

INSPIRED *discoveries*

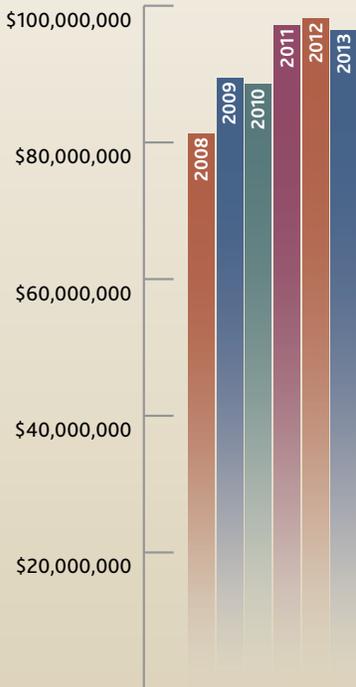
A Research Report University of Idaho



2013

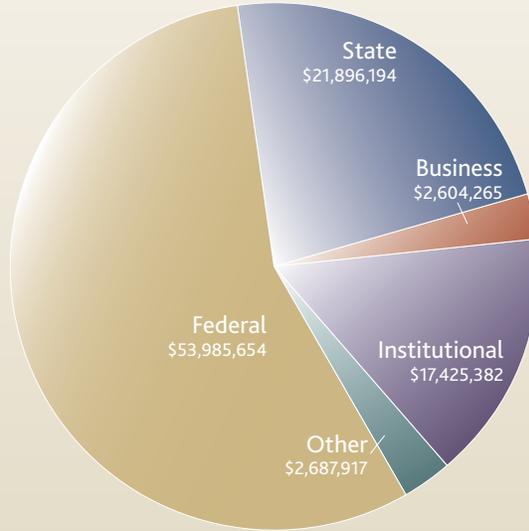
Fiscal Year summary

Research Expenditures



0 Research Expenditures as reported to the National Science Foundation HERD

Research Expenditures by Funding Source



Technology Commercialization

Disclosures **16**
 Applications **20**
 Issued Patents **24**
 Licenses **7**
 Start-ups **1**

Sponsored Project Expenditures by College

Sponsored Projects	Number	Total
College of Agricultural & Life Sciences	562	\$15,233,721
College of Letters, Arts & Social Sciences	22	\$226,591
College of Art & Architecture	44	\$1,274,920
College of Business & Economics	9	\$8,878
College of Education	87	\$9,275,157
College of Engineering	151	\$9,066,608
College of Graduate Studies	4	\$196,692
College of Law	9	\$161,684
College of Natural Resources	326	\$12,994,902
College of Science	128	\$5,375,853
General Library	5	\$9,683
Office of Community Partnerships	7	\$292,950
WWAMI Medical Education Program	21	\$3,782,246
Other Academic Affairs	15	\$842,265
University Outreach (North Idaho & Idaho Falls)	44	\$4,449,188.08
University Research	170	\$11,709,582
UWP - Env Science Water Resources	12	\$932,362
Other Central Administration	3	\$517,704
Total	1,619	\$76,390,993*

* Expenditures represent externally funded grants and contracts only. Additional activity is funded through other mechanisms.

Inspiring the Future

A dynamic 21st-century research university is partially characterized by the new knowledge it creates and the impact it has on addressing the problems facing society. With the celebration of its 125th anniversary, the University of Idaho can claim that status. In 2014, the tradition of research excellence and creative activity is stronger, the impact is broader and the problems addressed are more complex than ever before.

The University of Idaho studies multifaceted issues that require faculty, staff and students to work in teams that span a range of disciplines and cross institutional boundaries. Our collaborators include not only other universities, but also members of the private sector, government agencies and citizens.

Our research and extension stations span the state, effectively connecting the university to the people of Idaho. The central campus in Moscow and centers in Coeur d'Alene, Idaho Falls and Boise as well as the research stations generate knowledge and innovations that benefit the state and address problems critical to Idaho's future as well as that of the region and nation.

