the RESEARCHER

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Use of common gardens and greenhouse sagebrush growth (pictured here) allows GEM3 researchers to assess the adaptive potential of sagebrush in a changing environment.

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the RESEARCHER

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LETTER FROM THE DIRECTOR

Dr. Janet Nelson

EPSCoR is a catalyst for change. More specifically, it is a program intended to accelerate the growth of Idaho's STEM research and education by strengthening our state's capacity and capability.

As the only state-based program at the National Science Foundation, it is arguably one of the most important policy interventions of our time related to federal-state partnerships to enhance academic research and education and opportunities for diverse people, groups, and institutions.

At the heart of EPSCoR is leadership at the state level, which is vested in both our State Committee and project director. This is why I am so honored to have had the privilege of serving as interim project director for the past two years.

I want to take this opportunity to thank the State Board of Education, the Idaho EPSCoR Committee, and all the faculty, staff, and students who were and are so actively involved in both of Idaho's recent statewide NSF EPSCoR RII Track-1 awards: Managing Idaho's Landscapes for Ecosystem Services (MILES) and Linking Genome to Phenome to Predict Adaptive Responses of Organisms to Changing Landscapes (known as GEM3).

Our research community is working together to continue the expansion of Idaho's capacity for academic research with wide-ranging implications for our state and local communities, and research that demonstrated how Idaho's expertise and capabilities can contribute to national and international issues of global significance.

The fact that the project director plays such a vital role on behalf of our state and academic community is why I am so pleased to share the news in my final letter as director that the baton has been successfully handed off to Idaho's new project director, University of Idaho Professor Andrew Kliskey. Andy has many years of EPSCoR experience and is himself a leader in researching how communities adapt with changing environments.

I invite you to meet Andy in this issue of our Idaho EPSCoR newsletter! And as a returning member of the Idaho EPSCoR Committee, I am excited to work with Andy as he leads Idaho's pursuit of continued growth as a recognized contributor to the national and global STEM research enterprise.

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New Director

Meet Andrew Kliskey, Idaho NSF EPSCoR's New Director

The NSF EPSCoR program offers unparalleled opportunities to pursue a different model of science than is conventionally done – science as a partnership with non-scientists, acknowledging the wisdom, experiences and perspectives that community members can share, and science pursued as a team endeavor. These are both elements I am passionate about in my work and which are already embedded in Idaho EPSCoR.

Dr. Andrew Kliskey

I have been very fortunate to have been accorded the privilege of working with communities across the Pacific. As a starting assistant professor at the University of Canterbury / Te Whare Wananga o Otautahi I assisted the Te Runanga o Kai Tahu (tribal government) of Te Wai Pounamu (New Zealand's South Island) to document tribal perceptions and perspectives on natural resources and the environment as Kai Tahu were about to negotiate revised legislation on the National Conservation Act in New Zealand. Landscapes that to many Pakeha (New Zealanders of European descent) were viewed as pristine wildland for remote recreation were simultaneously understood by Tangata Whenua (Maori) as places previously criss-crossed by their ancestors, as important hunting and fishing locales, and environments embodying spiritual essence. While I lived in Alaska I had the opportunity to return year after year to Inupiat (Northern Eskimo) villages around the coast of the Bering Strait to collaboratively chart how communities adapt and respond to changing climate, hydrological and permafrost regimes, and fluctuating subsistence hunting and fishing. With the Dena'ina people of Eklutna (north of Anchorage in southcentral Alaska) we co-designed a geodatabase for dynamically representing ancestral connections to the land and water. And with the Kenaitze people of Kenai Peninsula we co-developed representations of Kenaitze Youth perspectives on changing landscapes and hydrology of the Kenai River and its salmon fisheries (this as part of an Alaska EPSCoR project). Place-based knowledge and understanding provide a rich context in which to understand science and that to me is phenomenally exciting.

To be able to weave the multiple strands of knowledge that emerge when we want to understand the complexities of landscapes and communities necessarily requires diverse thinking, approaches, and knowledge that team-based science offers. As a postdoctoral researcher at the University of British Columbia I spent four seasons in Kluane's boreal forest working with a large team of botanists, ecologists, zoologists, and modelers as part of a NSERC funded collaborative special project. In Alaska I co-led the Kenai Peninsula case-study for Alaska EPSCoR and was able to build and work with a team of anthropologists, aquatic ecologists, climatologists, community water advocates, education specialists, fishery biologists, geographers, geospatial scientists, hydrologists, economists, land and water managers, landscape ecologists, and tribal representatives focused on salmon fisheries. In Idaho I have been co-leading a team of agriculture specialists, behavioral scientists, climatologists, community representatives, computational modelers, economists, environmental scientists, hydrologists, landscape architects, and social-ecological systems scientists to develop and explore plausible futures for Idaho's Magic Valley under climate and economic scenarios as part of an NSF-funded Innovations at the Nexus of Food, Energy, and Water Systems award. All of these are uniquely challenging but critically involve systems thinking, large team science, and approaches to weave it all together. While these approaches are never easy, and involve things not always working out the first time, they are incredibly rewarding when things go right.

