



Gaffke Family Farm
Bozeman, MT

RKD Peterson

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Department Head: Happy Holidays!

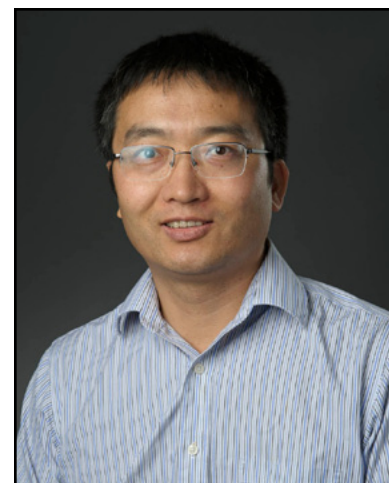
Please enjoy pursuing this fall's departmental newsletter (20 pager!) highlighting some of our many research, teaching, and service pursuits. We currently enroll 166 undergraduate students, 90 M.S. students, and 25 Ph.D. students. We want to congratulate our graduates who have completed their studies this fall. Best wishes to you in your future endeavors!

Tracy Sterling, Professor & Department Head

New Faculty

Dr. HongYi Li, Associate Professor of Watershed Hydrology

I was born in a small village in northwestern China, a semi-desert environment where people worship water more than anywhere else. This worship of water somehow has led to my curiosity of water, and guided my choice of water as my future career. In 1995 I left my home province Xinjiang for the first time, and spent seven years in Beijing at Tsinghua University pursuing my bachelor's degree in hydraulic engineering and master's degree in hydrology and water resources. Then I spent about three years working in a consulting company. Not before long I got bored and decided to embrace new challenges in my life. In 2005, I left China to pursue my Ph.D. in the Civil & Environmental Engineering Department at University of Illinois at Urbana-Champaign, USA, with a focus on watershed hydrology modeling. In 2010, I celebrated both the birth of my daughter Emerson and my doctoral degree.



Then I moved on to a postdoctoral job at Pacific Northwest National Laboratory and was promoted to staff scientist one year later. My curiosity of water continued and led me to some exciting research at the interface of watershed hydrology and earth system modeling. Since 2014 I was able to work with many visiting students and postdocs. It was a lot of fun, and more importantly, I gradually realized my passion and capacity for working with students. In 2014, the birth of my second daughter Emerald reminded me that I was not very young anymore, so I decided to embrace another major challenge in my life. Very luckily, I landed a faculty position at LRES starting in August 2016.

Continued page 4



Audrey Harvey and Stacy Davis examining blue bunch wheatgrass

Audrey Harvey received the American Indian Graduate Center Fellowship, Navajo Nation Graduate Fellowship and the Sloan Indigenous Graduate Partnership Fellowship for AY 2016-2017. She was also photographed in the Fall 2016 issue of *Mountains & Minds* "Home to Many" which discussed MSU's proposed American Indian student center.



Priscu takes Niskin Bottle water sampler to the lab in Antarctica

The American Institute of Biological Science released the October Antarctic issue of *BioScience* highlighting the combined research of 20 researchers from 14 institutions. Three of these papers, co-authored by Dr. **John Priscu**, focused on climate change. He is also the chief scientist on a \$1.2 million grant to probe an unexplored Antarctic Lake. **John Dore** is also a co-PI on the grant.

Jason Wood receives a PhD Dissertation Completion Award for Spring 2017 from The Graduate School.



Dr. **Bob Peterson** was elected Vice President-Elect of the Entomological Society of America. He also collaborated with Extended University to host a synthetic biology outreach event at the Belgrade Community Library called, "Should we Engineer the Mosquito?"



LRES MS student **Emery Three Irons** receives Institute on Ecosystems Fellowship for his research with Professor **Scott Powell** studying water quality on the Crow Reservation. The Crow Water Quality Project in partnership with Environmental Health News released a series entitled, "Sacred Water" to describe some of the issues on the Crow Reservation.



Dylan Strike, an LRES alum, was featured in the article, "Keeping it in Ag: With Bozeman expanding, is there a future for farming in the Gallatin Valley?" published in the Bozeman Daily Chronicle.



Dr. **William Kliendl** received a research grant for the proposed MSU Center for Regulation and Applied Economic Analysis in the Department of Agricultural Economics and Economics for his research on *Foundations of a Wetland Benefits Assessment Tool*



Katie Fogg won first place for her oral presentation titled, "When and How Dynamic

Hyporheic Temperature Mosaics Influence Channel Temperature Regimes" at the Montana Chapter of the American Water Resource Association.



Emeritus Professor, Dr. **Jerry Nielsen** was awarded a PRIME Award: 24 over 64. In partnership with his wife, LaVonne, they established the Nielsen Graduate Research Assistantship to help spread an enthusiasm for soils.

LRES Recognition



Dr. **Paul Stoy** was featured in the Bozeman Daily Chronicle and MSU news for his role as principle investigator for a \$6 million grant evaluating biofuel and carbon capture technologies on the Upper Missouri River Basin.



LRES Alumna **Carmel Johnston** was interviewed for her role as mission commander of the Hawaii Space Exploration Analog and Simulation crew for their year-long Mars

simulation. Her interviews were featured on NPR as well as the article, "MARS: *TIME'S* Space Writer spends 24 hours inside NASA'S Simulated Mars Base in Hawaii" published in *TIME* magazine.



Montana State University Magazine *Mountains & Minds* Fall 2016 issue featured the article, "Giving Peas a Chance". Dr. **Clain Jones** and Dr. **Perry Miller** contributed to the topic of pulse crop production in Montana.

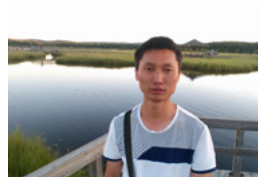
New LRES Staff



Sam Atkins is a Research Associate with the Soil Interrogation Lab and a course assistant for ENSC 245.

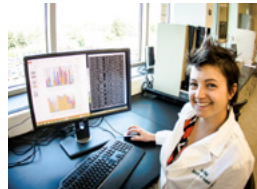
Cynthia Dean is a Program Manager for the Priscu Research Group.