We transform these new concepts and ideas into practical solutions that improve quality of life and bring sustainable economic development. Benefitting society also includes producing scholarly and creative works that stimulate the imagination, inspire individuals and enliven communities.

Our students are a vital part of the research process. They learn from leaders in their fields of study, test their abilities on real-life projects and graduate with skills necessary to lead a productive life.

The projects highlighted in this report are just a sample of the many activities at the University of Idaho. They illustrate not only the quality of our faculty, staff and students, but also the range of vital topics addressed at our university as we continue building the future.

We look forward to a bright future as we persist in our dedication to building a community of scholars and collaborators who together make a difference for Idaho, the nation and the world.

Chuck Staben
President

John K. McIver
Vice President for Research and Economic Development

Growing an Industry for the Future

To test the qualities of wheat used for bread products, researchers have one time-tested method: grinding their grain samples into flour and baking them.

But at UI's Aberdeen Research and Extension Center, associate professor Jianli Chen is honing a method that could revolutionize the testing process – and help her breed stronger, tastier wheat varieties.

"In my breeding program, we're developing genomics-assisted tools that can be used in the near future to predict these good qualities," Chen said. "You can get a small piece of leaf, and when the DNA is extracted, you can do the lab work to see which wheat lines have the genetic markers associated with the good qualities."

Chen's genomics-assisted testing methods don't just lead to soft bread and chewy noodles. They also help her breed new wheat varieties with characteristics that help them resist diseases and pests, survive pesticides or require less water and nitrogen while maintaining their yield and quality.

Chen's work is among a slate of wheat-research projects in Aberdeen and at UI locations statewide. UI scientists support Idaho's vital wheat industry by developing new varieties, determining the best growing methods, and finding ways to fight diseases and pests that damage crops.

UI works in close partnership with the Idaho Wheat Commission, which has expanded its support for wheat breeding and disease research through two \$1 million endowments. The university also has a long history of collaborating with industry leaders – most recently, UI has launched a Moscow-based partnership with Limagrain Cereal Seeds to share breeding resources with Limagrain researchers.

"Idaho growers are investing in their industry, and we are their research and development arm," said Donn Thill, director of the Idaho Agricultural Experiment Station, the research division of the College of Agricultural and Life Sciences.

"We focus on what's important to Idaho's cereals producers. We're going to address the problems that are most valuable to them."

www.uidaho.edu/rr-grain



Powering Nuclear Technology

A common nuclear power plant requires billions of dollars, thousands of tons of material and years of construction to complete.

Fatih Aydogan, an assistant professor in the College of Engineering's Nuclear Engineering Program, is studying smaller reactors that have greater potential for affordability, reliability and safety.

Aydogan and his graduate students study small modular reactors, or SMRs. Small reactors are growing in popularity worldwide, and the U.S.

Department of Energy has increased support for their use in the United States. Aydogan's team focuses on improving standard SMR designs.

"We are trying to improve the current systems so they will be safer, more simple and more economical," said Aydogan, who conducts research at the Center for Advanced Energy Studies (CAES), an Idaho Falls-based research center that brings together the UI, Boise State University, Idaho State University and the Idaho National Laboratory.

One aspect of Aydogan's research is studying how to design SMRs so they can be easily and inexpensively manufactured and shipped. He is also investigating passive safety systems, which allow reactors to shut themselves down in the event of a natural disaster or accident.

Before he came to the UI, Aydogan studied SMRs for Westinghouse-Toshiba. The company soon will use one of his designs, for which he recently published a patent, for its SMRs. Aydogan said his team at CAES will continue partnering with nuclear industry leaders to conduct research and transfer technology.

www.uidaho.edu/rr-reactors

Protecting Online Information

Every time a person connects to the Internet, he or she does so alongside more than 2 billion others. At least a few of the others have malicious aims – stealing information, identities or ideas.

