

the RESEARCHER

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School buses transporting 7th grade students to the GEM3 Adopt-a-Scientist field event south of Boise where GEM3 faculty and students use authentic research in sagebrush systems to inspire the next generation of scientists. Learn more on pages 11 & 12.

Photo credit: Boise State University

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LETTER FROM THE DIRECTOR



Andy Kliskey

It is very exciting to see our NSF EPSCoR Research Infrastructure Improvement Track-1 project, GEM3, maturing with such a wide array of published articles, conference presentations, and workshops that are showcased in this issue of the Idaho EPSCoR Newsletter. Each item highlights the importance of widely sharing project results and outputs and describing the transformative outcomes from the project.

Zhongqi Chen and colleagues' article on assisted migration published in *Evolutionary Applications* showcases how GEM3 genomics research can be translated to management actions. The recent GEM3 Modeling Workshop co-led by Travis Seaborn and Chris Caudill embodies the valuable role of integrative modeling in transdisciplinary science. The (Re)Cultivating & (Re)Newing Reciprocal Research Workshop co-led by a team from Idaho State University, Shoshone-Bannock Tribes, and University of Idaho, calls attention to the challenges we need to address to pursue partnerships between academic researchers and Idaho's Tribal Nations.

Project SCIENTIA led by Carolina Viera is making great strides in relating GEM3 science to Hispanic communities. The sagebrush oral histories initiative led by Kelly Hopping represents the important role of communicating research outcomes with Idaho's rural communities. The GEM3 Adopt-a-Scientist outreach event led by Jen Forbey epitomizes the opportunities for engaging with Idaho's youth to promote Science, Technology, Engineering, and Mathematics (STEM) learning. Finally, Andrew Child's work to create an open data ecosystem by means of the GEM3 Research Data Dashboard is potentially transformative. I strongly encourage the research community to use these tools to ensure accessibility to GEM3 project data.

To our readers, please stay tuned for more publications, presentations, and outcomes in the coming months. To all GEM3 students, postdocs, and faculty I applaud the phenomenal work you are each doing; it is garnering national recognition - keep the analyses, writing, and communicating coming!

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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.



GEM3 Research

Applying Genomics in Assisted Migration Under Climate Change

In Fall 2019, the newly funded Idaho NSF EPSCoR project, 'Genes to Environment: Modeling, Mechanisms and Mapping' (GEM3), was just taking shape. Researchers came together at the McCall Outdoor Science School (MOSS) in McCall, ID in October of 2019 for a GEM3 working group bringing together interdisciplinary research teams from around the state to discuss genomics research. From this meeting, a cross-taxa, multi-institutional research team was formed between faculty, postdocs, graduate students, and researchers at Columbia River Intertribal Fish Commission and USGS Forest Service.

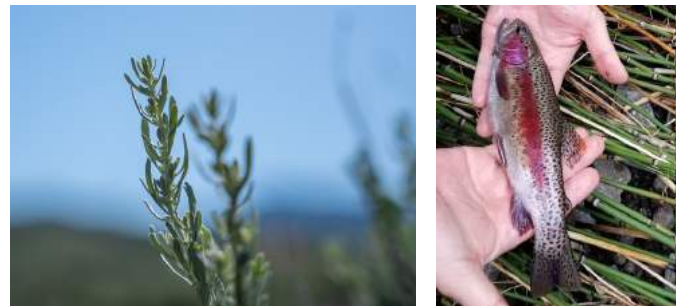
The team is addressing a critical need. Since the current rate of climate change is exceeding the capacity for organisms to adapt and/or naturally move to more favorable locations, there is a need to evaluate appropriate human interventions like the movement of individual plants and animals with climate adapted genes. This management action known as Assisted Migration (AM) is a valuable new management tool for ensuring species survival under climate change.

This collaborative GEM3 team recently published their case studies in a paper highlighting two GEM3 focal taxa of concern in Idaho and the region, sagebrush and redband trout. Both are critical to the local ecosystem and are threatened by changing environments. The paper titled, "Applying genomics in assisted migration under climate change: Framework, empirical applications, and case studies" discusses how genomic-guided assisted migration might be a potential conservation tool to mitigate the impact of environmental changes related to climate change. This paper makes recommendations for how managers can gather the information needed and make scientifically informed choices for AM.