Wei Li is a Post-Doctoral Research with Professor **John Priscu**.



Denfeng Liu is the Associate Research Professor with Dr. Li. He has a Ph.D in Hydrology and Water Resources.

Susan Massar is a Research Associate with Dr. **Tony Hartshorn**.



Suzanne Pellegrini is a Post-Doctoral Researcher with Professor **Fabian Menalled**.



Jessie Sheperd is the Administrative Associate III in the LRES main office.



Wondomagegn Yigzaw is a Post-Doctoral Researcher with Professor **HongYi Li**.

New Faculty: Dr. HongYi Li

Continued ...



HongYi in a soil pit on Carl Vandermolens's wheat field in Manhattan, MT

My research interest lies in hydrological and biogeochemical modeling and analysis at the watershed and regional scales. In viewing land as a series of watersheds and river systems with intertwined natural and societal functions, I have been developing novel modeling and data analysis tools to understand the lateral transport of water, energy and biogeochemistry fluxes across land surface and through river systems under climate and human-induced changes. In viewing land as an integral part of the Earth System, I am also pursuing the understanding of the two-way interactions and feedbacks between Human and Earth Systems within the climate-water-energy-environment nexus.

I will be teaching ENSC 445/LRES 545 (Watershed Analysis) course every spring. It is an advanced hydrology course following the Watershed Hydrology course taught by Dr. **Rob Payn**. This course will incorporate the process-based understanding into hydrologic data analysis, fundamental modeling principles via toy model building exercises, and implementation of the extensive used Soil and Water Assessment Tool (SWAT) model. I will also offer a graduate-level course with a focus on earth system modeling and analysis. I would appreciate feedback from any faculty or students on how to make this course attractive to the students with various backgrounds.

In my spare time, I enjoy reading history and novels, fishing and playing table tennis. I plan to start learning snow skiing together with my 7-year-old Emerson this winter. So I would also appreciate any challenge of table tennis, a partnership of fishing or coaching of skiing!

HongYi Li, Associate Professor of Watershed Analysis

LRES partners with federal agencies to merge graduate education with job opportunities



Meryl (pictured above) is currently partnered with the Water Science Center as part of the USGS Pathways Program. She will become a hydrologist with the center once she earns her degree. Dave (to the right) has previous experience with the Bureau of Land Management. With this new partnership he has accepted a position with the US Geological Survey to help interpret scientific work between the two agencies as a landscape ecologist.

Montana State University has been working on a partnership with federal agencies to help transition graduates into career scientist positions. LRES PhD students **Meryl Storb** and **Dave Wood** were among the top candidates participating in the new partnership. John Kilpatrick, director of the Wyoming-Montana Water Science Center, stated in an article in MSU News, “overlap between the next generation of scientists and our senior scientists nearing the end of their careers is important to the long-term success of [the] agency”.



For more information, please read:

<http://www.montana.edu/news/16523/partnerships-between-msu-and-federal-agencies-provide-job-opportunities-for-graduate-students>

New LRES Graduate Students

Fall 2016

Claire Donahoo
M.S. ENTO
Advisor: Peterson

Benjamin Fischer
M.S. ENTO
Advisor: Weaver

Audrey Harvey
M.S. LRES
Advisor: Mangold

Florence Miller
M.S. LRES
Advisor: Ewing

Mallory Morgan
M.S. LRES
Advisor: Stoy

Kimberly Roush
M.S. LRES
Advisor: Priscu

Emery Three Irons
M.S. LRES
Advisor: Powell

Ethan Wologo
M.S. LRES
Advisor: Ewing

Gabriel Bromley
Ph.D. ESEC
Advisor: Stoy

Adam Cook
Ph.D. ESEC
Advisor: Tronbridge

Bryce Currey
Ph.D. ESEC
Advisor: Brookshire

Miranda Margetts
Ph.D. ESEC
Advisor: Peterson/Keil

David Wood
Ph.D. ESEC
Advisor: Stoy

Alexis Bengé
M.S. LRES Online
King of Prussia, PA

Jennifer Becker
M.S. LRES Online
Belvidere, IL

Sean Carroll
M.S. LRES Online
Pleasant Valley, NY

Caitlin Dalby
M.S. LRES Online
Forest Ranch, CA

Amy Fellenz
M.S. LRES Online
Billings, MT

Joshua Hall
M.S. LRES Online
Kennewick, WA

Eric Martin
M.S. LRES Online
Bozeman, MT

Shaelyn Meyer
M.S. LRES Online
Conrad, MT

Dawn Morford-Graziano
M.S. LRES Online
Phoenix, AZ

Taylor Rodenberg
M.S. LRES Online
Neptune, NJ

Danielle Rottinghaus
M.S. LRES Online
Pueblo, CO

Mark Schnee
M.S. LRES Online
Kallispell, MT

Geoffrey Stillwell
M.S. LRES Online
Saint Ann, MO

Heather Stukas
M.S. LRES Online
Leviston, ME

Andrew Ulven
M.S. LRES Online
Detroit Lakes, MN

Tona Van Der Hiele
M.S. LRES Online
Kamperland, Netherlands

ESEC: Ecology & Environmental Sciences
LAND: Land Rehabilitation
LRES: Land Resources & Environmental Sciences
ENTO: Entomology

LRES Faculty/ Staff & Student Social

Martin Luther King Day
January 16, 2017



Games, lunch, & more! Stay
tuned for details...

Indigenous Knowledge Field Camp

LRES faculty (**Jane Mangold** and **Scott Powell**) and graduate students (**Audrey Harvey** and **Emery Three Irons**) participated in the Indigenous Knowledge Field Camp hosted by the University of Idaho and the Nez Perce Tribe. MSU also sent faculty (Dave McWethy) and a graduate student (Matt Weingart) from the Department of Earth Sciences. The four day program, also attended by faculty and students from the University of Montana, Montana Tech, the University of Idaho, and Salish Kootenai College, was an indigenous cultural immersion experience that focused on building bridges between indigenous and western-science methodologies. The highlights of the field camp included a tipi building lesson and overnight stay and a two-day raft trip on the lower Salmon River. Overall, the trip provided an amazing opportunity for faculty and incoming graduate students to get to know one another in a fun and educational setting.