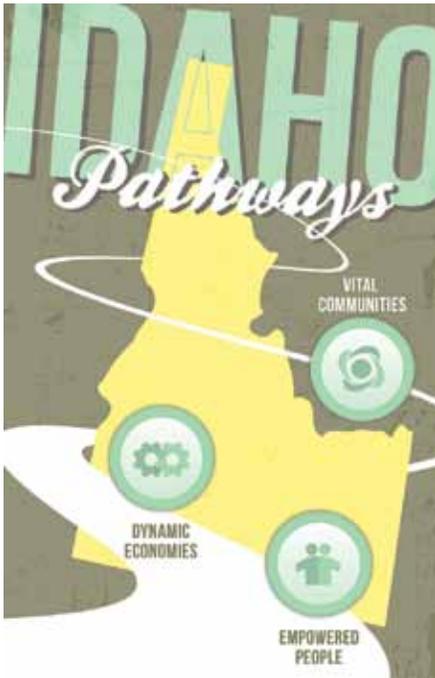
Computer science professor Jim Alves-Foss works with researchers across campus to understand how cybersecurity breaches happen and how organizations and individuals can protect themselves. One of his focus areas is cybersecurity for industry.

"Without secure systems, your website will be brought down, your data center will be brought down," he said.

Businesses must protect their customers' private information, as well as protect themselves against foreign hackers who seek to steal intellectual property.

Through the Idaho Legislature-funded Idaho Global Entrepreneurial Mission, or IGEM, Alves-Foss and his colleagues at UI's Center for Secure and Dependable Systems are working to help companies boost their cybersecurity measures. In April 2014, UI researchers invited Idaho and Northwest industry leaders to Moscow for a cybersecurity symposium focused on the ways university research can better provide technologies to businesses to secure themselves and their customers in the wired world.

www.uidaho.edu/rr-cybercrime



Revitalizing Economic Strategies

With a per-capita personal income and gross domestic product among the lowest in the nation, Idaho is in need of plans to boost its economy and improve its residents' earning potential.

The UI Office of Economic Development, the Idaho Department of Commerce, regional economic development agencies and other stakeholders have joined to create the Idaho Pathways Project – a collaborative effort to stimulate productivity while positioning Idaho's economy to be more competitive and dynamic in today's global marketplace.

"This state needs a living, breathing, workable roadmap to lead the economic development districts and the state to economic prosperity," said Tammi Laninga, an assistant professor of land-use planning at UI and a member of the Idaho Pathways team.

At meetings across the state in 2013, a team of UI faculty and staff gathered information from Idaho's six economic development districts to help each region revitalize its official comprehensive strategy.

The regional efforts came together at the 2013 Idaho Economic Development Summit, which united state and regional leaders in business and industry, education, economic development and government. The Idaho Department of Commerce and the economic development districts now are collaborating to create a statewide working group to write a comprehensive economic development strategy for Idaho.

www.uidaho.edu/rr-pathways



Inspiring Excitement About Science

Every year, more than 2,500 Idaho children transform into scientists on the shores of Payette Lake at the College of Natural Resources' McCall Outdoor Science School, or MOSS.

MOSS, founded in 2001, serves more than 40 Idaho communities, connecting K-12 students to UI research and sparking a love of science that extends beyond the classroom and into the world.

"One thing that sets MOSS apart from many other outdoor discovery environments for kids is we integrate very intimately between the research environment of the university and the real-world exploration for kids and their parents and teachers," said Lee Vierling, executive director of MOSS.

The 18 graduate students who live and work at MOSS each year alternate weeks between taking onsite environmental-education classes and implementing the concepts they've learned.

"They can immediately take those concepts and apply them to the outdoor classroom with kids and their teachers," Vierling said. "Students who visit MOSS are getting fresh information that's living and breathing. The kids become a key part of the discovery process."

Alongside cutting-edge educational techniques, MOSS incorporates the latest scientific knowledge generated at UI into its programming.

"Kids realize it's new and exciting," Vierling said. "They find that science isn't just from people who developed ideas in the past."