I look forward to the challenges we have ahead of us as a large team of students, staff, faculty, administrators, community and agency representatives engaged in EPSCoR GEM3 in this new mode of science.

Collaboration, Integration and Convergence - Editorial Note

In this Fall 2019 newsletter we highlight three overarching and interwoven themes that are fundamental to Idaho EPSCoR and its GEM3 project: collaboration, integration, and convergence. The RII Track-1 project (GEM3) is characterized by multiple levels of collaboration, including across the State of Idaho, among its universities and colleges, within each institution, and with an array of key constituencies (State Board of Education, Idaho EPSCoR Committee, federal and state agencies, landowners and other stakeholders). GEM3 represents large team-based science, that the NSF EPSCoR program is uniquely able to support, and by default requires collaborative approaches and thinking. For the multiple strands of inquiry, knowledge, and methods in GEM3 to be brought together to generate innovative research and education there must be a level of integration developed and applied. The fundamental challenge of solving the complex problems and questions we face in society has been characterized by the National Academy of Sciences as convergence, that is, the merging of ideas, approaches, and technologies from diverse knowledge streams through robust integration. The feature articles in this issue examine collaboration, integration and convergence through the use of legacy data, social-ecological systems frameworks and mapping, and stakeholder advisory groups.

GEM3 Lab Module Design Workshop

A GEM3 Lab Module Design Workshop was held at Boise State University on July 29th, 2019 to facilitate collaboration among Idaho universities and two and four year institutions (Primarily Undergraduate Institutions; PUIs). The workshop is part of the larger GEM3 Education and Workforce Development component, the Vertically Integrated Project (VIP) strategy, which is a fully integrated research, education and workforce development program designed to increase the number, diversity and preparation of skilled scientists and engineers in GEM3 fields. It brings together undergraduate education and faculty research in a team-based context.

Teams include members of the three research universities, PUIs, and more than a dozen public, private, and nonprofit collaborators and stakeholders. The workshop was created to identify ways GEM3 research can be integrated into undergraduate courses.

GEM3 Lab Module Development workshop participants

Approximately 30 attendees were on hand including staff, faculty, and graduate students. The group addressed various topics including transferability of GEM3 lab modules, integration of modules with VIP courses, timeline and recruitment strategies, learning outcomes, paid summer research experiences (SREs), and current needs important to the overall scope of the project. Graduate students currently planning or implementing a lab module were on hand to describe their current work.

Presentations included:

- **Remote Sensing for Ecology**
  (Dr. Sarah Dalrymple, faculty at Boise State University)
- **Animal Phenotypes: Physiology and Nutrition**
  (Brecken Robb, graduate student at Boise State University)
- **Photographic-based Fish Morphometrics**
  (Tyson Hallbert, graduate student at Idaho State University)
- **Assessing Diet Phenology: Comparing Microhistory to Genomic Applications**
  (Ty Styhl, graduate student at University of Idaho)

Engaging PUIs in the VIP strategy is important to ensure that we are providing "onramps" for undergraduates from PUIs to get engaged in GEM3 research. Currently, the College of Western Idaho (CWI) is leading the effort on creating lab modules within their institution and has been engaging other PUIs on how to best initiate that effort. Dusty Perkins, Associate Professor of Biology at CWI, works closely with the GEM3 leadership team and provides critical guidance on how to increase PUI involvement.

Dusty Perkins, CWI faculty, addresses group during GEM3 Lab Module Development workshop.

Dusty has been instrumental in creating VIP courses and lab modules such as his course on Ecotypic Variation in Showy Milkweed with a focus on identifying locally relevant adaptive traits to maximize restoration success (Fall 2019). He is also teaching collaborative lab module courses in coordination with Boise State University on Remotely Sensing Plant Phenotypes and Monitoring Functional Phenotypes of Wildlife (Spring 2020).

