the **RESEARCHER**

IDAHO NSF EPSCoR

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Redband trout in the common garden tank at U of I Hagerman Experiment Station under ultraviolet light (note the bright tags appearing as yellow-orange lines) read more on page 5-6

Photo Credit: Dr. Ron Hardy

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LETTER FROM THE DIRECTOR



Dr. Andy Kliskey

One of the tenets of the Established Program to Stimulate Competitive Research (EPSCoR), and not least GEM3, is collaborative science. Building on the Collaboration – Integration – Convergence troika I highlighted in the Spring/Summer 2019 Newsletter, I focus on collaboration in this issue.

More than 180 people are currently involved in GEM3, including undergraduate and graduate students, postdoctoral scientists, new faculty hires, faculty, staff, administrators, EPSCoR Committee members, Project Advisory Board members, state and federal agency partners, and many

other stakeholders. The breadth of collaboration among these groups was on view at our 2019 Idaho EPSCoR Annual Meeting in Boise, Dec 2-3, 2019, where collaborative science was at the center of a highly successful poster session, very constructive break-out groups, and numerous lunch-time discussions.

In GEM3 we have been able to advance significantly the level of cross-institution collaboration among Boise State, Idaho State University, and University of Idaho and take some important steps toward raising our level of collaboration with primarily undergraduate institutions.

A successful Trout Summit, Genomics and Reintroductions Workshop, and the Community-based Observing Network Workshop in Fall 2019 all supported important opportunities for collaboration across disciplines, institutions, and constituencies in Idaho. In total, these three events alone involved nearly 80 participants, with almost half of those from our academic community attending more than one of these events.

In 2020 we look forward to enhancing collaboration across the Modeling, Mechanisms, and Mapping components of GEM3 and between our research and education programs. I encourage all to look for new opportunities to collaborate this year in GEM3.

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Unless otherwise noted in feature byline, articles and features in this publication are written by Sarah Penney with editing and content contributions by EPSCoR administrative team.

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Idaho EPSCoR

Idaho EPSCoR Annual Meeting Highlights Collaboration, Integration, and Convergence



Governor Brad Little provides welcome address for the Idaho EPSCoR Annual Meeting

Jan 15, 2020 – Idaho NSF EPSCoR recently held their annual meeting in Boise, Idaho on December 2-3, 2019 to discuss progress on the current Idaho EPSCoR RII Track-1 project, Linking Genome to Phenome to Predict Adaptive Responses of Organisms to Changing Landscapes (GEM3).

Over 100 participants were in attendance bringing together stakeholders and researchers from the University of Idaho, Boise State University, Idaho State University, and other institutions, to understand the impacts of environmental and social change on Idaho's landscapes, wildlife, and people.

Idaho Governor, Brad Little, provided the welcome address and Laird Noh, EPSCoR State Committee Chair, shared opening remarks. The annual meeting is a place to bring all the GEM3 research teams and stakeholders together to integrate across disciplines. Breakout sessions for working groups on trout, sagebrush, social ecological systems allowed for a convergence of ideas. Diversity and Workforce development members also presented on status of Vertically Integrated Projects (VIP) and the overall GEM3 approach to broadening participation of underrepresented populations.

The event keynote was Dr. Camille Parmesan, NMA Chair in Public Understanding of Marine Science & Human Health, School of Biological & Marine Sciences (Faculty of Science & Engineering), University of Plymouth, who presented topics related to the Intergovernmental Panel on Climate Change (IPCC) report on ecosystems.

To help move GEM3 towards more convergence research and help the project work more effectively, attendees also participated in the Toolbox Dialogue Initiative (TDI) which is designed to help incorporate different perspectives within large and complex projects. The TDI, which studies and facilitates communication in collaborative, crossdisciplinary research and practice settings, helps with the challenge of communicating across disciplines and professions to accomplish GEM3 objectives.

GEM3 Project Advisory Board members, consisting of experts from key research areas from around the nation, were also in attendance to review progress and offer observations and suggestions. The project, which is currently in the second year of a five-year award, next will undergo an evaluation (referred to as a Reverse Site Visit) at the National Science Foundation in April 2020. The evaluation is an important component of the post-award oversight of all RII Track-1 Cooperative Agreements with NSF EPSCoR.