MOSS is expanding and changing, too, actively seeking donors to upgrade the entire campus and developing new programs for children, college students, teachers and community members of all ages.

www.uidaho.edu/rr-moss

Collaborating for Healthy Fisheries

In Hagerman, Idaho, a lab houses two fisheries-research powerhouses: the UI's Aquaculture Research Institute, or ARI, and the Columbia River Inter-Tribal Fish Commission, known as CRITFC.

ARI, established in 1988, began conducting genetic analyses for CRITFC in the late 1990s.

"They were so pleased with the genetic analysis of salmon and trout populations we generated that they decided to create their own program, and we developed an agreement to partner with them here," said ARI director Ron Hardy. "We share equipment, we share lab space, we share other resources, we work together on projects."

CRITFC focuses on the conservation and recovery of salmon and other key native fish species in the Columbia River Basin, while ARI studies aspects of aquaculture including food production, fisheries enhancement and stock restoration. The two programs collaborate on genetic research, equipment purchasing, training opportunities and more.

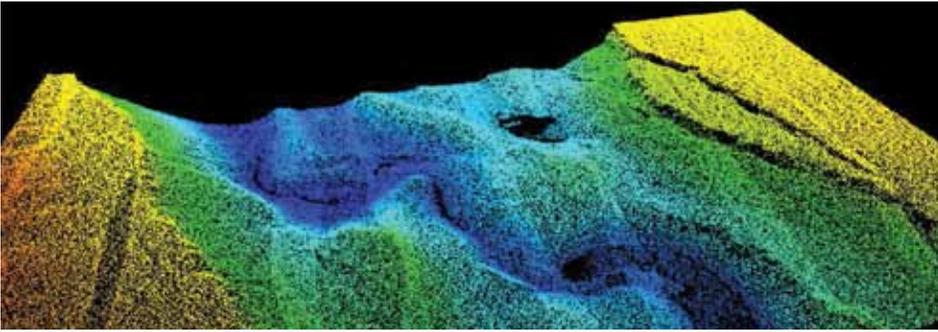
"University of Idaho provides an academic research environment that allows us not only to bring in our own interests, but overlap with some expertise that UI researchers have," said Shawn Narum, lead geneticist at CRITFC.

Working with CRITFC provides UI with a personal, long-term relationship with Pacific Northwest tribes, Hardy said, opening doors for communication and trust as well as collaboration.

"The partnership gives us many opportunities to interact with members of the tribes, and this leads to new insights on how to better use the university's resources to deliver value to them in both research and education," he said. "Plus, by co-locating our programs, it benefits our scientists and students, and helps us develop a more complete perspective on the resource issues facing the state."

www.uidaho.edu/rr-fish





Providing Access to Knowledge

Imagine a land-use planner in suburban north Idaho who's considering the re-zoning of a stretch of land along a stream. He wants to know what potential effects a change could have on the neighboring farms, the local water supply, the nearby wildlife habitat, and the people who live, work and commute through the area.

The amount of information he needs is enormous – but the data exist. With the help of UI's Northwest Knowledge Network, new knowledge and data from scientific research can reach the hands of the people who need it.

The network, known as NKN, helps researchers at UI and across the Northwest store, manage and share their data – giving them the resources they need to not only do better science, but also make their results more accessible to the public.

"There are different kinds of data out there from different sources throughout the state that, if put into the right framework, will benefit the public, stakeholders and planners throughout Idaho," said Luke Sheneman, NKN infrastructure architect and research coordinator.

A key client of NKN is a new National Science Foundation-funded project through Idaho's Experimental Program to Stimulate Competitive Research, which aims to help Idahoans make science-based decisions about natural resources. Working with NKN, this interdisciplinary project will produce tools that allow stakeholders to visualize the long-term effects of different land-use scenarios.

"We serve people across disciplines, across institutions and across states who are dealing with climate change and land-use resources," NKN Director Steven Daley-Laursen said. "Research data management is sitting right at the core of this."

www.uidaho.edu/rr-nkn

Connecting the World to Research

Hundreds of researchers work in dozens of disciplines at the University of Idaho. A new tool from the UI Library builds connections among these researchers and makes their work more accessible to the public.