LRES on the Nez Perce Reservation at Winchester Lake State Park. From Left: Scott Powell, Emery Three Irons, Audrey Harvey, and Jane Mangold

Audrey Harvey, LRES MS student

Emery Three Irons, LRES MS student

Jane Mangold, Associate Professor of Integrated Invasive Species Management

Scott Powell, Assistant Professor of Environmental Spatial Analysis

Outreach in Photos



*The education stations at the **Montana Weed Control Association golf fundraiser** were a hit with golfers. Pictured above are four of the six volunteers who helped run the stations waiting for one of the golfers to identify a weed correctly: (From left) Stacy Davis (LRES), Jane Mangold (LRES), Ed Duggan (Ravalli County volunteer), golfer Pete Novich, and Christy Schram (Ravalli County volunteer).*

Featured in Weed Times (Vol. 34 Is.3)

Bison traffic jam!

Research associate, Stacy Davis, submitted this photo from a field sampling trip to a hoary alyssum site near West Yellowstone, MT



Research & Outreach in Photos



*LRES Online MS student, **Erika Sturn**, presents her professional paper titled, "GeoChemical Indicators of Hydrological Process Regimes near Bozeman, Montana" to a local audience.*



***Perry Miller** (LRES) and **Darrin Boss** (NARC) facilitating the Cropping Systems discussion at the **MAES Summit** in November. Attendees included Research Center Superintendents, Department Heads, growers, and various agency representatives.*

LIGHTS, SOIL, ACTION



Badma, LRES PhD candidate at Headwaters State Park, MT

The 15th Annual Quivira Conference was a great opportunity for me to meet and learn from experienced ranchers, wise researchers, awesome young agrarians, and indigenous tribal people of USA and other countries about immediate concerns related to soil, land use, and associated communities on those lands. The unique thing about this conference was that no single talk separated humans from the land and approached challenges as a whole.

The impressive speakers talks started with Dr. Temple Grandin, Professor of Animal Science at Colorado State University and spokesperson for autism, and Wes Jackson the founder of "Land Institute" sharing their lessons learned and continued with young farmers sharing how they face the issues of land management.

As a researcher from Mongolia, where land is common and very abundant, but degrading from overgrazing and recent mining activities, I felt like I was a guest from the past. It was very important for me to learn from the speakers such as Nikki Cooley, researcher and Program Coordinator for Northern Arizona University's Institute for Tribal Environmental Professionals, Luci Waruingi the executive director of the African Conservation Centre in Nairobi, Kenya, and Gary Burnett, Executive Director of the Blackfoot Challenge of Western Montana. They all described advanced problems and methods to solve them, which I will use to advance my PhD research here at MSU to study Northern Mongolian soil quality.

I would like to thank the donors who generously contributed travel funds to the MSU College of Agriculture, my adviser Dr. **Anthony Hartshorn** and LRES department head Dr. **Tracy Sterling** for awarding me the scholarship to attend this conference.

*Badmagarav Dovchin, LRES Ph.D Student
15th Annual Quivira Conference-Albuquerque, NM
November 9-11, 2016*

Reis is second place in the student competition at XXV International Congress of Entomology (ICE 2016)



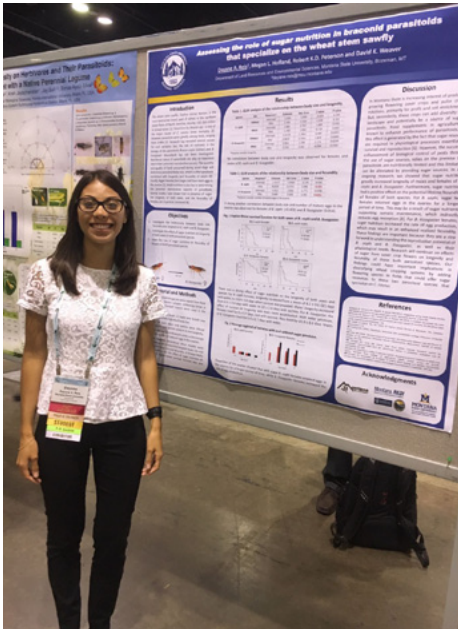
The International Congress of Entomology (ICE) is a venue for scientists and other experts of the discipline to share research with a global audience and network amongst the thousands of attendees from around the world. **Dayane Reis**, a M.S. Entomology student in LRES went to XXV ICE in Orlando this September and won second place in the student competition session “Frontiers in Entomology” after presenting some exciting findings.

The research Reis conducted with her major advisor Dr. **David Weaver**, focused on the role of sugar sources in the reproductive physiology of beneficial parasitoids that specialize on the wheat stem sawfly, the major insect pest of wheat in Montana. Sugar sources are required for parasitoids in essential physiological processes such as survival and reproduction. Potential sugar sources for these insects that kill wheat stem sawfly larvae has considerable merit because of increased interest in growing flowering cover crops and pulses in crop rotations in Montana. The research explored the role of sugar sources on longevity and fecundity of two native species of wheat stem sawfly parasitoids in

Montana. The results of this research indicated that sugar provision greatly increased longevity of males and females of both species. Furthermore, females of both species had more eggs in the ovaries and for a longer period of time. Their findings suggest that sugar supports somatic maintenance of eggs, and indirectly affects potential lifetime fecundity of parasitoids.

Their research contributes to a better understanding of the reproductive potential of wheat stem sawfly parasitoids, as well as the physiological needs of these valuable members of Montana agroecosystems. Reis and Weaver’s research will continue by assessing effects of sugar available from cover crop flowers on longevity and fecundity of parasitoid species. Ultimately, their findings could have important implications for the ongoing diversification of wheat cropping systems by adding nectar producing flowering species to fields that can provide sugar resources to parasitoids. Reis and Weaver thank the LRES department and The Graduate School for their helpful contributions to travel costs for Reis to attend ICE.