The team, which conducted a comprehensive literature review of existing knowledge on the

application of genomics/genetics in AM practices in terrestrial animals, plants and aquatic animals, also developed a framework with detailed guidelines on how genomics should be applied in AM and be involved in a broader decision-making process. Since climate change-caused biodiversity loss is a global concern, outcomes of this project are expected to have a much broader impact and will be beneficial to the biodiversity conservation community. To read the full publication, visit: <https://doi.org/10.1111/eva.13335>.

This GEM3 publication team includes Zhongqi Chen (UI postdoc), Lukas Grossfurthner (UI graduate student), Janet L. Loxterman (ISU faculty), Jonathan Masingale (UI graduate student), Bryce A. Richardson (Research Geneticist, US Forest Service), Travis Seaborn (UI postdoc), Brandy Smith (ISU graduate student), Lisette P. Waits (UI faculty), and Shawn R. Narum (Senior Scientist/Lead Geneticist, Columbia River Inter-Tribal Fish Commission)



Pictured above: members of the GEM3 interdisciplinary research working group- McCall, ID

GEM3 Open Data Provides Fair Access

By Andrew Child

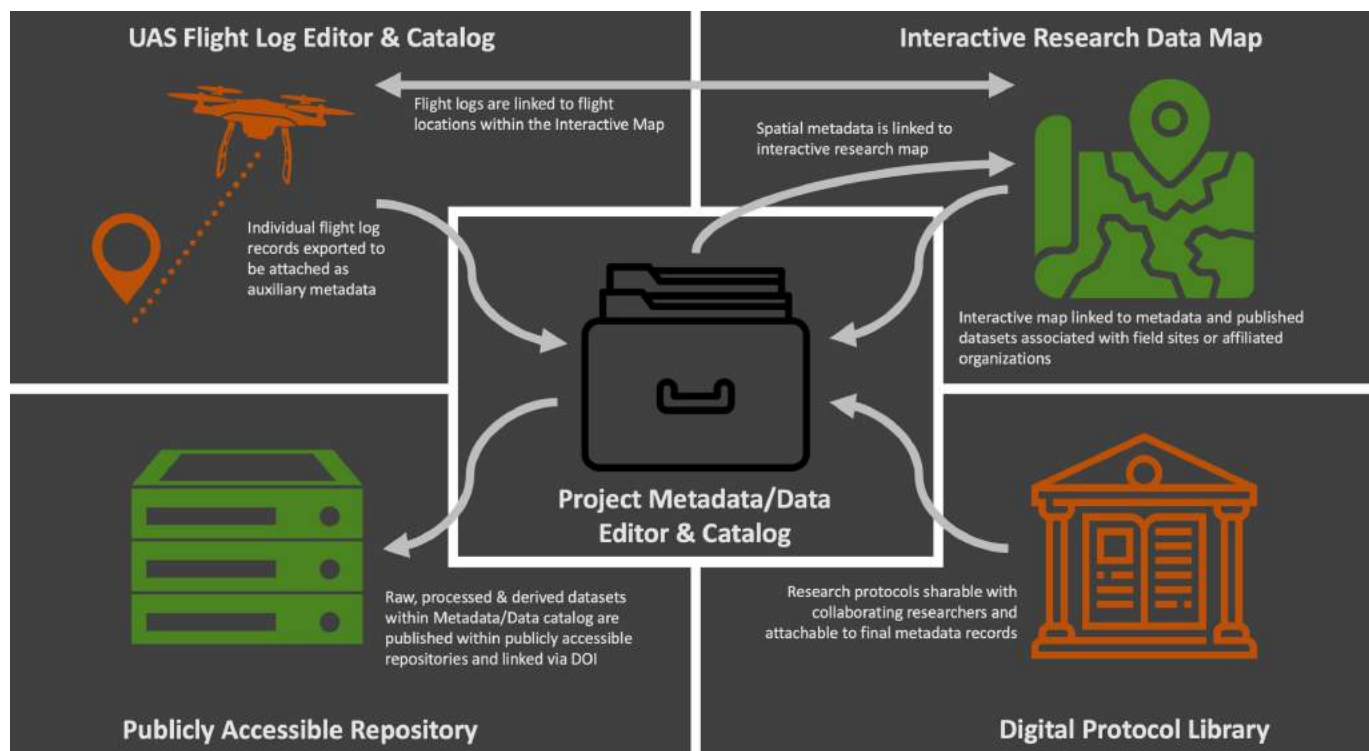


Figure: Centralized metadata/data platform design and functionality schematic. Icon Credits: kareemov1000, Nawicon, lastspark, Eucalypt and Andy Miranda from the Noun Project (<https://thenounproject.com/>)