VIVO is a web-based interface that allows users to browse or search information on UI people, departments, courses, grants and publications. The program was first developed at Cornell University, and UI began laying the groundwork for its own VIVO system in 2012. The tool – which UI's Northwest Knowledge Network supports – is still in development, but is now available for anyone to explore.

UI librarians are continually harvesting information to keep VIVO up to date with in-depth information. They're also developing applications to help users visualize VIVO's data, such as colorful webs that display the scope of scientific subjects a particular researcher has studied.

"Building something like VIVO gives us a unique opportunity not only to catalog all of the research done at the University of Idaho, but also to catalog the researchers and faculty whose research makes this university successful and to make connections between them," said scholarly communication librarian Annie Gaines, one of the project's leaders. "Also, VIVO can serve as a promotional tool, allowing future grad students to browse potential advisers and citizens of Idaho to see what kinds of interesting research their land-grant institution is up to."

www.uidaho.edu/rr-vivo



Briefing the Public on Native Law

With five major American Indian governments located across the state, Idaho's citizens are bound at some point to drive through tribal territory, make a purchase at a tribal business or otherwise interact with tribal land. But most Idahoans know little about American Indian law or legal history.

Angelique Townsend EagleWoman, James E. Rogers Fellow in American Indian law and director of UI's Native American Law Program, wants that to change. With Stacy L. Leeds, dean of the University of Arkansas' School of Law, EagleWoman recently wrote "Mastering American Indian Law."

"From my perspective, the tribal view and depth of legal history is not commonly known and would enhance and enrich any educational program, and should be a matter of common knowledge in the legal field," EagleWoman said.

"Our intent as co-authors was to create a text that simply and easily explains U.S. Indian policy eras, tribal government and justice systems, and relationships on the federal, state and tribal levels."

Whether lawyer or layperson, people in the United States should be informed about native law issues, EagleWoman said, because they have a role in them.

"Most U.S. citizens don't know that the U.S. Supreme Court has held that the Congress has plenary, or absolute, authority over American Indians," she said. "Since the Congress is elected by U.S. citizens, this means the public has a role in this area of law."

www.uidaho.edu/rr-nativelaw



Enhancing Safety with Simulation

A rural railroad crossing at night, an airplane landing in rough conditions and a bank of nuclear reactor controls all fit into one lab at UI.

The Human-in-the-Loop Simulation Laboratory features multiple simulators and analysis tools for understanding how human behaviors affect safety outcomes, and what factors can influence those behaviors. The lab is operated by Brian Dyre and Steffen Werner, faculty in the UI Department of Psychology and Communication Studies' graduate program in human factors.

Inside the lab, banks of enormous liquid-crystal displays become an immersive environment for test subjects. Instruments measure their reactions to simulated situations – whether driving, flying or operating control systems – down to the level of eye movements and breathing rate.

The simulators are the work of psychology professors Dyre and Werner, who use the lab to train their graduate students and serve external customers with top-of-the-line research. Though the lab has myriad uses, many of the research group's current projects focus on driving-safety issues that hit close to home, such as passing habits on rural highways and signage for isolated railway crossings.

"What we're trying to do is carve a niche and look at issues that have to do with rural roads," Dyre said. "It makes sense to be doing this type of research that applies to Idaho and the Northwest, but it's not getting a lot of attention anywhere else."

www.uidaho.edu/rr-simulator



Preparing Future Business Leaders

The world of business is unpredictable - so how do business students prepare for the twists and turns of real-life careers?

John Lawrence, a professor in the College of Business and Economics, specializes in creating field-researched teaching cases, which use actual situations to help students learn the art of decision making.

"Instead of just standing up and giving a lecture, we give the students a case to read, then we say, 'Now you're the director of operations, you're the CEO, how do you go about taking advantage of this opportunity, addressing this threat,

making this decision?' " Lawrence said.