Dayane A. Reis, LRES MS Grad Student



Above: LRES Grad Students help with the recruitment booth at the International Congress of Entomology 2016. Left to right: Chris Brown, Alyssa Piccolomini, and Collin Preftakes

To the left: Dayane presenting at ICE

Photos by Bob Peterson

Professional Spotlight

Anne Loi, Spatial Sciences Center Systems Administrator

Anne Loi is one of the most recent additions to the LRES department, having joined us as Computer Systems Administrator a few months ago. She has, however, been working closely with many in the department for decades. Anne received her degree in Computer Science from the University of Southern California in 1986 and worked as a computer scientist for ten years in southern California and Switzerland before joining the Geographic Information and Analysis Center (now the Spatial Sciences Center) at MSU in 1996. She currently splits her time between LRES, the Spatial Sciences Center, and as a software engineer for the School of Film & Photography. Anne has always enjoyed the diverse challenges afforded by her position, and her current appointments certainly provide ample opportunities to challenge her skills (LRES faculty should not, however, take this as a challenge themselves!). And if you want to practice something other than English, her other language skills include French, Chinese, Python, HTML, JavaScript, PHP, MySQL, C, Pascal, awk, and BASIC. When not fixing our sick computers, she enjoys shuttling her son Sean to soccer games, cooking gourmet meals, and enjoying Montana's great outdoors.



Rick Lawrence, Professor and Director of Spatial Sciences Center

Dr. Gejiao Wang on sabbatical at MSU Professor, Huazhong Agricultural University



During Fall 2016 Dr. **Gejiao Wang** has been on a sabbatical visit with Dr. **Tim McDermott**. Dr. Wang is from the State Key Laboratory of Agricultural Microbiology, College of Life Science and Technology, Huazhong Agricultural University in Wuhan, China. She runs a big group, involving 20-25 students and two Research Professors that focus on microbial redox transformations of arsenic, antimony, and selenium.

While on sabbatical here at MSU, Gejiao has been getting caught up on manuscript writing and reviewing, as well as using this “free time” to begin designing and planning new research thrusts that will involve new and expanded MSU research collaborations. While here at MSU, she has also worked with Tim on Yellowstone Lake and participated in some lab group activities such as a hike in the Spanish Peaks.

Importantly, Gejiao is also spearheading the establishment of a new joint education program between MSU and Huazhong Agricultural University. This effort seeks to formalize at the institutional level the collaborative research she and Tim have

enjoyed since 2010 and that has yielded nine peer-reviewed papers thus far (and many more in the mill). These studies have involved international lab rotations for PhD students sponsored by international collaboration grants to Gejiao from the Chinese National Science Foundation, with Tim as the US collaborator. The next student to participate will be Ms. **Rachel Rawle** who will rotate through Gejiao's lab. Rachel, a Ph.D. student in Ecology and Environmental Sciences, will be co-advised by Tim and Brian Bothner in Chemistry/Biochemistry, and is funded from the NSF Systems and Synthetic Biology Program. Rachel's international lab rotation is a key part of the Broader Impacts component of that grant. Her work uses RNA Seq-based efforts as well as metabolomics, with the latter aligning with student projects in Gejiao's lab and sets the stage for Gejiao's collaboration to now expand near seamlessly with Brian now taking the lead.

*Tim McDermott,
Professor
of Soil and
Environmental
Microbiology*



Update from LRES Alums

Gill Singh received his BS and MS from LRES and is working as an Assessor in Sarawak Malaysia for the Global Forestry Services, an organization that provides services for wood processing and trade to meet local legal regulations and international certification standards. Roads are limited, so he travels to many field sites via long boats or express boats which have fancier seating than airplanes!



(Top) Gill stops for lunch near a waterfall in Malaysia

(Center) Jungle view!

(Below) Some sites have to be reached by long boat, Gill standing on right



LRES alum Gill Singh's commute via express boat. (To the right) Take a look inside!



Alumni in Action



LRES graduates **Dr. Temuulen “Teki”** and **Dr. Joel Sankey** live in Flagstaff, Arizona with their eight year old twin boys, Luka and Levi. Dr. Teki (LRES PhD 2006) is an Assistant Professor in the School of Earth Sciences and Environmental Sustainability at Northern Arizona University (NAU), where she specializes in remote sensing and geospatial analysis with applications in coupled human-environmental

systems in the western US and northern Mongolia. She directs Northern Arizona University’s Remote Sensing and Geoinformatics Laboratory within the newly established School of Informatics, Computing and Cyber Systems. Her laboratory equipment includes a state-of-the-art Unmanned Aircraft System (UAS) and several other ‘practice’ drones. She teaches a graduate course in remote sensing and directs 4 PhD and 4 Masters graduate students working with remote sensing applications for global croplands inventory, ponderosa pine forest restoration, implications of erosion rates on degraded rangeland for policy formulation, restoration to resist invasion of buffleggrass in Saguaro National Park, effects of tamarisk beetle on tamarisk shrubs in Grand Canyon National Park and use of remote sensing to aid in forest restoration and wildland fire management.

Dr. **Joel Sankey** is a Research Geologist with the Southwest Region of the US Geological Survey’s Grand Canyon Monitoring and Research Center, and the Southwest

Biological Science Center in Flagstaff, Arizona. After receiving his B.S. and M.S. degrees from LRES, Joel completed a PhD at Idaho State University, and was awarded a USGS Mendenhall Fellowship leading to his present position. Joel focuses on blending approaches of geomorphology, soil science, ecology, remote sensing, GIS, and spatial science to understand how disturbances such as fire affect erosion, sedimentation and vegetation. This work, focusing on the arid and semi-arid landscapes and rivers of the western US, provides guidelines for resource management and conservation in the face of change. Joel conducts much of his ‘monitoring’ with annual river trips down the Colorado River.



Teki and Joel met at MSU when Joel’s parents joined a Bio-Regions ‘work trip’ to Mongolia. They later conducted joint field work in Mongolia with their twin infants, and still return frequently to their family small grains farm near Erdenet City in northern Mongolia.