Open data (OD) is growing in popularity among scientists and encourages research reproducibility and integrity. Furthermore, within the scientific community OD is expanding by both funder and publisher requirements. One of the challenges for researchers within multi-institutional and interdisciplinary research projects, beyond making data publicly available, is to document and catalog those data in a manner that increases their FAIR (findability, accessibility, interoperability and reusability) access to the scientific community.

Recently the Idaho EPSCoR GEM3 project demonstrated that one solution to increase data FAIRness and elevate research integrity within multi-institutional and interdisciplinary research projects is a centralized, customized, and project-specific data management platform built using interoperable components. This GEM3 Research Dashboard was

recently featured within the Reproducibility and Research Integrity collection of the open access journal BMC Research Notes.

The GEM3 dashboard is a web-based toolkit which provides an interconnected inclusive environment for researchers from diverse areas of study to consolidate, catalog and share project data and metadata. It also acknowledges the specific needs of each discipline and establishes a unified structure and ontology connecting each discipline within the project (e.g., project-wide controlled vocabulary, data/metadata standardization initiatives). The dashboard contains several tools and resources (i.e., protocol library, metadata catalog, data/metadata submission portal, UAS flight log/portal, multimedia access, ArcGIS HUB, and project keyword list) for researchers to make open and private sharing of data and metadata easier. The platform's design decreases user confusion from

Research cont.

solely using jargon-heavy and discipline-specific metadata forms and improves searchability during data/metadata queries by unifying discovery-level metadata fields across all project disciplines.

In addition to fostering research integrity, transparency, and reproducibility by abiding FAIR principles, the unique centralized metadata platform attempts to bridge the gap of discipline specific research silos by providing open access to metadata, protocols, and associated OD and OD products within an integrated and searchable project-specific platform. Furthermore, this type of centralized metadata/data platform could become a reference for researchers working within similarly complex interdisciplinary and multi-institutional research environments. Overall, this type of interoperable framework supports reproducible Open Science and its distribution to various stakeholders and the public in a FAIR manner by providing open access to raw data while also providing access to protocols, metadata and supporting workflow materials.

GEM3 Research

Bringing it Together: Using Modeling for Transdisciplinary Research

By Travis Seaborn and Christopher Caudill

Many researchers focus on a particular scale, such as individual plants or the climate of the Pacific Northwest. Moreover, each scientific discipline tends to have its own culture, where even the same word may have quite different meanings when compared to other disciplines. Because of this, there are multiple challenges when doing transdisciplinary research. This spring semester, to address those challenges,

modelers from across GEM3 came together for a Modeling Workshop held at the Integrated Research and Innovation Center (IRIC) at University of Idaho.

The aims of the workshop were to improve integration across the GEM3 modeling teams

and establish the core research products each modeler will produce. Participants brought a wide variety of skills and projects, ranging from measuring land cover change to modeling stream temperature with data from drones, to simulations of trout populations under climate change. This breadth of topics and expertise provides an opportunity to bring novel combinations of different types of models together for the first time, while also presenting practical challenges due to the diverse types of data, time scales of the models, and different geographic areas.

The workshop used a number of activities to bring these research projects together. To start the workshop, an activity led by the Toolbox Dialogue Initiative (<https://tdi.msu.edu/>) explored each participant's views on the goals of modeling and their philosophies of research. The exercise also brought to light areas of difficulty when working together. In later sessions of the workshop, participants detailed the specific modeling software, data inputs, and anticipated model outputs in a combination of research talks and virtual jam boards to help align modeling research across the teams, which allowed visualization of how data and results will be used to integrate GEM3 efforts in coming months. Most of the later parts of the workshop were then devoted for individuals to work on their projects and connect with each other. For example, trout and social-ecological systems modelers overlaid their model outputs and discussed ways in which the social-ecological systems outputs could help inform the trout models (see map above). The workshop culminated by discussing future goals and next steps.