Lawrence's work is featured in textbooks worldwide, and he soon will take over editorship of Case Research Journal, a top resource for such studies.

Each case study includes a narrative to engage students and an instructor's manual to guide professors as they introduce critical business concepts. The manual also can help the case study's subject company.

For example, Lawrence wrote a study on Moscow-based Cowgirl Chocolates, examining the owner's marketing tactics as she launched the growing company out of her garage into the international marketplace.

"The instruction manual became a helpful tool to her," Lawrence said.

Many of Lawrence's cases focus on Idaho and Northwest companies – such as Litehouse Foods and Telect, Inc. – giving students insight into small-town business life.

"A lot of students come from smaller towns and envision working in smaller towns," he said. "It really broadens their views of what their careers could look like."

www.uidaho.edu/rr-business

Nurturing Safer Schools

Incidences of school violence across the United States have sparked national debates, but these discussions often leave out an important element – the everyday culture within schools and its influence on student safety.

Melanie Brooks, a Boise-based UI education professor, and Jeff Brooks, chair of the College of Education's Leadership and Counseling Department, study ways educational leaders can proactively address the atmosphere in their schools.

"If students don't feel they're in a safe environment, they're not going to learn," Jeff Brooks said. "A school should be a community of support and care for every student."

This means educators must focus on students as individuals and be aware of small events that build up and hurt students and staff.

"Microaggressions" – such as undercurrents of racism, sexism or homophobia; social exclusion; or a curriculum that discriminates against students' cultures – can create a hostile environment for students and eventually may lead to physical violence.

Policymakers who address school violence must engage educators and students in discussion and understand their points of view, Melanie Brooks said.

The foundation of safer schools is built not only on overt methods like discussing violence in curricula, creating anti-bullying campaigns, or addressing gun control and mental health policies. It also demands attention to the ways educators shape how students feel when they come to school, Jeff Brooks said.

"Children need to know that people are working to make a safe environment for them, that we care for them, that we love them. From that foundation we can build an excellent learning experience. Without that foundation, students cannot be at their best."

www.uidaho.edu/rr-safeschools



Supporting Rural Needs

Growing up in British Columbia, Lil Alessa watched as outside researchers came to town, handed down edicts to community leaders and left without understanding what the people really needed.

Now she's a national leader in helping rural communities develop on their own terms.

Alessa joined the College of Art and Architecture faculty in 2013, tasked with forming the new Center for Resilient Rural Communities, or CRRC. The CRRC is devoted to providing communities with the tools they need to grow while remaining economically, socially and environmentally healthy.

The CRRC recognizes, values and incorporates communities' local, place-based knowledge to help them engineer their own paths, Alessa said. "They tell us what's most important to them, and we bring them the science that serves their priorities."

For example, a community could want to expand access to health care, bring in new job opportunities or find ways to encourage its younger generations to stay in town. A town that relies on sheep grazing may want to use interventions to improve its topsoil quality, or a community with limited water resources may need better and more efficient storage and distribution methods. Whatever the need, the CRRC will provide communities with tools to track important indicators, use their resources efficiently and monitor progress toward their goals.

Alessa and her longtime collaborator Andrew Kliskey — who will serve as CRRC director — bring experience, knowledge and proven methods from their years of research at the University of Alaska Anchorage.

"The CRRC is going to draw on the fact that we're one of the leading groups in how to do this well and how to do it on the ground, not just in theory," Alessa said.

The two states have much in common, Alessa said, and her on-the-ground experience translates directly to Idaho.

"Our rural communities are the future," she said. "I'm from one of these communities, so there's a real passion behind this as well."

www.uidaho.edu/rr-ruralcommunities



Examining Evolutionary Paths

Chris Marx studies evolution at the microscopic scale, peering into the rapidly changing world of bacteria.

"Evolution is something that happens, and happens quickly enough to be observed and quickly enough to matter," said Marx, an associate professor of biological sciences who recently came to UI from Harvard University.

