

Idaho EPSCoR

www.idahoepscor.org



IDAHO
EPSCoR



GEM3

Genes by Environment
Modeling · Mechanisms · Mapping

Welcome to NSF
EPSCoR in Idaho
2018-2023

V.3.19

About Idaho EPSCoR/Governance

What is EPSCoR?

The Established Program to Stimulate Competitive Research (EPSCoR) is a program started at the National Science Foundation (NSF) to fulfill the mandate of the NSF to promote scientific progress nationwide. EPSCoR partners with eligible states to enhance the competitiveness of Science, Technology, Engineering, and Mathematics (STEM) researchers and institutions in jurisdictions that historically receive smaller amounts of federal research funding.

MISSION

EPSCoR enhances research competitiveness of targeted jurisdictions (states, territories, commonwealth) by strengthening STEM capacity and capability.

VISION

EPSCoR envisions its jurisdictions as recognized contributors to the national and global STEM research enterprise.

GOALS

- **Catalyze research capability across and among jurisdictions;**
- **Establish STEM professional development pathways;**
- **Broaden participation of diverse groups/institutions in STEM;**
- **Affect engagement in STEM at national and global levels; and**
- **Impact jurisdictional economic development.**

EPSCoR uses Research Infrastructure Improvement (RII), Co-Funding of Disciplinary and Multidisciplinary Research, and Workshops and Outreach investment strategies to achieve its goals.

Research Infrastructure Improvement (RII)

RII Track-1 awards provide up to \$4 million per year for up to five years. They are intended to improve the research competitiveness of jurisdictions by improving their academic research infrastructure in areas of science and engineering supported by the NSF and critical to the particular jurisdiction's science and technology initiative or plan. These areas must be identified by the jurisdiction's EPSCoR governing committee as having the best potential to improve the jurisdiction's future R&D competitiveness.

Governance

Idaho EPSCoR Committee

Idaho EPSCoR currently is led by a governing committee composed of 16 members with diverse professional backgrounds from both the public and private sectors and from all regions of the state. The EPSCoR Committee reports to the Idaho State Board of Education. The State of Idaho has demonstrated long-standing commitment to develop its research basis through EPSCoR by contributing to non-federal match as part of the appropriation for the State Board of Education (SBOE) via the Higher Education Research Council (HERC). The Idaho EPSCoR Office and the Idaho EPSCoR Project Director are located at the University of Idaho, and partner research institutions are Boise State University and Idaho State University.

For more information visit www.idahoepscor.org or www.nsf.gov/od/oia/programs/epscor/

Idaho EPSCoR Staff

As a statewide program interacting with hundreds of participants at all levels, the Project Director is assisted by a professional staff to ensure the efficient and effective performance of all project responsibilities.