Web resources:

<https://nau.edu/cefns/natsci/seses/faculty/teki-sankey/>
<https://sites.google.com/a/nau.edu/remote-sensing-lab/>
<https://www.usgs.gov/staff-profiles/joel-b-sankey>

Cliff Montagne, Professor Emeritus

Institute on Ecosystems EPSCoR Summer Research: An MSU undergrad's experience

One of the greatest things about MSU is the opportunities it gives its undergraduates to conduct research. This summer, I was able to experience this first hand through MSU's connections with IoE EPSCOR. Under Dr. **Kevin O'Neill**, Professor of Entomology in LRES, I studied how temperature effects the agriculturally significant Alfalfa Leafcutter Bee. I met Dr. O'Neill in his Introduction to Entomology (BIOO 262) class and I was lucky enough to gain his support in writing a grant to Montana's Institute on Ecosystems to study the fascinating and adorable leafcutter bee. Though looking through a microscope all day at dead bees may seem strange, I felt like I had landed in a dream while I worked in the O'Neill Lab this summer. It wasn't all lab work though; while I worked on my project, I also helped Dr. **Casey Delphia**, Ecology Research Associate, with a similar project in which I got to get outside and see live bees. Some days I



Frances Ambrose finishes up securing wood nesting blocks placed into shelters for the alfalfa leafcutting bee. The different symbols painted on the nesting blocks help the female orient to their individual nesting holes.

Photo by Jacklynn Lathrop

conducted fat extractions and leafcutter bee nest diagnostics and other days I planted flowers or collected pollen off bees in an alfalfa field at one of MSU's farms. Compiling and analyzing the

data is ongoing, but we are projected to show that the Alfalfa Leafcutter Bees' health is relatively dependent on summer temperatures. As global climate changes, this information will be vital as we continue to work towards sustainable food security.

Though it was a lot of work, I learned so much this summer and met so many wonderful people. This semester, I am turning my IoE summer project into my Entomology minor thesis with the help of Dr. O'Neill. He has also allowed me to be his teacher's assistant in his BIOO 262 class as well. I feel as though my degree has come full circle this year and I have never been more excited about the future. Through the incredible experience I have gained because of MSU and Kevin O'Neill, nothing can stop me from graduate school and beyond

*Frances Ambrose
Ecology student majoring in Biological Sciences: Conservation Biology/Ecology*

The Economy and Climate Change: Agriculture in Montana

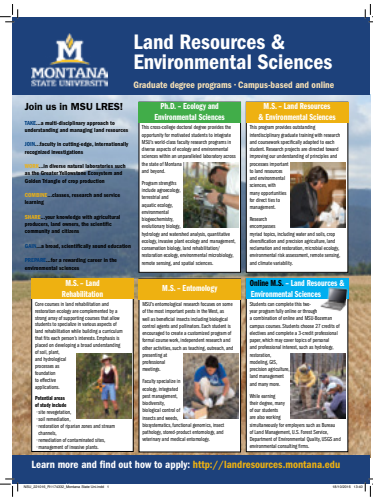
This summer I researched the economic impact of climate change on agriculture in Montana under the guidance of Dr. **Bruce Maxwell**. This research was done for the Montana Climate Assessment Team which Bruce led by meeting with stakeholders in Montana. We found that the three major economic impacts of climate change would be 1) an increase in uncertainty which would be a cost to farmers; 2) a shift of planted acres from spring wheat to winter wheat; and 3) a change in traditional crops that can be grown in certain areas, paying special attention to the slow but steady increase of corn farmed in Montana. This will eventually be published online at the end of the summer of 2017 and is planned to be continually updated in the future so that all interested citizens of Montana can utilize the information we found in this research when making agricultural decisions.

Laura Ippolito - LRES Sustainable Food and Bioenergy Systems- Agroecology



*Montana Climate Assessment Team
Bruce Maxwell middle row, far left. Laura Ippolito is in the top row, second from left.*

Calling all Grads!



LRES had the good fortune of receiving one of the Provost's One-Time-Only Strategic grants for Fall 16/Spring 17 with a focus on supporting Graduate Education. The grant's focus is to enhance marketing and recruitment of graduate programs. Activities to increase marketing of our graduate programs include advertisements in journals such as *New Scientist* and hosting recruitment booths at various professional conferences representing our diverse disciplines such as at the International Congress of Entomology, American Water Resource Association, Crop & Soil Science Societies of America, Weed Science Society of America, and the American Geophysical Union (pictures show ad and example booths). Additionally, working with Extended University and The Graduate School, ca. 800 mailings were distributed to our academic peers including those at Land-Grant Institutions and multiple state and federal agencies such as MSU Extension, USDA ARS, National Park Service, BLM, and DEQ to name a few.



These funds also allow LRES to fund multiple graduate student recruits to visit us in the spring semester so they get a chance to see MSU and meet with faculty and grad students. **Please spread the word that MSU is a great place for graduate studies!**

Montana Hall on a fall morning.



RKD Peterson

Northern Rockies Invasive Plant Council Conference



President Jane Mangold provided welcoming remarks at the Northern Rockies Invasive Plant Council Conference in Boise, ID, October 17-20

Several LRES faculty and staff and an online graduate student traveled to Boise, ID, from October 17-20 for the Northern Rockies Invasive Plant Council (NRIPC) conference. Dr. **Jane Mangold**, president of NRIPC from 2014 through the conference, helped to organize and execute the event. One of the highlights of the conference was a half-day symposium on Russian olive, in which we learned about biocontrol and other management options, as well as how management may affect wildlife. We also attended a full-day symposium on rush skeletonweed where various state and regional perspectives on this weed and its management were shared, including a presentation by Dr. **Jeff Littlefield** who discussed his work on the rush skeletonweed biocontrol agents *Bradyrrhoa gilveolella* and *Oprosymma wertheimsteini*. **Jane Mangold** presented on hoary alyssum (*Berteroa incana*) during the invasive mustard half-day symposium and also presented “The economic costs of noxious weeds on private rangeland in Montana.” **Noelle Orloff** spoke about “A meta-analysis of Canada thistle (*Cirsium arvense*) management in organic perennial systems.” **Stacy Davis** presented on “Mitigating priority effects of invasive plants during revegetation by altering perennial grass planting date.” Finally, **Shelley Mills**, an online LRES master’s student and MSU Extension Agent from Valley County, presented “Narrow-leaf hawksbeard (*Crepis tectorum*): A new invasive plant to northeastern Montana.”