Marx not only studies the effects of evolution, but also develops mathematical models to predict how bacteria may change in the future.

Medical problems such as microbial disease, cancer and antibiotic resistance have roots in evolution, Marx said. Evolution is often working against medicine — for example, quickly evolving bacteria can adapt to new antibiotics in a matter of years or months, rendering the drugs ineffective against infection. But models like Marx's could give pharmaceutical developers a way to anticipate bacterial adaptations and design antibiotics accordingly.

In his own lab, Marx investigates ways to harness the abilities of helpful bacteria. With metabolic engineering, scientists can use bacteria to produce fuels, chemicals, or feed for animals by guiding a bacterial species' evolutionary path so it expresses certain helpful characteristics, Marx said.

Marx joins a strong community of evolutionary biologists at UI, centered on the Institute for Bioinformatics and Evolutionary Studies, or IBEST. He is the first hired among four new professors in physics, mathematics, statistics and biology who will work to bridge their disciplines at UI — leading to new approaches, new ideas and new solutions.

www.uidaho.edu/rr-evolution



Safeguarding Idaho's Roads

Idaho's highways wind through mountains and along rivers — paths that make them vulnerable to natural disasters.

Tim Frazier, an assistant professor of geography, is working with the Idaho Transportation Department to study how the state can protect its transportation network from natural disasters such as fires, floods, avalanches and landslides, as well as how climate change may affect such hazards in the future. UI's National Institute of Advanced Transportation Technology funds the project.

Disasters that block roadways pose problems for communities that rely on neighboring towns for medical care, electricity, or goods and services.

"It's quite easy for a disaster to surpass the ability of a community to deal with it themselves, so help has to get there — and help has to come from somewhere," Frazier said.

By preparing Idaho's transportation system for natural hazards, Frazier's work could also aid communities on an everyday level. Road enhancements and increased connectivity help isolated towns expand their commercial reach.

"It's kind of a cascading benefit," Frazier said. "You prepare for natural disasters, hazards and climate change, and that has the additional benefit of contributing to economic opportunity for that region."

www.uidaho.edu/rr-hazards



Blending Cultures with Art

Nishiki Tayui considers herself a hybrid. She's a native of Japan who has spent 10 years traveling the world and living in the United States, and she's a painter who combines traditional and contemporary methods in her work.

Tayui, an assistant professor of painting, says her work reflects her desire to bring together disharmonious elements in a harmonious way. Her most recent series of paintings uses Japanese calligraphy as a base for emotional exploration.

"I think about the word and be with the word, and visualize the meaning of the word by borrowing the shape of the word," she said. "I'm borrowing the essence of it."

One recent piece about decision making uses Japanese characters expressing uncertainty to form the painting's base, followed by layers in which Tayui adds nuance and complexity using language and brush strokes. The final layer declares decisiveness.

Tayui came to the UI in fall 2013 and is in good company in the Studio Art and Design Program – four new artists have joined the faculty in the past two years, bringing fresh perspectives and international experience.

www.uidaho.edu/rr-painter

Bringing a New Tune to Classrooms

Growing up in south Texas, Amanda Soto was immersed in Mexican and Mexican-American music – but she never realized it was important.

"I thought it wasn't great music because it wasn't taught in the classroom," said Soto, now an assistant professor of music education in the Lionel Hampton School of Music.

Soto wants to ensure future generations don't miss the value in their cultural music. Funded by the UI Seed Grant Program, she is conducting case studies across the United States to understand how Mexican and Mexican-American musical genres can be incorporated into K-12 music education. Soto and her mentor, University of Washington professor Patricia Campbell, have been awarded a contract with Oxford University Press to write a book for teachers on the subject.

Bringing cultural music into classrooms is vital, Soto said, because research shows that young children who accept their own culture are more open to others.

"I think it's important for students to have pride in their music and the cultures they come from, and for others to recognize and respect it," she said. "When you don't validate the music, you don't validate the people behind it. Music is a representation of the human self."

www.uidaho.edu/rr-culturalmusic