Idaho Research

Using Legacy Data to Understand Gene by Environment Interaction in Big Sagebrush

Big sagebrush is a diverse species that occupies a wide range of habitats across the Western United States. Increasing wild fires across the range of big sagebrush call for effective restoration of degraded lands over large, varied landscapes. However, the success of restoration efforts is highly mixed, making management outcomes unpredictable. Researchers in Idaho's NSF EPSCoR GEM3 project are working collaboratively to investigate the role of high genetic variation combined with human decision to understand this source of variability in restoration.

Sagebrush common gardens in southeast Idaho

Local adaptations of big sagebrush populations are an important consideration for restoration success, however, local seeding material for restoration purposes isn't always available. This mismatch between supply and demand compels researchers to identify genetic, physiological, and ecological traits in big sagebrush that will allow them to predict population performance under a specific set of environmental conditions. To date, legacy data from long-term experimental common gardens have allowed researchers to quantify adaptive genetic variation on population vital rates. Additionally, GEM3 researchers have evaluated the role of demographic processes, such as density dependence, have on plant growth and survival. Including population performance and density dependence, such as competition, is essential for predictions of plant populations over time and across landscapes.

Researchers also used legacy data to quantify life-history traits in big sagebrush that are related to root architecture and belowground growth. Specifically, based on an isotope tracer experiment the variation in sideways root growth was found to be linked to genetic variation within the species more than it was to plant size. These findings have implications for variation in patterns of water use, one of the major limiting factors in arid ecosystems. Mechanisms of resource use and allocation of belowground biomass are important to unravel variation of life-history traits, provide strategies to overcome environmental stress, and help generate future hypotheses about the interaction between genetic variation and environmental conditions.

Understanding Social-Ecological Systems and Impact on Idaho's Resources

With growing population and changes in Idaho's landscapes, there is a pressing need to determine how both human and environmental factors, often referred to as social-ecological systems (SES), work together to either help or hinder the adaptive capacity of Idaho's plants and animals. Understanding these factors increase the ability to monitor and manage landscape processes to foster greater ecosystem resilience.

Although much research has been done to determine how these factors buffer the impact of environmental changes, there is still little understanding of how SES processes influence the adaptive capacity of plants and animals, or the outcomes of the various management actions that need to be taken to increase adaptive capacity under uncertain future SES conditions.

Dr. Donna Delparte from ISU testing out unmanned aerial vehicle

Efforts to create mapping tools and an SES framework is underway. Mapping tools will converge GEM3 data with social science and land use data to project how anticipated environmental changes and policy decisions influence adaptive capacity outcomes in plant and animal populations across landscapes. The end product will be spatially explicit maps that begin to reflect the influence of different SES system factors on population level adaptive capacity across aquatic and terrestrial ecosystems.

The GEM3 team is utilizing sensors and scaling up both on-ground and unmanned aircraft systems (UAS) to help collect mapping data at research sites. These remote sensing tools will assist in measuring phenotypes of sagebrush and redband trout and environments. Unmanned aerial vehicle (UAV) flights were conducted to collect both hyperspectral and thermal data which has been combined with on-the-ground measurements for analysis.

The team has also been mapping SES conditions, which involves mapping and analyzing land use and land cover change and developing a plan to perform quality control at legacy sites. Satellite imagery from these sites from the last 35 years has been acquired to map land use and land cover change. UAV data has also been collected at these sites for comparison and upscaling to improve land cover classification. Remote sensing analysis of land cover change will inform scenario generation and modeling efforts.

The GEM3 team is also working to develop a novel participatory mapping approach that takes into account local ecological knowledge of resource managers and other stakeholders (see stakeholder advisory group feature). The team will assess and characterize the interactions between human decisions and adaptive capacity outcomes, an approach that provides insights into how human land use may alter adaptive capacity of Idaho's redband trout and sagebrush populations.

Idaho Researchers Initiate Collaborative Groups to Catalyze Research and Informed Decision-making

A transdisciplinary team of GEM3 scientists from Idaho universities (University of Idaho, Boise State University, and Idaho State University) is engaging Idaho residents and decision-makers through the creation of a unique framework for collaboration. The aim of this work is to understand the impacts of environmental and social change on Idaho's landscapes, wildlife, and people. The overall focus of GEM3 is on the way in which genomes affect adaptive capacity in sagebrush ecosystems and redband trout habitat.