Jane Mangold, Associate Professor of Integrated Invasive Plant Management

Students Attend Soil Summit in Billings, MT

A “Soil Summit” workshop at the Billings Red Lion in October, sponsored by the Northern Plains Resource Council, attracted >100 farmers and ranchers alongside representatives from NRCS, Extension, local businesses, and MSU. I attended this workshop with several other Environmental Science and Natural Resources students including **Jeremy Ditto**, **Kirby McRae**, **Mike Oakes**, and **Sam Leuthold**. This workshop showcased a range of speakers, including our own **Tony Hartshorn**, who briefly and enthusiastically demonstrated how to use a CO₂ gas analyzer to measure soil breath or respiration. Other speakers included Molly



Haviland who introduced her miniherder manifesto, speaking about building healthy microorganismal communities to improve crop soils, and even suggested it can drastically improve weed management. Blain Hjertaas discussed Holistic Management and the Importance of Monitoring Carbon Topic in your Soil and its Sequestration. This transitioned well into Jimmy Sinton and Mik

McKee’s talk about programs that are in progress or already in place to incentivize carbon sequestration approaches appropriate for Montana farms and ranches. The open discussions for the second half of the day were the most inspiring. Long-time ranchers, holistic management teachers, educators, extension specialists, and environmental scientists all constructively participated and openly discussed what we can do to be more productive and soil-smart, sustainable agriculturalists and environmental scientists. This experience was one of the most encouraging days in my higher education career.

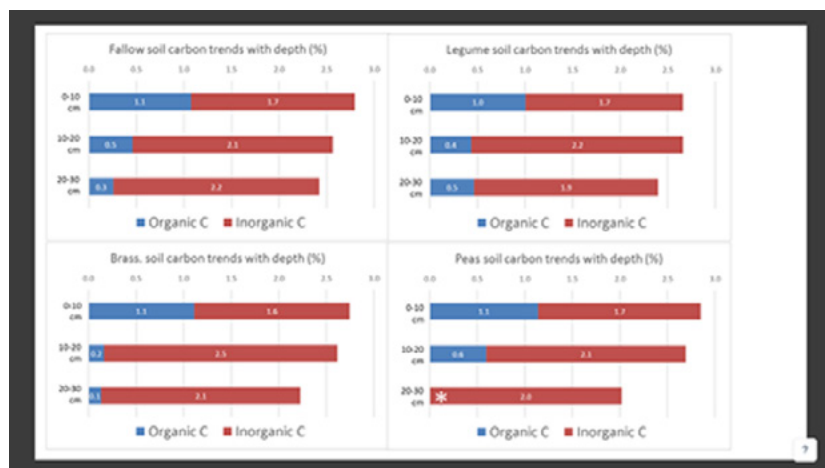
Kelsey Simon, LRES student majoring in Land Rehabilitation

Cover Crop Cocktails on an Amsterdam Soil

Many years ago, LRES faculty members **Clain Jones**, **Perry Miller**, and **Cathy Zabinski** designed a cover crop cocktail field experiment on one of Carl Vandermolens' wheat fields off Arnold Road southwest of Manhattan. This long-term experiment has been yielding insights into the agronomic consequences of varying management practices via a number of Master's theses (Susan Tallman, 2014; Megan Housman, 2016). In 2016, a collaboration between Emily Glunk (Animal & Range Science) and **Tony Hartshorn** led to a follow-on, LRES-undergraduate-powered study to quantify and characterize above ground biomass as well as surface soil properties, including organic and inorganic carbon as well as soil organic carbon residence times, for replicated plots seeded with 7 sets of different cover crop "cocktails," mostly driven through four root functional groups (*): fallow, fibrous roots*, legumes*, mustards*, peas, and taproots*, as well as a full combination of the four non-fallow, non-pea root functional groups. Our initial results suggest multiple plantings of these functional groups do not yield statistically significant increases in soil organic carbon (as soil organic matter, versus soil inorganic carbon as calcium carbonate salts) or soil organic carbon residence times, even compared with the wheat-fallow treatment. On the brighter side, our fieldwork has, however, helped us discover that watershed modelers enjoy backhoe pits (See page 4)!

Tony Hartshorn, Assistant Professor of Soils

Figure below: Patterns of soil organic carbon (about half of soil organic matter) and soil inorganic carbon (typical of calcium carbonate $[CaCO_3]$) with depth across four of the Amsterdam cover crop cocktail treatments. In every case, there is more soil inorganic carbon than soil organic carbon; no samples were run from the 20-30 cm interval for the plots seeded with peas.



ENSC 245 Update

Every Fall for the last several decades, Soils (ENSC 245) students have been encouraged to pull together a creative synopsis that compares and contrasts their "favorite soils." After a diabetes-inducing glut of soil-themed cakes and desserts in Fall 2015, Tony Hartshorn experimented with the creation of electronic portfolios this Fall. Entirely skipped by LRES staffer **Sam Atkins** (Soils, Fall 2013; and whose own capstone favorite soil report is online at <https://www.youtube.com/watch?v=jxihEYDBQgY>), this pilot effort attracted ~20 students, all of whom completed pre- and post-surveys. This year's pilot products also included websites (e.g., <https://fsr3ep.wordpress.com/> or <https://wukokisoil.wordpress.com/>), many clever #soilculture videos or animations or podcasts, as well as the World Premiere of "Minnie the Microbe."

Sam Atkins & Tony Hartshorn



Danielle Staudenmeyer and Emily Glunk



Paul Rychener, Kelsey Simon, Kirby McRae, and Josh Botti-Anderson



Kelsey Simon



Rew's Sabbatical Highlights

Dr. Lisa Rew was on sabbatical for the 2015-16 academic year. She spent most of her time in her home office collaborating with colleagues using a variety of digital formats, but she was fortunate to visit a few of them in person in other parts of the USA and Chile. To mark the start of her sabbatical she rode nearly 1000 miles in 9 days with members of her family to raise money for two cancer charities.