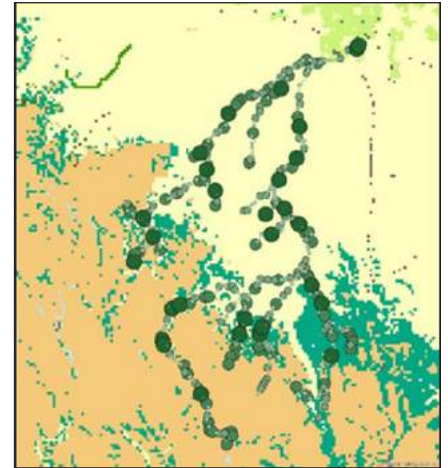


Figure: Map showing overlay simulations of land cover change from the social-ecological systems research (colors of the landscape) and trout ecology-evolution climate change simulations (green circles).

ISU Workshop Series Explores Reciprocal Research with Tribes

By Georgia Hart-Fredeluces & Laticia Herkshan

Idaho EPSCoR participants, in collaboration with the Shoshone-Bannock Tribes, hosted the (Re) Cultivating & (Re)Newing Reciprocal Research: Working Toward Collaborative Tribal-University Research Relationships workshop series in spring 2022. The event attracted a total of 124 registrants from Idaho, Montana, Washington, Colorado, and British Columbia, Canada, including 39 Native-identifying participants representing 18 different Tribal Nations. Participants also represented 27 different institutions, including all three Idaho research universities, with one Idaho college in attendance. The workshop series was spread over three days in February, March, and April, and was designed to open up conversation around research partnerships to support more equitable and collaborative research relationships among Tribes, communities, and universities in Idaho.

This workshop series, through a combination of presentations, interactive activities, and small group discussions, informed participants about how we can move toward reciprocal research practices while acknowledging Tribal Nations and Indigenous Peoples possess vast traditional cultural knowledge and teachings, making them experts in their cultures, lands, and histories. Through culturally-appropriate collaboration, both Tribes and universities can work together to address and privilege Tribal needs, produce valuable knowledge, and advance science for the overall betterment of local relationships.

The first of three events in the series held on Friday, February 4, 2022, was themed “(Re)Establishing Research Frames.” Dr. Deondre Smiles, Leech Lake Band of Ojibwe, Black and Swedish descent, Assistant Professor in the Department of Geography at the University of Victoria, provided the keynote address during the first event titled, “Un-Settling Indigenous Research—A ‘recipe’ for anti-colonial



A teepee sits on the campus of Idaho State University Quad as part of Indigenous People's Day 2019.

research with Indigenous communities.” The March 4, 2022 workshop theme was “Reciprocal Relationship Building” and included a keynote from Dr. Megan Bang, Ojibwe and Italian descent, Professor of Learning Sciences and Psychology at Northwestern University entitled “Envisioning the Ideal Research Relationship: Making Right Relationships that Contribute to Indigenous Thriving.” The theme for the final workshop day on April 22, 2022 was “Communicating & Maintaining Respectful Relationships.” The keynote speech, by Dr. Desi Small-Rodriguez, Northern Cheyenne and Chicana, Professor of Sociology and American Indian Studies at UCLA, was entitled “Data for Indigenous futures: Nothing about us without us.” Keynote presentations are available under the “Presenters” tab on the website at: <https://recultivating-and-renewing-reciprocal-research.com/>.

A survey designed to assess the workshop series had a total of 32 participants complete both the pre and post-surveys, of which 6 identified as Native, 72% were female, and 56% had a natural science background. Participants indicated that the most useful topics they learned about were data sovereignty, community-based research methods, and relationship building with Tribal Nations. Participants also indicated that they were very likely to incorporate these concepts in their future research work. The top challenges indicated for Tribal-university research partnerships were not knowing who to contact to get started, not knowing who to collaborate with, and lack of trust. For future workshops, participants suggested that more information about how to support Native students in collaborative research would be useful, and many

Workshops cont.

indicated a need for more opportunities to expand their knowledge on the topics presented at this workshop.