The GEM3 social-ecological systems (SES) team is working with local communities, land managers, and decision-makers to develop stakeholder advisory groups (SAG) in two communities in Idaho. Together, the SES team and the SAGs will identify and discuss approaches to key land and water management issues and challenges. The SES team is collaborating with community members that bring diverse perspectives and rich local knowledge to the GEM3 research goals. This collaborative approach will focus research questions on and help create tools to address the real-world challenges that these communities face.

Stakeholder workshops held in southeast and southwest Idaho during May 2019, involving 18 individuals representing diverse interests (state, tribal and federal agencies, landowners, and NGO's), have informed the process of identifying data to be collected for SES mapping. Stakeholders identified the importance of mapping landscape values with respect to sagebrush and trout. As a result, the SES team is implementing an SES hotspots mapping methodology.

In addition to the SAGs, the SES team is utilizing community-based observing networks and systems (CBONS) which will help in the development of a mapping approach that links quantitative and qualitative data to provide insights into Idaho's social-ecological systems.

The groups are organized around a broad theme of adaptation to social and environmental change and, as such, will be useful for addressing challenges around land and resource management, development, and conservation. Long-term impacts of these groups will include establishing collaborative frameworks within these communities and ensuring that GEM3 research serves the needs of Idaho's citizens.

A stakeholder advisory group meets with GEM3 SES team in Driggs, Idaho in May 2019.

Faculty

Welcome New Faculty

The Idaho NSF EPSCoR GEM3 project was already successful in bringing in five of the six proposed new faculty to fill important roles in the overall scope and mission of the project. This strategy is an important way to further develop Idaho's research capacity and capability. New hires were completed as planned at both Boise State University and Idaho State University. A Quantitative Population Ecologist will also be hired at Boise State University next year.

Megan Cattau

is Boise State University's new Assistant Professor in Human-Environment Systems and will serve as a Data Scientist in the GEM3 project. She received a Ph.D. from Columbia University, a Master of Environmental Management and a Certificate of Geospatial Analysis from Duke University, and a Bachelor of Fine Arts in painting and a Certificate of Environmental Ethics from the University of Georgia. She is coming from the Earth Lab, University of Colorado Boulder, where she was working as a Research Scientist.

Megan's primary interest is in how extreme disturbances or multiple interacting disturbances, both natural and anthropogenic, affect the capacity of ecosystems to recover, and how that relates to social-ecological stability. She is using field-based inventories, drone- and plane-based data, and satellite data to explore the spatial and temporal patterns of disturbance and how ecosystems may respond to disturbance across different levels of ecological organization.

"I am looking forward to building relationships within the GEM3 project and to contributing to the project's goals. In this time of rapidly changing land cover and climate, I am glad to be able to engage in research that will help us more fully understand adaptive responses and ultimately help us manage our resources more sustainably."

Sarah Ebel

recently joined the GEM3 team at Idaho State University serving as an Assistant Professor in the Department of Anthropology. She will serve as an Environmental Social Scientist in the GEM3 project. She received her undergraduate degree from Bowdoin College and a Ph.D. from the University of Maine.

Sarah's current research focuses on the governance of natural resources as well as institutional and individual adaptation to environmental change. Specifically, her work is situated in the Lakes Region of southern Chile where she studies ocean governance and the collective action and adaptive capacity of resource users. As a new faculty member in Idaho, she will be studying the social, cultural, and political dimensions of trout in Idaho, and how riparian habitats are affected by, and also influence, stakeholder behavior and the development of policy and adaptation plans.

"I am excited to contribute to a large interdisciplinary team focused on integrating genomics, ecology, and the social sciences. GEM3 provides a unique opportunity for cross-disciplinary engagement with a focus on understanding real-time and future problems through engaging stakeholders and holding conversations across diverse academic disciplines, agencies, and individuals. I look forward to thinking about adaptation scenario planning and working closely with stakeholder groups in Idaho."

Leonora Bittleston will

join the GEM3 team in January 2020 as an Assistant Professor in the Department of Biological Sciences at Boise State University. She will also serve as an Ecological Genomic Modeler in the GEM3 project. She has a B.S. in Molecular Environmental Biology from University of California Berkeley and a Ph.D. in Organismic and Evolutionary Biology from Harvard University. Leonora is currently a Postdoctoral Fellow in Dr. Otto Cordero's lab at Massachusetts Institute of Technology through a fellowship funded by the James S. McDonnell Foundation.