Idaho EPSCoR

GEM3 Annual Meeting Highlights



Laird Noh gives opening remarks



Toolbox Dialogue Initiative Session



Students and faculty were able to participate in a poster session featuring GEM3 research

(PHOTO CREDIT: Carrie Roever)



To learn more about the GEM3 project visit: **www.idahogem3.org**

To view individual poster PDFs visit: https://www.idahogem3.org/annual-meeting-2019

Working Group Breakout Sessions

Investigating the Nature vs. Nurture Question

By Dr. Ron Hardy and Dr. Chris Caudill

"Nature vs. Nurture" is a classic debate. Are the traits exhibited by plants and animals controlled by genes, by the environment, or by an interaction of the two? This question has been debated for centuries in the fields of ecology and evolution. The debate has pressing importance because humans are altering environments at increasing rates. Knowing how the genome of an individual organism interacts with the environment it experiences to shape its development, physiology, behavior, and survival will provide insights into which populations and species will persist in changing landscapes.

How can we measure the importance of these effects? The 'gold standard' approach is a common garden experiment, where populations of fish from distantly separated streams are reared in one or more 'common' environments. This allows scientists to tease



GEM3 Trout team members at Fawn Creek (Cold Montane, near Cascade Idaho).

apart how genetics and environment each contribute to variation in characteristics such as body form, behavior, and key physiological traits such as temperature tolerance. Populations from different environments likely differ in genetic diversity, suggesting that populations with large genetic diversity should contain fish with a wider range of phenotypes than populations with lower genetic diversity and therefore should be more likely to persist in the face of a changing environment. However, populations with lower genetic diversity may adapt to environmental challenges, such as high water temperatures, by other adaptive strategies such as modifying their metabolism, behavior, or physiology. The GEM3 project selected redband trout, a subspecies of rainbow trout, to investigate the nature versus nurture question because redband trout have populations known to differ in genetic composition and because traits differ within and among populations. In particular, past work by several GEM3 investigators has demonstrated genetic adaptation to warm water in 'desert' streams in the southern portions of Idaho. GEM3 investigators hypothesize trout that survive in desert streams, where upper water temperatures approach theoretical lethal levels, may differ in genetic diversity from cool-water populations. However, cool-water populations may contain individuals who have it 'in their nature' to withstand warm

Research cont.

temperatures. The GEM3 common garden study will provide information to test this hypothesis.

GEM3 researchers, working with Idaho Department of Fish and Game, identified several redband populations that have evolutionary histories in warm and coolwater environments and collected fry to use in common garden studies. In addition to collecting fish from desert streams in southern Idaho, fish were collected in northern Idaho where water temperatures are much cooler throughout the year. For example, two creeks were sampled in drainages high above the Kootenai River, and in fact had to be accessed by driving into Montana first! Through the summer, these streams averaged about 54°F during August and did not exceed 61°Fmuch cooler than summer temperatures that their desert counterparts experience, which can exceed 84°F during the day in the peak of summer. How well these populations can grow at different water temperatures and tolerate short-term exposure to very warm temperatures will be examined during the GEM3 project.

One challenge faced by researchers is how to identify fish collected from different streams once they are placed in common garden tanks. Fish

were collected from several streams in three distinct environments: cold, cool and warm-water streams. It is important to know the stream of origin for each fish after they are placed together in common garden tanks. The stream identity of each fish can be established by genetic analysis from a fin clip, but researchers need to quickly identify them. The solution is to apply fluorescent plastic tags, essentially tattoos, that light up with different colors (red, orange/yellow and green) under UV light (see cover photo), allowing researchers to immediately identify the origin of trout in the common garden tanks.

The common garden studies will allow scientists to determine how much of the redband trout's ability to adapt is related to genetics vs. phenotypic plasticity—nature vs. nurture.



Dr. Chris Caudill snorkeling collection locations at Callahan Creek (Cold Montane, N. Idaho, near Troy, MT. Photo Credit: Victoria Potts).

Dr. Ron Hardy is the former Director of the Aquaculture Research Institute and Professor at University of Idaho

Dr. Chris Caudill is an Associate Professor of Fish & Wildlife Sciences at University of Idaho

STEM

New Statewide Idaho STEM Ecosystem Taking Shape

In October of 2019, the Idaho STEM Ecosystem was chosen, through a highly competitive process, to join the STEM Learning Ecosystems Community of Practice – a global STEM ecosystem initiative.

The Ecosystem is a community of localized partners, programs, and other resources the Idaho STEM Action Center has been charged with sustaining and growing to advance science, technology, engineering, and math fluency and workforce development.

The Idaho Diversity Network, which is funded by the Idaho NSF EPSCoR program, is part of this effort and is working with the Idaho STEM Action Center to increase the involvement of STEM partners in Idaho.

The first convening of the new Idaho STEM Ecosystem was held on January 16, 2020 with over 60 Idaho STEM supporters in attendance. Intended outcomes from the Idaho STEM Ecosystem include:

- Develop a shared understanding of the importance of ecosystem approach to goals
- Craft shared goals, aspirations, and indicators of success for Idaho STEM Ecosystem
- Identification of constraints that stand in the way of success for Idaho
- Development of outline or action plan for Idaho, including identification of priorities, work groups, general governance structure and timeline

The first convening also starts the process of creating the blueprint for the Idaho STEM Ecosystem that allows for adaptation to regional needs. Additional planning meetings will be held throughout the year with the intention of bringing on additional members – all with the goal of increasing STEM literacy in the state of Idaho.