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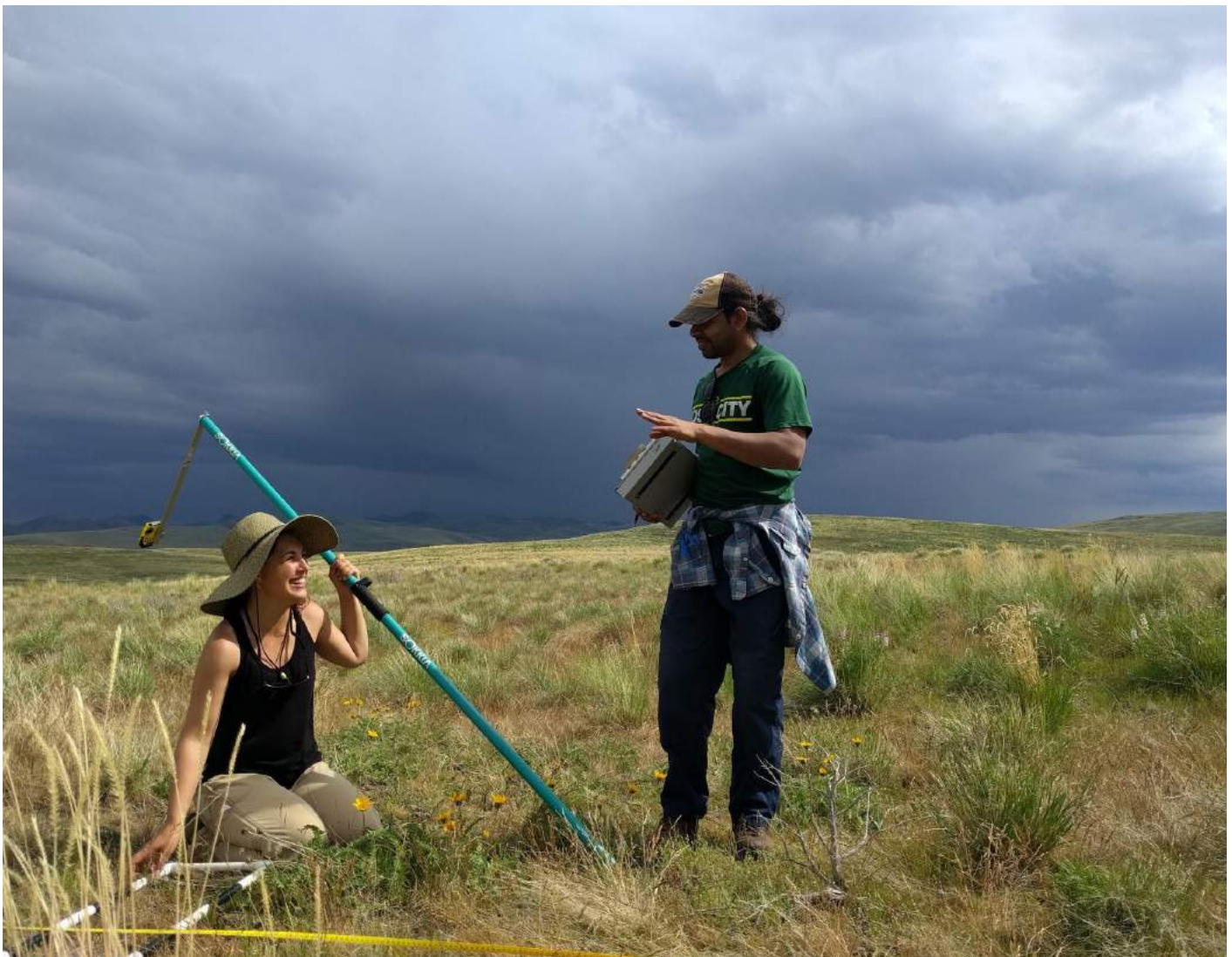


Photo credit: Dr. Jen Forbey and Dr. Trevor Caughlin, Boise State University

Research/GEM3

Genes by Environment: Modeling, Mechanisms, and Mapping (GEM3)

Idaho's newest RII Track-1 award (2018-2023), *Linking Genome to Phenome to Predict Adaptive Responses of Organisms to Changing Landscapes*, will advance fundamental knowledge on the mechanisms that rule genome to phenome pathways to predict how species adapt to external stressors and a changing environment. This knowledge will be useful for evidence-based resource management policies and practices for more adaptive and resilient species and landscapes. An additional goal is to strengthen and diversify Idaho's STEM workforce.

GEM3 includes a statewide participatory research program committed to the concept of Idaho EPSCoR's "ONEIdaho" vision of an integrated, productive and creative research culture and community of Idaho researchers that transcends institutional boundaries. GEM3 researchers will work across institutions, fostering integration of science and stakeholders, integration of science disciplines, and integration of research and education.

This statewide project combines research strengths in bioinformatics, complex modeling, ecology, fisheries science, genomics, geospatial science, remote sensing, and social-ecological systems (SES) science to contribute to one of the most compelling and contemporary national challenges of our time – understanding the "Rules of Life: predicting phenotypes from what we know about the genome and environment."

GEM3 Vision

Idaho leads the nation with thriving, collaborative, and inclusive research to discover and predict how plants, animals, and people interact and adapt to changing environments, resulting in the sustainable management of natural resources.

The overarching project goal of GEM3 is to enable the research community to understand the factors for, and forecast the outcomes of, how genetic diversity and phenotypic plasticity affect response to environmental change, shaping both population response and adaptive capacity.

GEM3's research hypothesis is that genetic diversity, or more precisely adaptive genetic variation, of populations will vary across key landscape axes in predictable ways and influence the adaptive capacity of populations.

While discoveries will be applicable to many plants and animals, two focal taxa will be under study: one aquatic (redband trout) and one terrestrial (sagebrush). These taxa are integral to ecosystems in the American West, and are central to land-use management decisions that drive the economy of the region. Using a landscape approach, key objectives will be achieved:

- 1. Modeling:** Discover gene by environment mechanisms and model populations across space and time;
- 2. Mechanisms:** Identify and understand genetic, environmental, and phenotypic mechanisms that translate to adaptive capacity of populations; and
- 3. Mapping:** Map genotype by environment outcomes in populations across complex Social Ecological Systems (SES) to inform management decisions.