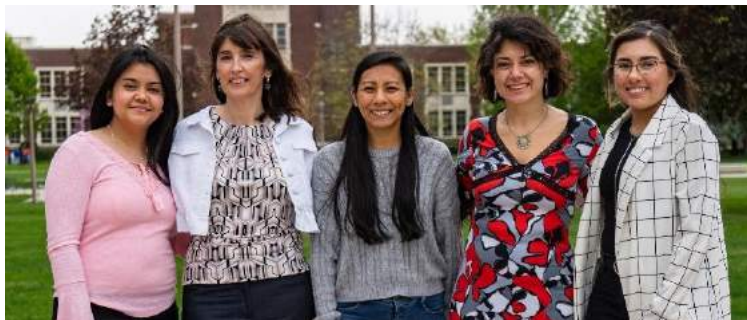
In addition to assessing what participants found most useful and what they were most likely to implement, the survey also sought to assess participants' levels of understanding and comfort with topics addressed in the workshop, as well as provided an opportunity to suggest ideas for future workshops. These topics included, Indigenous and Western epistemologies and research methods, community-engaged research methods, Indigenous data sovereignty, academic publication expectations and norms, and Tribal sovereignty. Preliminary results indicate that there was an increase in self-reported comfort and understanding pertaining to all of the Indigenous related topics.

Further, participants indicated a significant increase in understanding between the pre- and post-surveys related to the topics of Indigenous epistemologies, Indigenous research methods, Indigenous data sovereignty, academic publication expectations and norms, and Tribal sovereignty. Interestingly, between the pre- and post-surveys, there was no significant increase in level of comfort with any of the topics.

The third workshop series day included sessions devoted to envisioning and planning follow-up steps including maintaining connection as a group and actions we could take to work towards the goals of the workshop series. Groups discussed a range of ideas from initiating reading groups on workshop series related topics to applying for funding to host additional workshops. Potential ideas for follow-up workshop series include highlighting and building collaboration around Indigenous-led projects in progress across the region.

GEM3 Outreach

Project SCIENTIA Expands Outreach



Some members of the Project SCIENTIA team include: (L-R) Mayra De Anda Hernandez (undergraduate student); Fatima Cornwall (Instructor, Clinical Faculty); Sandra Velazco (graduate student); Carolina Viera (Project Manager, Professor); and Valeria Montelongo (undergraduate student)

Project SCIENTIA, an initiative designed to communicate STEM Research in languages other than English, has been working to make science more inclusive and accessible through the creation of STEM dissemination materials tailored to Spanish-speaking audiences. The team takes its name from the Latin word for “science” and involves undergraduate students, graduate students, and faculty from Boise State University (BSU).

The team has been working to present GEM3 research in a less-technical and more-engaging format and have utilized podcasts and blog posts as recruitment tools, with the ultimate goal of increasing numbers of Hispanic students entering STEM fields.

Earlier this year, the team released a GEM3 glossary for researchers that contains GEM3 technical terms needed to communicate science in Spanish and provides contextual examples for both languages. The new Spanish/English glossary can be accessed from the Project SCIENTIA website and includes all the GEM3 keywords. In addition to the glossary, the team created three new research abstract videos in Spanish.

During Spring 2022, the team collaborated with Jennifer Forbey in her Vertically Integrated Project (VIP) course - Nature's Cipher: Translating the Natural World. The VIP course investigates the signaling phenotypes emitted and received by microbes, plants, animals, and humans and

Outreach cont.



Faculty and students in VIP course, *Nature's Cipher*, at Boise State University in Spring 2022.

how these natural conversations influence the behavior of individuals, populations and species.

Students were able to gain knowledge, skills, and abilities in several tools and methodologies including science communication and outreach to diverse audiences by translating scientific discoveries into other languages. In Fall 2022, Project SCIENTIA will be offered as its own VIP course at BSU.

The Project SCIENTIA team has also been engaged in outreach efforts. On April 23rd, Carolina Viera and Fátima Cornwall, Department of World Languages, presented at two national conferences including the 2022 Chicago Language Symposium held at the University of Chicago. Their talk was titled “LSP and STEM Interdisciplinary Research.” Both instructors showcased Project SCIENTIA and shared preliminary research findings regarding their collaboration with BSU’s Biological Sciences Department.

Future plans include identifying new community outreach endeavors, circulating additional communication products, and making their website more interactive in addition to housing educational materials to make readily accessible to interested Spanish language instructors in the Treasure Valley and Idaho.