EPSCoR Support

EPSCoR Support Brings Broader Impacts Training to Idaho Faculty



Dr. Jory Weintraub, Science Communication Program Director at Duke University, presents "Broader Impacts 101" to U of I participants.

Recognizing the importance of Broader Impacts (BI) in developing competitive proposals for the National Science Foundation (NSF), Idaho EPSCoR, the University of Idaho (U of I) Office of Research and Faculty Development, and Washington State University co-sponsored Broader Impacts 101, a half-day training from the NSF-funded center Advancing Research Impact in Society (ARIS). The workshops, held from November 6-8, 2019, at U of I, Idaho State University, and Boise State University, drew nearly

100 researchers to the three events. The workshops were presented by Dr. Jory Weintraub, Science Communication Program Director with the Duke University Initiative for Science and Society and BI trainer for ARIS.

Broader Impacts of your research are the potential to benefit society and contribute to the achievement of specific, desired societal outcomes. NSF has emphasized the importance of broader impacts, factoring it into proposal review criteria. Nancy Holmes, Proposal Development Specialist and workshop organizer at U of I stated, "Judging from the number of participants at all three workshops, it's clear that researchers are interested in learning more about broader impacts and how to address these in their proposals. Dr. Weintraub did a great job of engaging us in the process, and his message was appropriate across all STEM disciplines. We're grateful for EPSCoR's support of these workshops!" For more information on the NSF's review criteria, please see their Proposal and Award Policies and Procedures Guide. For a clear and concise overview of NSF's expectations with respect to broader impacts, please see Broader Impacts Guiding Principles and Questions, published by the National Alliance for Broader Impacts (NABI).

UI LSAMP Bridge to Doctorate Program Recruitment Underway

In the fall of 2019, the University of Idaho (U of I) was awarded a \$1 million grant from the National Science Foundation (NSF) for students to participate in STEMbased doctoral degree programs. This effort, funded through the NSF Louis Stokes Alliances for Minority Participation (NSF-LSAMP) Bridge to Doctorate fellowship program, will assist Native American doctoral students who wish to pursue a doctoral degree in a STEMrelated field.

The award is being led by Dr. John Wiencek, Provost and Executive Vice President, Dr. Jerry McMurtry, Dean of the College of Graduate Studies, and Dr. Yolanda Bisbee, Executive Director of Tribal Relations at U of I.

College of Graduate Studies will administer the grant and recruit participating students for fall 2020 through a partnership with the All-Nations LSAMP program, which involves 25 tribal and higher educational institutions, including U of I. The recruitment process is underway and selected students will begin doctoral programs in fall 2020.

The task of awarding only twelve positions from a large number of meritorious applications will be a challenge. According to Dr. Jerry McMurtry, there are more students interested in the program than anticipated. Much of the interest comes from partner institutions involved in the All Nations LSAMP program such as Salish Kootenai College in Montana and Heritage University in Washington. There is also interest from neighboring tribes such as the Nez Perce Tribe, Yakama Nation, and Confederated Tribes of the Umatilla Indian Reservation, and as far away as Lumbee Tribe from North Carolina. The team is also recruiting at National LSAMP events and recently did a presentation at the 25th Annual Celebration of the Alaska Native Science and Engineering Program in Anchorage, Alaska. A trip to Navajo Technical University, Diné College, and Haskell Indian Nations University, is also in the works.

This new award also receives EPSCoR co-funding, which is an NSF effort to provide joint support along with NSF directorates and offices for select meritorious proposals in order to accelerate the movement of EPSCoR researchers and institutions into the mainstream of NSF support. One of the objectives of EPSCoR co-funding is to broaden participation in science and engineering by institutions, organizations and people within and among EPSCoR jurisdictions.

Over 40 U of I professors have expressed interest in partnering with incoming students, and participating students and their program leaders will be encouraged to integrate traditional ecological knowledge, an indigenous way of seeing science and the environment, into their studies.

Dr. McMurty stated, "It's exciting and encouraging to see the interest that is out there, especially interest in STEM degrees across the university in fields such as Natural Resources, Engineering, Entomology, and others."

EPSCoR Track-4

EPSCoR Track-4 Awards in Idaho

The NSF EPSCoR Research Infrastructure Improvement (RII) Track-4 fellowship awards are a relatively new approach to support the development of early-career faculty in EPSCoR Jurisdictions. These awards now are distributed to researchers across 20 states. Awardees make extended collaborative visits to laboratories and scientific centers, establish partnerships with researchers with complementary expertise, learn new techniques, have access to sophisticated equipment, and may even shift their research focus in new directions.