A fully integrated research, education, diversity, and workforce development program will be implemented to increase the number, diversity and preparation of skilled scientists and engineers in GEM3 fields (e.g., bioinformatics, computational biology, conservation genetics, ecosystem management). GEM3 adopts a Vertically Integrated Projects (VIP) strategy to establish an on-ramp for students and provide a range of training, mentoring and professional development support to both students and faculty; it will be implemented statewide. The goal is to provide the scaffolding to support transdisciplinary science and grow the next generation of conservation science leaders and workers.

GEM3 will leverage state and federal resources to promote sustainable outcomes. Overall, 61% of Idaho land is owned and managed by federal agencies. Engagement of agency partners at all levels (biologists, land managers, policy makers, and administrators) will facilitate integration of science into management and policy and provide opportunities for knowledge sharing and development of professional networks between students and potential future employers.

GEM3 is fully aligned with, and guided by *Idaho's Research Strategic Plan for Higher Education* approved by the SBOE. The Idaho EPSCoR Committee selected GEM3 following an analysis by Elsevier Global Strategic Alliances and a rigorous year-long external review process. The topic was deemed to have the highest impact based upon several factors, including: (1) contribution to long-term economic and educational priorities of the state; (2) seamless integration of the academic strengths and priorities of the state's research universities; (3) ability of Primarily Undergraduate Institutions (PUIs) to contribute to the integrated research, education and workforce development activities; (4) industry demand for a larger, more diverse and better trained biological sciences workforce; and (5) value added to national strategic priorities.

People

A core group of over 30 researchers and educators, many with existing cross-institutional and cross-discipline collaborations worked together to develop this inspiring research and education plan.

For more information on GEM3 participants visit "People" at www.idahogem3.org



GEM3
Genes by Environment
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Photo credit: Dr. Ernest Keeley, Idaho State University



Photo credit: Dr. Jen Forbey, Boise State University



Photo credit: Dr. Jen Forbey and Dr. Trevor Caughlin, Boise State University

Education, Workforce Development, and Diversity

GEM3’s research and education ecosystem includes three research universities, four primarily undergraduate institutions (PUIs) and more than a dozen public, private, and nonprofit collaborators and stakeholders. PUIs include North Idaho College (NIC), Lewis-Clark State College (LCSC), College of Western Idaho (CWI), College of Southern Idaho (CSI), and College of Idaho (C of I).

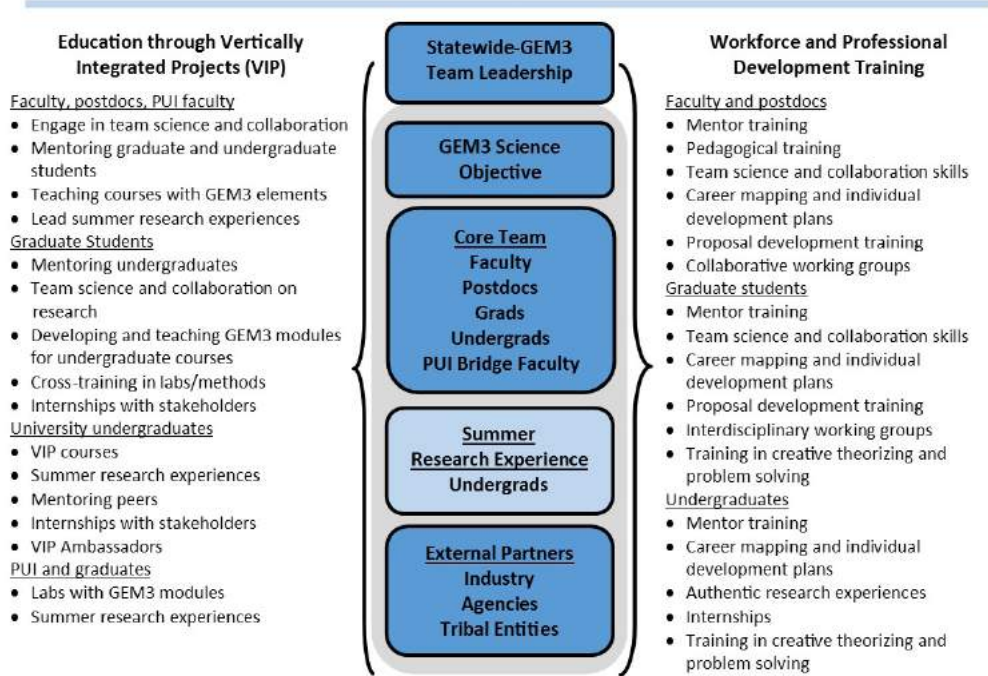
A fully integrated research, education and workforce development (WFD) program will be implemented to increase the number, diversity and preparation of skilled scientists and engineers in GEM3 fields (bioinformatics, computational biology, conservation genetics, ecosystem management).