GEM3 Students

Boise State’s Leticia Camacho Receives NSF Fellowship

Leticia Marisol Camacho, a master’s student in Biological Sciences and participant in the GEM3 project, is among three students from Boise State University (BSU) selected for the prestigious National Science Foundation Graduate Research Fellowship (GRF). The GRF provides three years of financial support, comprising a \$34,000 stipend per twelve-month Fellowship Year.



Leticia Camacho, BSU graduate student, pictured here working with ferruginous hawk nestlings, prior to GEM3, as a field technician for BSU during her undergraduate career.

Camacho, an Idaho native who grew up in Boise, Payette, and Kuna, started college at College of Western Idaho and then completed her bachelors in science (B.S. in Biology with an emphasis in Ecology, Evolution, and Behaviors) at BSU.

Camacho is currently studying Leporids, including black-tailed jackrabbits, which are keystone prey in the sagebrush steppe for predators including Golden Eagles; however little is known about their current distribution or abundance. This is partly due to the lack of effective field techniques to sample them in the wild. Camacho is working on developing novel protocols for surveying Leporids including more rigorous spotlight surveys, repeated over multiple nights, as well as surveys using thermal cameras from drones. During her project, Camacho hopes to do outreach, particularly focusing in Hispanic-serving K-12 schools.

Once she has completed graduate school, Camacho is hoping to work for a government agency such as Bureau of Land Management or Fish and Game, as well as the possibility of being an ecological youth educator who can bring the science of ecology to the classroom.

“Winning the Graduate Research Fellowship will honestly change my life for the better in so many ways. I did not

Students cont.

grow up in a financially wealthy household and have had to work very hard to get through college, so winning this award will mean I finally have financial freedom. This award will free me up to focus on my research to hopefully better the ecosystem around us that I so dearly cherish.”

Camacho’s selection as an NSF Graduate Research Fellow is a highly significant national accomplishment and places her amongst an elite group of fellows who have gone on to distinguished careers in STEM or STEM education.

GEM3 Research

Sagebrush Oral History Project Team Seeks to Understand Local Perspectives

A GEM3 team from Boise State University (BSU) is working to develop better communication, awareness, and empathy across social groups in Idaho through the use of oral history interviews.

Leading faculty member, Kelly Hopping, assistant professor in Human-Environment Systems at BSU, along with collaborators, Jill Heney and Tiffany Hitesman (faculty from the Department of English at BSU), received GEM3 workforce development seed funding in 2021 to support an effort to expand an existing Vertically Integrated Project (VIP), “Shared Stories,” to train students in active listening skills along with cultivating workforce-relevant communication skills.

To effectively manage ecosystems in which people have strong connections to the land requires awareness of local histories and perspectives, which in turn calls for increased dialogue between local stakeholders and scientists. However, according to Hopping, ineffective communication ranks as one of the top barriers to such partnerships, and the interpersonal and communication skills needed to elicit these types of understanding are rarely taught formally. The team’s project responds to this need by creating hands-on experiences for students to elicit local perspectives while helping them develop workforce skills in communication and technology.

With the support of the GEM3 seed funding, the team conducted the sagebrush oral history project through two semesters of a VIP at BSU starting in Fall 2021 through Spring 2022.

In addition to collaborating with faculty from the English department, the team also worked with Bob Reinhardt, assistant professor in BSU’s Department of History, and a graduate student from the Working History Center at BSU. Cumulatively, 4 faculty, 9 undergraduates, 2 MA students, and 1 PhD student participated across the two semesters of the project.

During the VIP course, the team hosted guest speakers who discussed interviewing techniques, active listening, oral histories, and how to translate their experiences working on this project into job-relevant skills.

The team also formally partnered with the Owyhee County Historical Society, Museum, and Library based in Murphy, Idaho (Owyhee County) which allowed them to recruit interviewees and conduct interviews with Owyhee County residents at the museum. The project was also greatly assisted by the help of GEM3 Owyhee Stakeholder Advisory Group members, who helped the team recruit interviewees from additional communities.

The oral histories shared with the team represented different experiences from across Idaho’s sagebrush steppe, including those from ranchers, conservation professionals, local officials, search and rescue volunteers, among others.

The oral history interviews captured insights about the social-ecological history of sagebrush steppe in Idaho that would otherwise not likely be available to the GEM3 community. For example, people described legacies of past land use that affect current

Research cont.

ecosystem conditions, as well as changes that they have seen over their lifetimes, such as the increased severity of insect outbreaks (Mormon crickets).