Unlike other types of NSF EPSCoR awards, which focus on supporting research centers and partnerships among institutions, RII Track-4 focuses on giving individual researchers the foundation for collaborations that span their entire careers. RII Track-4 supports EPSCoR's mission of increasing scientific progress nationwide, as fellows enhance the research capacity of their local institutions and jurisdictions.

There are currently five active Track-4 EPSCoR projects in Idaho:



Dr. Michael Strickland

Assistant Professor, Department of Soil and Water Systems, University of Idaho

RII Track-4: A Multiomic Approach Towards an Understanding of the Environmental Implications of Antibiotics on Soil Processes

\$215,522 (2018-2020)

Dr. Strickland is working with colleagues at Pacific Northwest National Lab (PNNL) to better understand the effect of antibiotics on soil microbial communities and ecosystem processes using multi-omic approaches that leverage genomics, transcriptomics, and metabolomics.



Dr. Lisa Warner

Assistant Professor, Department of Chemistry and Biochemistry, Boise State University

RII Track-4: Using in-cell NMR to follow 13C-fluxomics in living cells

\$193,997 (2017-2020)

Dr. Warner is working with colleagues at the National Renewable Energy Lab (NREL) to answer fundamental questions about the flow of metabolites in bacterial cells, which will broadly impact areas of research where understanding basic cellular metabolic processes are important.



Dr. Samrat Choudhury

Assistant Professor, Chemical & Materials Engineering, University of Idaho

RII Track-4: Optimizing the Chemistry of Heterointerfaces in Photovoltaics: A Combination of Electronic Structure Calculations and Machine Learning Approach

\$152,050 (2019-2021)

In collaboration with Los Alamos National Laboratory, Dr. Choudhury is working to determine the chemistry of a multi-component heterointerface with targeted materials property for photovoltaic and other energy applications using a combination of electronic structure calculations and machine learning approach. The objective of this research is to apply machine learning tools to substantially reduce the time and cost to discover advanced materials.



Dr. Eric Hayden

Assistant Professor, Department of Biological Sciences, Boise State University

RII Track-4: Investigating Evolutionary Innovations through Metagenomics

\$130,772 (2017-2020)

Dr. Hayden and collaborators will study the microbiomes

of the digestive systems of animals that eat sagebrush, a toxic plant, to discover how the microbes deal with these plant-derived chemicals which may lead to new ways to chemically synthesize plant molecules, discover new antimicrobial drugs, or combat animals that eat commercially and ecologically important plants.



Dr. Gunes Uzer

Assistant Professor, Department of Mechanical and Biomedical Engineering, Boise State University

RII Track-4: Mechanical Regulation of Intra-Nuclear Mechanics and Gene Transcription

\$213,571 (2019-2021)

Dr. Uzer will be working with colleagues from UC Boulder to answer fundamental questions of how mechanical signals are transduced at the cellular level to regulate gene expression. Specifically, he will be mapping how application of mechanical challenge impacts the real time mechanics of chromatin in live cells.

Funding

USDA EPSCoR Funding Opportunities

The United States Department of Agriculture (USDA) has established grants designed to help institutions develop competitive projects and to attract new scientists and educators into careers in high-priority areas of national need in agriculture, food, and environmental sciences.

Through the Agriculture and Food Resource Initiative (AFRI), the Food and Agricultural Science Enhancement (FASE) Grants consist of New Investigator Grants, Preand Postdoctoral Fellowship Grants, and Strengthening Grants. Strengthening Grants are further divided into Sabbatical Grants, Equipment Grants, Seed Grants, Strengthening Standard Grants, Strengthening CAP (Coordinated Agricultural Project) Grants, and Strengthening Conference Grants. Fifteen percent of AFRI funding is set aside for Strengthening Grants and Pre- and Postdoctoral Fellowship Grants. Strengthening Grants are available during each funding cycle to ensure that researchers at institutions and states that are underrepresented in terms of Federal research, education, and/or extension funding receive a portion of AFRI funds. Strengthening Grants are limited to: (1) small and mid-sized or minority-serving degree-granting institutions that previously had limited institutional success for receiving Federal funds; or (2) State Agricultural Experiment Stations or degree-granting institutions eligible for USDA Established Program to Stimulate Competitive Research (EPSCoR) funding.

The National Institute of Food and Agriculture (NIFA) periodically offers webinars to EPSCoR states on funding opportunities and other programmatic information. Learn more at: https://nifa.usda.gov/afri-fase-epscor-program

Idaho EPSCoR

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About NSF 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