Leonora's current research uses the small ecosystems that form inside of carnivorous pitcher plants as model systems for understanding communities of species and how they influence hosts and ecosystem processes. The Bittleston Lab at Boise State will continue working with pitcher plant-associated communities but as part of GEM3 will also study the microbes colonizing sagebrush as a novel mechanism influencing adaptive capacity of plants. She brings expertise in bioinformatics that will help the research community understand patterns of genetic data, and her work will help systematically discover mechanisms of genomic expression for species in response to different stressors.

"I'm looking forward to working on the GEM3 project because it is an amazing collaboration across different departments, universities, and stakeholders. The questions of the GEM3 project also align closely with my research over the past few years, and I am excited to be more deeply investigating genotype to phenotype connections and ways to predict how our ecosystems will shift in a changing environment."

Matt Williamson

recently joined Boise State University in August 2019 as an Assistant Professor in Human Environment Systems and will serve as an Environmental Network Systems Scientist in the GEM3 project. He received his B.S. and M.S. in Wildlife Biology from Colorado State University and a Ph.D. in Ecology from the University of California, Davis.

Matt served as a Liber Ero Postdoctoral Fellow (in conjunction with the University of British Columbia, Okanagan; the University of Waterloo; and the Wildlife Conservation Society). Other former roles include working as a restoration ecologist in Illinois and program director for an environmental nonprofit in Arizona. He also served as a National Science Foundation Graduate Research Fellow, Wilburforce Foundation Conservation Science Fellow, Wilderness Society Gloria Barron Wilderness Scholar, Center for Large Landscape Conservation Science Fellow, and a Switzer Foundation Environmental Fellow.

His work focuses on integrating environmental, social, political, economic, and institutional data to identify locations where management actions are both necessary and feasible. For species like sagebrush and redband trout, successful conservation and restoration is likely to require a diversity of approaches that can be implemented across a variety of ownership and jurisdictions. His hope is that his work can help match the right tools to the right landowners in the most important places to ensure that we are using limited resources most effectively.

"I think GEM3 offers a really exciting opportunity to translate mechanistic understanding of multiple scales of interaction into human decision-making to create a landscape that can facilitate adaptation to the growing list of environmental changes."

Faculty

Kathryn Turner recently joined the GEM3 team as Assistant Professor in Ecological Genomics in the Department of Biological Sciences at Idaho State University and will serve as a Genetics Scientist in the GEM3 project. She has a B.A. from the University of Texas and a Ph.D. from University of British Columbia. She most recently served as an Eberly Postdoctoral Research Fellow in the Department of Biology at Eberly College of Science at Pennsylvania State University.

Her research focuses on evolutionary ecology and invasion biology. She combines experimental, genomic, ancient DNA, and geo-referenced distribution data to investigate plant ecological genetics, particularly rapid adaptation to novel environments and the evolution of ecologically important traits. As part of the GEM3 project, she will associate patterns of genetic change to ecological traits in big sagebrush, and investigate connections to land use change and biological invasions.

"GEM3 will give me the opportunity to apply what I have learned about rapid evolution in invasive species to an iconic foundation species. I am excited to join this large collaborative team and dig into this new system."

Student Highlights

Finding Research Success through Early Experience and Mentorship

In 2012, Tyrell Styhl, made a life changing decision. He decided to leave his successful business and pursue his education in the field of wildlife ecology.

He enrolled at College of Western Idaho (CWI) in 2013 determined that if he was going to succeed in a scientific, natural resources career, varied research experiences would be his ticket. In his first year, he dove into his first research experience under the guidance and mentorship of Dr. Steven Lysne, Assistant Professor of Biology at CWI, and eventually began conducting an independent research project evaluating the molluscan community found in southern Idaho.

As a freshman, he was learning research sampling design and advanced statistical analysis even though he felt a lack of knowledge on these subjects. This drove him further into his research and enhanced his desire for greater understanding. He participated in poster sessions early on sharing results of his work and won many top honors. According to Ty, this project allowed him to "learn by doing," which is a concept he has carried over into other research endeavors. He also learned early on the importance of communicating research to a broader audience.

After realizing his passion for ecological research and education from his early experience, he transferred to the University of Idaho (U of I) in 2015 to earn a B.S. in Ecology and Conservation Biology with a minor in Statistics and Wildlife Resources. He continued his undergraduate research by becoming involved with numerous research projects including a Research Experience for Undergraduates (REU) at Boise State University studying habitat suitability and breeding success of Ospreys in west-central Idaho. He soon became a participant in the EPSCoR MILES Undergraduate Research and Internships (MURI) program at CWI under the supervision of Dusty

Student Highlight

Perkins, Associate Professor in Biology, where he continued his Osprey research, modeling the morphometric growth of Osprey nestlings.

