cushion plants on mountaintops from Missoula to Alaska, the Andes, Europe and New Zealand, studying how plants facilitate survival among one another and form communities in some of the harshest environments on Earth.

Callaway earned his doctorate from the University of California, Santa Barbara, in 1990. After a postdoctoral fellowship at UC Santa Barbara, he had a joint faculty appointment with the University of Illinois and Duke University. He joined UM as an assistant professor in 1993 and earned the rank of full professor in 2002. Students working in Callaway's lab range from undergraduates to postdoctoral researchers and include scientists from around the world. They study topics ranging from resource competition to ecological changes brought about by herbivores and soil microbes. He has served as Montana's NSF EPSCoR director since 2013.

--Source: UM News

ScienceMontana launches as portal to STEM resources

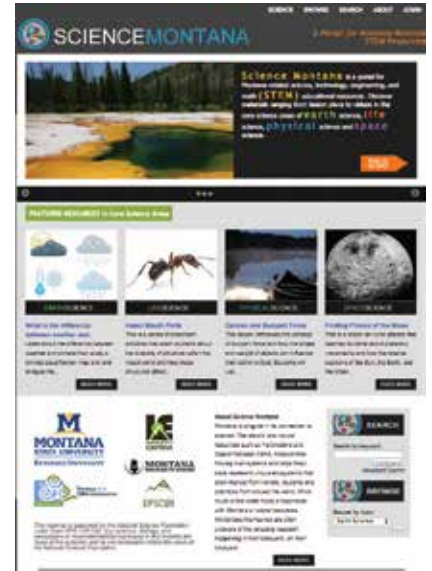
Montana NSF EPSCoR has launched **ScienceMontana**, an online database of educational resources covering science, technology, engineering and mathematics (STEM) topics. The database features resources created *in* Montana and *about* Montana, as well as resources relevant to the northern Rockies. The site was developed by Montana EPSCoR's outreach partner MSU Extended University, and many of the resources relate to science conducted under current and past EPSCoR grants, including **Montana Institute on Ecosystems** research on wildfires, biodiversity, climate and the Greater Yellowstone Ecosystem.

The state's rare natural resources – Yellowstone and Glacier national parks, massive free-flowing river systems and large fossil beds – represent unique ecosystems that draw interest from visitors, students and scientists from

around the world. While much of the world holds a fascination with Montana's natural resources, Montanans themselves are often unaware of the research happening in their backyard. ScienceMontana seeks to connect Montanans to the science happening in our state.

Resources include lesson plans, videos, hands-on activities and other materials in earth science, life science, physical science and space science. The database also includes multi-cultural STEM lesson plans created by Native American teachers.

Visitors can browse by topic or keyword, such as climate, water, ecosystem, nano, astronomy and more. New resources will be uploaded periodically, and Montana organizations and educators as well as other EPSCoR states are encouraged to submit resources for inclusion.



Access STEM resources made **IN** Montana and **ABOUT** about Montana at www.sciencemontana.org

Hu and Jencso: UM-MSU Collaboration Thrives

One goal of the Montana NSF ESPCoR Track 1 research project is to increase multi-institutional research collaboration. Through creation of the statewide Institute on Ecosystems and innovative programs to engage faculty across disciplines, departments, and institutions, such as the Rough Cut Science Series, the Mentoring Program for Interdisciplinary Initiatives (PI2), the Science Summit, and the popular affiliate program, many multi-institutional research collaborations have been established. One example of collaborative success involves two early career faculty, **Dr. Jia Hu** at Montana State University and **Dr. Kelsey Jencso** at the University of Montana. Hu, a plant ecophysiologicalist, was an EPSCoR-supported hire and holds a joint appointment with MSU's Ecology Department and the IoE. Jencso, a watershed hydrologist and climate scientist, was hired to lead the Montana Climate Office. Through the IoE, Hu and Jencso met and hatched an idea for a research partnership. With seed funding from the IoE and NSF ESPCoR Track-1, they started working together at the **Lubrecht Experimental Forest** to understand how declining winter snowpack and increased deposition of nitrogen affect the productivity of forests in the western U.S.

In recent decades winter snowpack has declined, while anthropogenic nitrogen deposition has increased. Particularly in our complex mountain landscapes, these changes impact hydrology and geochem-

istry of snow-dominated montane forests in complex ways. Hu and Jencso want to understand how these factors combine to influence forest productivity. They established research sites with extensive sensor networks to collect necessary data. Based on initial data collection, they began writing proposals for additional funding. Montana NSF EPSCoR Director Ray Callaway puts this type of seed funding into perspective: "Leverage, leverage, leverage. EPSCoR seeds new ideas that can be competitive for new research grants, building Montana's research enterprise."

The first success of this partnership was a grant from **USDA** – also including co-PI **Dr. Yuriko Yano** – that funds expansion of their interdisciplinary study. They will examine the topographic controls on nitrogen availability, tree nitrogen uptake, and nitrogen loss from the ecosystem within a coniferous forest, experiencing relatively low nitrogen deposition rates. Their project includes field observations and controlled pot experiments. In the field component, they are examining topographical controls on snowpack dynamics, which affect the temporal synchrony between nitrogen availability and tree nitrogen demand. They are measuring seasonal nitrogen availability, tree nitrogen uptake rates, nitrogen use efficiency and tree growth rates in different species. In the pot experiment, they are simulating different snowpack levels and determining differences in nitrogen



Students Justin Martin and Nate Looker establish a meteorological station in the Lubrecht Experimental Forest.

uptake kinetics by different species. This work will provide a baseline understanding of topographical and seasonal controls on nitrogen availability, as well as provide a physiological understanding of how water and N control forest productivity. In more simple terms, their work will help to sustainably manage agroecosystems in response to changing environmental conditions. All three researchers are also very active in and committed to public outreach and mentoring university students.