Education and Workforce Development

Vertically Integrated Projects (VIP)

GEM3 uses a Vertically Integrated Projects (VIP) strategy. The VIP is an intentional curricular infrastructure that establishes an onramp for students and provides a range of training, mentoring and professional development support to both students and faculty. The VIP is implemented statewide and the goal is to provide the scaffolding to support transdisciplinary science and grow the next generation of conservation science leaders and workers.

Vertically Integrated GEM3 Approach



For more information visit www.idahogem3.org

Diversity

The GEM3 Diversity Plan aims to increase participation from underserved populations (primarily Hispanics and Native Americans), low-income, rural and/or first generation students, and women, through diversity programs and outreach to regional Tribes, Hispanic communities, and rural communities. Increased public scientific literacy will be achieved through the engagement of citizen scientists and communities. Agency, industry, and tribal stakeholders will participate in scientific data exchanges, inform GEM3 research questions, and provide internship opportunities.

Undergraduate Diversity

GEM3 supports Student Authentic Research Experiences (SARE) to promote diverse participation and success in GEM3-related STEM fields. The WFD program – through VIP – provides a unique framework to amplify the impact of research experiences on diverse undergraduate students. Substantial enrichments include: (a) use of student Ambassadors to recruit peers from diverse groups to participate in VIP; (b) a strong social support network; and (c) a sustained effort that guides students from freshman to graduation.

This program specifically seeks underrepresented minority (URM) students, providing them with an intensive laboratory and field experience, while creating an important bridge between academic years. This experience is also open to diverse students from the PUIs who transfer to Idaho research institutions.

Faculty Diversity

A more inclusive and diverse faculty will be promoted on campuses by taking a career-cycle approach that improves recruitment, retention, and advancement of URM and female faculty. The Idaho System to Attract and Retain Talent (START) will adopt the effective practices of the NSF ADVANCE model to attract and retain diverse faculty. Idaho START promotes best practices in faculty recruitment and retention of faculty from underrepresented populations. The START team, comprised of funded coordinators at each institution will map existing practices to gain a clear understanding of current recruitment, retention, and advancement activities. START will then select key departments to pilot best practices and work with the department leadership and faculty to align diversity practices with START protocols.

Statewide Diversity

Diversity statewide will also be promoted by expanding the Idaho Diversity Network (IDN). The IDN is a statewide network managed and funded by Idaho EPSCoR with leadership provided by STEM and diversity representatives from Idaho's academic institutions and other sectors across the state.

For more information on Idaho Diversity Network visit www.idahodiversity.org



Photo credit: Dusty Perkins, College of Western Idaho

Funding Opportunities

Seed Funding

The GEM3 Seed Funding program allows the program to respond to new opportunities as well as pursue high impact, potentially transformative research and educational projects. Its principal objective is to create a mechanism to catalyze new research on focal species, species interactions, ecosystems, genomics/phenomics, or other emerging areas related to the scope of GEM3.

Topic areas may be identified during the annual review of the NSF-approved RII Strategic plan, the Project Advisory Board (PAB) and External Evaluator, and the NSF Reverse Site Visit. Three types of awards will be available as noted below. Seed funding awardees are expected to use results of the work as a basis for pursuing external funding, co-authoring peer reviewed papers, and/or developing other GEM3-related innovations.

1. Small Research Seed Funding (\$50K, 1 year):

The primary purpose of these awards will be to support early career faculty who are initiating research in topics related to GEM3; established faculty with innovative ideas will also be eligible to apply. The award will provide support for exploratory and/or high-risk research for which preliminary data are needed.