Styhl graduated with his bachelor's degree in May 2018 and soon started his Ph.D. program in fall 2018 under the supervision of Dr. David Tank, Associate Professor in the Department of Biological Sciences, and Dr. Courtney Conway, Professor in the Department of Fish and Wildlife Sciences. His research focus is on studying changes in the diet of southern Idaho sage-grouse from chicks to adults.

This study will inform management and policy decisions by providing detailed knowledge about the diet of greater sage-grouse and help document the effects of grazing on explicit species of forbs and insects important in sage-grouse diet. Additionally, the floristic collections will be publicly available and provide a community assemblage in space and time of the flora found across study areas in southern Idaho.

Ty, who comes from Idaho Falls, has a deep connection to sagebrush steppe since his family has lived here for many years. Better understanding the sagebrush dietary community that greater sage-grouse eat will inform habitat management initiatives that support a multiuse landscape. Thus, providing opportunities for recreation, ranching, hunting, and wildlife across the sagebrush steppe in Idaho.

Moreover, protecting greater sage-grouse and their habitat benefits other species that rely on sagebrush ecosystems like pronghorn, mule deer, elk, and upland game – all of which serve as valuable economic and cultural resources for Idaho.

In addition to his research, Ty is sharing his knowledge with other students. He is currently creating Vertically Integrated Project (VIP) courses, along with Dr. David Tank, for the U of I under GEM3's education and workforce development component. The VIP course, *Protecting and Conserving Sagebrush/Grouse Habitats* (BIOL 403), will be offered in Fall 2019 and Spring 2020.

He was also selected as a National Science Foundation Graduate Research Fellowship recipient in Spring 2018 which recognized his outstanding work in NSF-supported science, technology, engineering and mathematics.

According to Ty, his ecological research is motivated by the fact that without an understanding of natural systems, society is unable to conserve and preserve its inherent diversity and resources. A variety of research and outreach experiences have built a strong professional foundation and prepared him for the rigors of graduate research. Through his research, he will further our scientific understanding of isolated populations within wilderness areas, and contribute to the sustainability of Idaho's natural resources.

Tyrell Styhl, National Science Foundation Graduate Research Fellowship recipient

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GEM3 Seed Funding

The Purpose of GEM3 seed funding is to allow project leadership and the Idaho research community to respond quickly and effectively to new opportunities as well as pursue high impact, potentially transformative research. Its principal objective is to catalyze new research on focal species, species interactions, ecosystems, genomics/phenomics, and other emerging areas related to the scope of the GEM3 award. It is aimed at groups or individuals that emphasize the collaborative development and testing of important ideas and theories, cutting-edge analysis of recent or existing data and information, and/or investigation of social ecological systems issues.

Results of seed funding should enable the submission of proposals to NSF and other funding agencies, and/or result in conference presentations and publication of papers in peer reviewed journals, and/or other data products or innovations. It is also an important mechanism to broaden participation of institutions, faculty, and students from underrepresented groups.

The first round of GEM3 Seed Funding was awarded in August 2019 and another request for proposals is scheduled for January 2020. The three types of seed funding awards available include: Small (up to $50K), Large (up to $150K), and Workforce Development (up to $30K). Congratulations to the following award recipients!

SMALL SEED FUNDING AWARD RECIPIENTS:

Title: *Towards a genomic model to predict drought tolerance in sagebrush: Preventing embolism as a key adaptation*
Lead: Sven Buerki (BSU)
Co-Investigators: Stephan Novak, Marcelo Serpe, and Marie-Anne de Graaf (BSU), and Bryce Richardson (USDAFS)

Title: *Seasonal and thermal regulation of hormone signaling, growth, and reproductive success in free-living redband trout, Oncorhynchus mykiss gardneri*
Lead: Devaleena Pradan (ISU)
Co-Investigator: Ernest Keeley (ISU)

LARGE SEED FUNDING AWARD RECIPIENT:

Title: *Mapping and modeling to forecast ecosystem recovery after megafires in sagebrush steppe*
Lead: Trevor Caughlin (BSU)
Co-Investigator: Donna Delparte (ISU)

WORKFORCE DEVELOPMENT SEED FUNDING AWARD RECIPIENT:

Title: *Pathways to Conservation Careers*
Lead: Amber Greening (ISU)
Co-Investigators: Mark Beaver, Kitty Griswold, Morey Burnham, and Sonia Martinez (ISU)