More academic accomplishments included co-chairing a meeting on the invasion of pathogens, plants and animals into mountain and high latitude systems, and the risk these pose to human health and communities, as well as biodiversity. The meeting was with 25 colleagues from around the world in Flen, Sweden. She is leading a paper highlighting these issues. She also presented results from a number of studies she and her students, and colleagues have worked on in recent years, at four national/international meetings.

Throughout the year she worked with colleagues from the Mountain Invasion Research Network to analyse plant survey data the group has collected from 10 sites globally. They have



Lisa Rew enjoys an early morning sunrise in Chile

found that non-native and noxious plants are spreading up into mountains, reaching higher elevations along the disturbed roadsides than they do in the adjacent vegetation only 100 m away. While some patterns of invasion are clear the species that move away from the road have no similar traits (e.g. annuals versus perennials, grasses versus forbs, wind dispersed seeds versus other types) meaning we still can't predict which species are going to invade less disturbed rangelands and native habitats. As a result of these projects and collaborations she achieved other sabbatical goals which included improving her statistical and R programming skills which she has already brought back to the classroom for her senior and graduate classes.

Lisa Rew, Associate Professor of Invasive Plant Ecology

Navajo Communities Visit



During October 14 -17 I was able to accompany members of the Center for Native Environmental Health Equity on a trip across the Navajo Reservation in New Mexico and Arizona. The Center is a National Institute of Health funded collaboration among the Navajo, Crow, and Cheyenne River Sioux Tribal communities, along with academic partners from the University of New Mexico, MSU Bozeman and Little Big Horn College. The purpose of the trip was to visit and learn from Navajo communities that are affected by abandoned uranium mine waste, with a long-term goal of collaborating across tribes to understand health impacts from uranium and other metals contaminating our reservations.

We visited the Red Water Pond and Blue Gap-Tachee communities. The Red Water Pond Community is part of the Church Rock mining district, which had three mines in operation from 1968 – 1986. Two hundred residents live within two miles of the three mines, including near the Northeast Church Rock mine, where there is still a mound of tailings. From several community member accounts, the EPA was allegedly supposed to remove the tailings in 2012 (though the date has since been moved to 2028). Given the critical environmental stress on these communities, many have felt frustrated and disappointed. We felt honored to be invited into their homes for a meal and conversation.

We then visited the Blue Gap-Tachee community. Blue Gap-Tachee hosts 17 families living within one mile of the Claim 28 Mine, which was in operation from 1954 to 1968. One family living right across from the mine was nice enough to take time with us and share their stories, which included testimonials about how the mine has affected their water quality. This family has requested action on mine-cleanup since 1988, and has had little support in terms of solution or action.

These two communities have been working with researchers from New Mexico doing various studies from respiratory effects of exposure from contaminant dust to health assessments. These communities have endured generations of uranium mines and will not give up the fight of mine cleanup. The communities mainly wanted to have the group hear their stories and increase awareness of the situation and to spark the drive needed to clean up these uranium mine wastes. It is increasingly important to elevate and respond to our nation's Native voices in the wake of community and environmental maltreatment.

Emery Three Irons, MS Student & Sloan Scholar in LRES

Call for abstracts coming for the Spring LRES Research Colloquium

The LRES Research Colloquium will be held in the Strand Union Building on **April 25, 2017** (more details coming soon).

The event offers on-campus and online graduate and undergraduate students from LRES an opportunity to present their research to friends, colleagues, and faculty in an informal setting. All LRES undergraduate and graduate students are encouraged to submit. Come and share what you have been working so hard on!

Other highlights of the Colloquium include a keynote talk, door prizes, and prizes for the best presentation(s). Appetizers and beverages will be served.

Questions? Interested in helping organize the event?

Email lresgso@gmail.com or touch base with current **LRES GSO Leaders**:

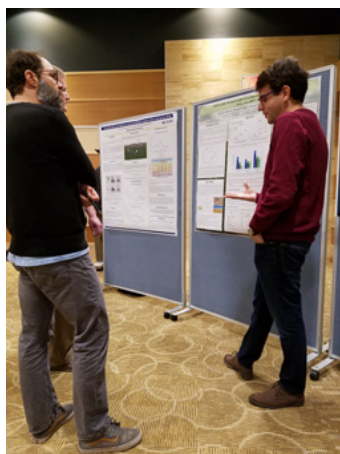
Co-Chairs: Tessa Scott & Keenan Brame

Mentoring Committee: Buddhi Achhami

Curriculum Committee: Madelyne Willis

Social Committee: Kim Roush

Online Student Rep: Chris Caron



Carlos Romero presents his research at the Spring 2016 Research Colloquium

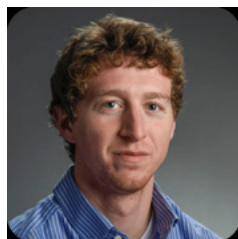
Science Olympiad 2016



Every Fall, hundreds of middle- and high-school students from all over the state (“Sugarbeeters”, “Refiners”, “Wolves”) descend onto the MSU campus for the Montana Science Olympiad. Many faculty and staff, including those from the College of Agriculture, volunteer their time to support hands-on learning as part of this statewide outreach program. In this mosaic, students from Browning, Drummond, and Sweetgrass (and many many buses photographed in the Museum of the Rockies parking lot Monday, Nov. 22) took advantage of the recently renovated Soils Teaching Lab to learn about SOILS!

Tony Hartshorn, Assistant Professor of Soils

Keenan Brame: Graduate Student Organization Liaison to Undergraduate Club



My role involves bridging the gap between our excellent undergraduate and graduate programs in LRES. Having graduated from the department with a bachelor’s degree in Environmental Sciences and worked for professors during my time as an undergrad. I understand firsthand the benefits and experiences gained through undergraduate research. I am also willing to offer advice and personal experience for those students nearing the end of their

B.S. degree who have questions about attending graduate school or life after graduation. I am co-chair of the LRES GSO (graduate student organization) and have open communication with other graduate students within the department who might be searching for needed undergraduate research in their respective labs. Dr. **Amy Trowbridge** and I plan on having a graduate-undergraduate informal meeting in the Spring where graduates can talk about their research and those undergrads with similar interests can reach out to the grads for potential lab experience.