2. Large Research Seed Funding (\$150K): These 2-year awards will support collaborative research in topics related to GEM3. To broaden participation, proposing teams must include faculty from at least one other institution and discipline. Funding will support M.S. and Ph.D. research and allow for student exchanges within the state.

3. Workforce Development Seed Funding (\$30K): These awards will provide support to strengthen internship or training opportunities with existing institutional agency, underrepresented community, or Tribal collaborators.

GEM3's Seed Funding program will be initiated in Spring 2019, with competitions held annually. Competitions will be announced and advertised statewide. It is expected that at least one new large research award and two small research awards will be made on an annual basis. All proposals must address NSF criteria for Intellectual Merit and Broader Impacts.

For more information visit www.idahogem3.org



Photo credit: Dr. Jen Forbey, Boise State University

Partnerships & Collaborations

GEM3 leverages state and federal resources to promote sustainable outcomes. Overall, 61% of Idaho land is owned and managed by federal agencies. Engagement of agency partners at all levels (biologists, land managers, policy makers, and administrators) will facilitate integration of science into management and policy, and provide opportunities for knowledge sharing and development of professional networks between students and potential future employers.

Research and Education

Regional and State partnerships with local, state, federal, and Tribal agencies will allow GEM3 to pursue its research agenda using existing data relevant to the study systems and organisms of interest. Partners include Idaho Department of Fish and Game (IDFG), Columbia River Inter-Tribal Fish Commission (CRITFC), US Geological Survey (USGS), US Forest Service (USFS), Shoshone-Bannock Tribes, and the Bureau of Land Management (BLM). Partnerships are directly related to GEM3 investigations: USGS and USFS have sagebrush common gardens and archived seed collections, and collaborative expertise; BLM will provide access to field sites; CRITFC will collaborate on genome sequencing, fish collection, and common garden experiments; and IDFG will participate in sampling redband trout populations and provide tissue samples from archived collections. The Shoshone-Bannock Tribe will collaborate on research and education to recruit native students into internship and graduate student position.

Partnerships

Partnerships will leverage EPSCoR investments. Collaboration with the Consortium of Pacific Northwest Herbaria will contribute to and utilize online access to information about the flora of Pacific Northwest. Collaboration with the USDA ARS Reynolds Creek Experimental Watershed and Reynolds Creek CZO will allow us to leverage existing common gardens within their boundaries for mechanistic, mapping, and monitoring studies. Current data are related to soil microbiology, carbon allocation and fluxes, soil nutrient dynamics as well as educational outreach efforts. Integration with Tribal biologists and students will foster sharing of cultural knowledge and values, providing a richer context for application of science to natural resource management. Such partnerships will expand the ability to understand, monitor, and manage the genetic and phenotypic mechanisms that allow plant and animal populations to persist in the face of environmental change.

Education, Workforce Development, and Diversity

Idaho EPSCoR's collaboration with 2-year and 4-year colleges has grown significantly since 2013. Existing connections among universities and colleges will continue to promote pathways for students and dialogue among faculty. College partners include North Idaho College, Lewis-Clark State College, College of Western Idaho, College of Southern Idaho and College of Idaho. Faculty and students at these colleges will be involved in WFD/Diversity. GEM3 partnerships will leverage the strengths of other STEM education organizations within Idaho such as the Idaho STEM Action Center to achieve program goals. GEM3 will translate research training to agency partners and industry, and use the project as a mechanism to engage teachers and students in authentic research experiences and prepare them for diverse careers.

Milestones and Timeline

Within the first six months of the award, GEM3 will initiate biannual meetings with existing and potential partners, each themed with rotating topics (e.g. Research, STEM Education and Workforce Development, Diversity, and Commercialization) to ensure regular and bilateral communication, coordination, and data sharing. Collaborating organizations will also be invited to participate in the Idaho EPSCoR Annual Meeting each fall to ensure the dissemination of project results and promote opportunities to coordinate activities for the coming year and to develop ideas and plans to co-produce papers, publications, agreements, and transcripts that reflect best-science and management strategies.

Participant Expectations/Data Management

Participant Information

Faculty participation in GEM3 is coordinated by the Principal Investigators at each university. Policies and procedures governing participation are administered by the Idaho EPSCoR Office.

Expenditures

Project expenditures are governed by the federal cost principles (2 CFR 200) and must conform to NSF policies, grant provisions, grantee internal policies, and Idaho EPSCoR Office requirements.