More proposals are pending and so far the feedback looks promising for more grant success. A growing team of undergraduate and graduate students are working on the project. Unlike the annual Cat-Griz football game where one team celebrates victory on the field, this MSU and UM project is a win-win. Or in the "one Montana" idea of the IoE, it's a win for Montana.

MtnSEON network promotes SES

The Mountain Social Ecological Observatory Network (MtnSEON) is a research network with the goal of improving social and ecological resilience and sustainability for complex mountain landscapes in the Northern Rockies region and neighboring areas. Funded by the **NSF Research Coordination Network program**, MtnSEON emphasizes social-ecological systems (SES) approaches, bringing together social and ecological scientists to collaboratively understand these coupled human-natural systems. Led by an **Jim Gosz** at the **University of Idaho** and an executive committee that includes Montana EPSCoR Director **Ray Callaway**, MtnSEON facilitates, coordinates, integrates and synthesizes existing research; designs new research and education projects; and creates partnerships. Nine working groups cover an impressive range of topics, from large carnivores to riverscapes.

One of the growing partnerships is the **Social Ecological Systems Training and Education Program**. SESTEP aims to provide professional certification and graduate-level accreditation of “SES (social-ecological systems) in practice” for land and natural resource practitioners, managers, and decision-makers. The 10-week program will include two weeks of in-person training and eight weeks of virtual course work. Participants will learn SES theory, communication and collaboration skills of working across disciplines, regulatory considerations, and a process to identify and analyze the SES system in which they work. The first SESTEP prototype is under development at the **University of Montana**.

MtnSEON is an ideal partner for the IoE, which has established SES science as a priority for research and education through new social science faculty hires and statewide programs such as the IoE SES Initiative. The IoE will continue to work with MtnSEON to address a fundamental question: How can we reduce the vulnerability, improve resilience, and support sustainability of natural and human systems in complex mountain landscapes? Answering that question will require new collaborative research and education that crosses a diverse spectrum of disciplines and perspectives.

NSF EPSCoR in Montana (cont. from p. 1)

to identify and support high priority research and technology.

After a decade of support provided by MONTs, the NSF program also evolved, which led to a MONTs II program with new expectations. The university and the Legislature collaborated, and, in 1989, two highly significant bills were passed: HB 683 provided “Seed Capital” for research over 5 years of \$7.5 million to be managed by the state science committee—the Montana Science and Technology Alliance (MSTA); and HB 233 returned 100% of IDCs (indirect costs for grants) to campus.

When Swenson became MSU's Vice President for Research in 1990, he stated that the “faculty were excited about and committed to the rapid growth of research opportunities due to a “can do” spirit on campus.” Swenson wrote to faculty “...I have been overwhelmed ... by the spirit and quality of the faculty ... and the resulting vitality.” The 90's saw a substantial increase in funding for research, including a commitment and capacity to hire excellent new faculty.

In the 1990s the NSF program added new dimensions with increased funding: emphasis on Science-Technology-Engineering-and Math (STEM) education and on technology transfer and economic development. Match dollars were available from the state.

Meanwhile, in the early 1990s, EPSCoR and EPSCoR-like programs were developed at NASA, NIH, DoD, USDA, DoE, and EPA. Using the very successful MONTs model created for

NSF, MSU established similar models for each of the six new EPSCoR programs. By the end of the 90s, Montana was second only to Louisiana in winning EPSCoR awards.

Meanwhile, Congress changed the intellectual property (IP) rights policy for research funded by federal agencies. Enacted in 1980 and amended in 1984 and 1986, the Bayh-Dole Act created a uniform policy among all federal agencies that gave the IP rights funded by those agencies to the universities. By the early 90s NSF and other agencies were encouraging/requiring universities to participate in technology transfer activities. As a result, MSU created two new programs in 1993: The IPATNT office (Intellectual Property Administration and Technology Transfer office) focused on campus services for inventors, assisting in patenting decisions, and advertising IP options for licensing, and the CERTT center (Center for Economic Renewal and Technology Transfer Center) focused mainly on off-campus services to license and develop campus IP and was located in the Tech Park.

The legacies of each of these continue today as The Technology Transfer Office and TechLink in the Research Park.

In Part II of this article (Spring 2015), read about three major impact stories, a continuing history of NSF EPSCoR support in Montana, the legacy of this program throughout the state, and the current state of NSF EPSCoR-supported research, including the Montana Institute on Ecosystems.

Students assist NPS with monitoring projects (cont. from p. 1)

monitoring relate to climate measurements like temperature and precipitation.

Cooperation between the IoE and the Greater Yellowstone Network provides a tremendous opportunity for interns to gain practical experience conducting scientific work for the NPS. In turn we benefit directly from the assistance interns provide, and we are energized and inspired by the curiosity, enthusiasm, and work ethic that interns bring to our program. Motivated interns help us continually explore new ways to talk about and share our work – work that is meaningful to those involved no matter where their educational and career paths lead them. We look forward to teaming up with interns into the future. Learn more at <http://science.nature.nps.gov/im/units/gryn/index.cfm>

At right: Intern Suzanne Stevenson records data as part of the interagency whitebark pine long-term monitoring program (2014, NPS Photo)