In total, VIP students conducted 24 interviews with 30 people. The interviews generated 16 hours of audio recordings that will be archived in perpetuity at Boise State University's Albertson's Library. We will also share the audio files and transcripts with our partner organization, the Owyhee County Historical Society, Museum, and Library so that relevant historical information from our Owyhee-based interviews can be used to update their museum exhibits.

The broader impacts of the team's work include providing opportunities for rural Idahoans to share their experiences and perspectives on sagebrush steppe and in Idaho more generally. This helped our students gain appreciation for the experiences and perspectives of rural communities, which are often not given much of a voice in higher education. This is perhaps especially true in STEM disciplines, despite the relevance of understanding rural perspectives for students interested in working in natural resource management and related fields.

The team documented Idahoans' stories so that they will be available for current and future generations, both in their own communities and beyond. The team also created documentation of their VIP and project that can be shared with others in Idaho who are interested in adopting similar methods for using oral history interviewing as a workforce development training opportunity. Finally, the project helped students develop communication and interpersonal skills that will serve them in their lives and careers as noted by their feedback below:

Anika Bennett, BSU VIP undergraduate student stated, "The most enjoyable part of the VIP this semester was getting to travel to Owyhee County to do interviews at the museum. I'd been looking forward to this part of the project all throughout both fall and spring semesters, and the experience was hugely beneficial! It takes actually going there to understand how culturally different our communities are, even though we only live an hour apart."

John Behrens, BSU VIP undergraduate student stated, "I think the biggest skills in this project were active listening and communication as a whole. I feel like these skills were important for all of the functions of the project, but also very important for me to practice and get better at. Between communicating with the team and the interviews I did I found myself in situations where both were incredibly necessary. These same skills can be applied to everything I do in life, both in work and the everyday aspects of life. ... In most jobs and school I have people's numbers or have times where I know I will definitely see them. But in this project I had to coordinate with others. This might seem kind of small, but I found it really important practice for the future."

Nicole Crandall, BSU VIP undergraduate student stated, "Interviewing people helps us be able to connect to different people and have the connection to have a conversation with them. This is an important skill to know because working in a career that I want to go into it is important to be able to talk to the public. Working in conservation, the way to protect the habitats is to have the public on your side."



Members of the BSU VIP team outside of the Owyhee County Museum in Murphy, Idaho, after a successful day of interviewing. L-R: Kelly Hopping (assistant professor in Human-Environment Systems), Nicole Crandall, Kacey Bates & Anika Bennett (VIP undergraduates), Tiffany Hitesman & Jill Heney (faculty from the Department of English), and Amy Mallory (VIP undergraduate)

GEM3 Outreach

GEM3 Adopt-a-Scientist Event Aims to Inspire Next Generation of Researchers

In April 2022, 7th graders from Idaho's Treasure Valley took part in the Adopt-a-Scientist outreach event with the focus of "Seeing the landscape through different lenses." The event was held on Bureau of Land Management land south of Boise in the Morley Nelson Snake River Birds of Prey National Conservation Area and Idaho National Guard Orchard Combat Training Center. The outreach event was aimed at helping to inspire the next generation of scientists by providing hands-on STEM learning activities that help students understand what the ecosystem is made of, to value it, and understand why it matters.



Event leads, Zoe Duran (pictured above center), Natural Resources Specialist with the Idaho Army National Guard, and Jennifer Forbey, professor in BSU's Department of Biological Sciences, provide an orientation to students.



Students took part in STEM stations which allowed them to engage with hands-on activities such as biochar seedling experiments, remote sensing, vegetation surveys, and exploring wildlife of the sagebrush steppe. Photo credit: Boise State University

Scan here
to see
students
in action!



Or visit:
<https://youtu.be/CMODdCg4VDI>

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Adopt-a-Scientist Event cont.



Students engaged in tracking and surveying techniques with unmanned aerial vehicles and global positioning system tracking taught by Idaho Army National Guard soldiers.



More than 180 seventh grade students engaged in hands-on learning during the two-day event.
Photo credit: Boise State University

The event was supported by Idaho NSF EPSCoR, the Idaho Army National Guard, the Bureau of Land Management, the Idaho Rangeland Resource Commission, 4-H Americorps, Boise State University, and Heritage Middle School.