- **Boise State University:** Transactions will be processed by the BSU EPSCoR Research Administrator, Denise Pfeifer.
- **Idaho State University:** Transactions will be processed by the ISU EPSCoR Research Administrator, Kitty Griswold.
- **University of Idaho:** Transactions will be processed by the UI EPSCoR Administrative/Financial Specialist, Vanessa Henry; except for departmental credit card statements. Credit card charges must be pre-approved by the Idaho EPSCoR Office and documentation must be provided along with the corresponding journal number.

To access financial forms or for additional information visit www.idahoepscor.org/financial-forms

Reporting

The purpose of reporting is to showcase achievements to NSF, which may be highlighted for the general public; to show compliance with award requirements; and to show how EPSCoR-supported research and education is positively affecting quality of life, education, and economic prosperity in Idaho.

Reporting Requirements

EPSCoR reporting requirements are greater than those of a standard award.

Participants must be willing to provide ad hoc and regular reports of progress. Annual reports will be due via an Idaho EPSCoR online reporting system by May of each year. Reports will include topics such as technical progress, key outcomes and achievements, and anticipated or achieved impacts linked to the Strategic Plan; training and professional development; broadening participation; outreach activities; publications; proposals; websites, data and other products; technologies & techniques, patents, inventions, licenses; organizational collaborations; and honors and awards.

Post Award Reporting

Upon reasonable request, participants are expected to provide Idaho EPSCoR with updated information about their research, education, and outreach activities and accomplishments for five years after RII award completion. This information will be important to promote the lasting impacts of the EPSCoR investments and to the State when the Idaho EPSCoR Committee applies for future EPSCoR support.

Project Advisory Board

The Project Advisory Board (PAB) is a group of independent external experts who annually review the progress of the GEM3 project and provide guidance to help ensure its success. Their recommendations are provided in written reports to EPSCoR leadership and the National Science Foundation.

External Evaluation

The RII program includes review and evaluation by an independent external evaluator. Our evaluator regularly contacts project participants during preparation of her reports; your timely response to her requests will be appreciated.

Data Sharing

Data sharing allows scientists to expedite the translation of research results into knowledge, products, and procedures to improve human-environment systems. By accepting funds from GEM3, participants agree to federal standards which require that all of their data and research products be made available to the public in a timely manner. For purposes of GEM3, we define timely as 6 months for raw and processed data and two years for derived data and non-data research products. Participants also agree to share their research products internally with GEM3 members as soon as it is cleaned and ready for analysis. Please review the GEM3 Data Sharing Plan at www.idahogem3.org.

To share your data visit www.idahogem3.org or contact one of the GEM3 Data Managers.

Communication/Related STEM Networks

Communication is key for collaboration and integration. Idaho EPSCoR hosts a number of websites, publications, and social media venues to enhance communication and promote the positive impacts of STEM research and education in Idaho.

Websites

Idaho EPSCoR – www.idahoepscor.org

This site provides important EPSCoR announcements, call for proposals, news, highlights, calendar of events, headlines on twitter, plans and policies, office staff contact information, online reporting system, videos, and other resources.

GEM3 – www.idahogem3.org

This site provides information specific to GEM3 study sites, research teams, stakeholders, vertically integrated program (VIP), online reporting system, strategic plan, directory information, and other GEM3 resources.

Participants should login to the secure portion of the site to view Working Groups, calendars, data, and other collaborative tools.

Newsletter Publications

The Researcher

The Researcher is an Idaho EPSCoR newsletter published tri-annually and is available in digital or hardcopy format.

INBRE/EPSCoR E-News

Idaho EPSCoR provides an email news publication published monthly in conjunction with the INBRE Program. The E-news is a shorter version of an Idaho EPSCoR newsletter containing research highlights, student profiles, and upcoming events and deadlines.

Social Media

Participants can also follow Idaho EPSCoR on Twitter @IdahoEPSCoR

Related STEM Networks

Idaho Diversity Network (IDN)

www.idahodiversity.org

The IDN is a statewide organization managed and funded by Idaho EPSCoR with leadership provided by STEM and diversity representatives from Idaho's academic institutions and other sectors across the State.

Other Services

Services such as videoconferencing and teleconferencing are also available for participant use. To learn more about how to schedule a meeting visit our website at **www.idahoepscor.org**.

Subscribe

We encourage all GEM3 participants to subscribe to EPSCoR news and also to submit story items by visiting **www.idahoepscor.org**