LRES Degrees Awarded Fall 2016

Bachelor of Science

Geospatial & Environmental Analysis

Edward Johnson

Land Rehabilitation

Joseph Rizzi, with Honors

Sustainable Foods & Bioenergy Systems-Agroecology

Torryn Frazee, with Honors

Kelly Kjorlien, with Honors

Master of Science

Land Resources & Environmental Sciences

Christian Larson

Online Master of Science

Land Resources & Environmental Sciences

Marianne Alford

Shelley Mills

Lizzy Montgomery

Zev Reuter

Amanda Rothermal

Ricardo Segovia

Erika Sturn

LRES Fall Capstone

This year's LRES Capstone has taken a new approach to how undergraduates apply what they have learned in their undergraduate years in LRES. We focused this year's course on the new Story Mill Regional Park and its wetlands. The City of Bozeman and Trust for Public Lands has been working to protect and transform 55 acres adjoining the historic Story Mill in Bozeman, Montana, into a unique city park with exciting opportunities for active recreation, outdoor community gathering spaces and a nature sanctuary. The park is set for completion in 2018. Along with this park project they also enhanced several wetlands and riparian areas in an attempt to improve the ecological services these systems provide to help the City address local violations in state water quality standards due to impacts from urban,



Story Mill Stakeholder meeting at the Bozeman Public Library

suburban, and agricultural land uses. Although the wetland and floodplain enhancements have been implemented, the City, TPL and the State of Montana still have many questions about the effectiveness of the restoration, the continued impacts from the City, and how

they can leverage ecological services to provide a holistic management approach to the City's stormwater problems. Earlier this semester the LRES Capstone students met several of the Story Mill Stakeholders to hear their concerns and questions about this complicated issue. The students then selected several of their important questions and spent the semester conducting literature searches, GIS models, and developing methodological suggestions. They presented their findings back to the Stakeholders and the general public on November 30th at 1:00 in the meeting room of the Bozeman Public Library. Their findings were posted on the LRES website and provided to the City.

William Kleindl

Assistant Research Professor of Wetland Ecology



LRES Capstone students present on topics such as eutrophication and green infrastructure during the December Story Mill Stakeholder meeting at the Bozeman Public Library

New LRES Grants Awarded from Dec. 2015 - Nov. 2016

These funds fuel our research and teaching mission-to discover new knowledge, to engage and train students using laboratory and field studies across local to global scales, and to enrich the lives of Montanans. Please take a minute to congratulate our faculty and staff **in bold** on their meaningful work and impressive accomplishments.

Montana Grants

Montana Department of Agriculture

E. Davis & Menalled Evaluation of burndown efficacy, wild buckwheat control, and dry pea tolerance to Spartan + Sharpen

Montana Department of Environmental Quality

Peterson & Kleindl Wetland Strategic Framework Funding

Montana Fertilizer Tax Fund

Engel & Jones Understanding acidification and management of Montana soils

Engel, Jones & Miller Fertilizer Management Strategies for Enhanced N Recovery and Reducing N Losses in No-till Wheat

Ewing, Brookshire, Klassen & Jones Research Analytical Chemist, Environmental Analytical Laboratory

Jones, Miller, Ewing & Sigler Fallow replacement and nitrogen rate effects on nitrate leaching, yield, and quality

Miller, Ewing, Jones & Engel Long-term N management effects on soil organic C and N in traditional and diversified cropping systems

Miller, Jones & Zabinski Advancing cover crop knowledge in Montana: Soil Fertility Implications

Miller & Jones Long-term N management in alternative crop rotations

Montana Noxious Weed Trust Fund

Littlefield Host specificity testing of biocontrol agents of weedy mustards

Littlefield Host testing of biocontrol agents for hawkweed

Littlefield Screening of new biocontrol agents for common tansy and ox-eye daisy

Littlefield Release and monitoring of Russian knapweed biocontrol agents

Mangold & Frame-Martin Montana Noxious Weed Education Campaign

Mangold Mitigating priority effects of invasive plants during revegetation by altering perennial grass planting date

Mangold & S. Davis The effect of herbicide application and soil texture on hoary alyssum seed biology and control

Rew, Mangold & Lehnhoff Integrated management of dense cheatgrass on productive rangelands.

Weaver Addressing challenges posed by yellow, Dalmatian and hybrid toadflax using integrated approaches that support biological control

Weaver Candidate Agents for Biological Control of Russian Olive

Montana Wheat & Barley Committee

Z. Miller (WARC) & Menalled On-farm assessment of field bindweed (*Convolvulus arvensis*) impacts crop yields and response to organic management.

Miller & Jones Legacy effects of long-term diversified cropping systems.

Stoy, Maxwell & Powell Remote technologies for precision agriculture in wheat agroecosystems

Weaver IPM of Wheat Stem Sawfly

Federal Grants

National Aeronautics And Space Administration (NASA)

Ward Comprehensive comparison of taxonomic composition and metabolic functioning in oxygenic and anoxygenic microbial mats of Yellowstone hot springs

National Science Foundation (NSF)

Hartshorn EAGER: Collaborative Research: Microbial Populations as Biosignatures for Evaluating Long Term Effects of Urbanization

**E. Shanahan (PoliSci),
C. Izurieta(CompSci)
J. McEvoy (EarthSci),
E. Raile (PoliSci),
R. Ready (AgEcon), & Poole** The Impacts of Narrative-Based Risk Communication on Hazard Preparedness

Priscu & Dore Collaborative Research: Subglacial Antarctic Lakes Scientific Access (SALSA): Integrated study of carbon cycling in hydrologically-active subglacial environments

Stoy The role of ecosystem management on boundary layer development & precipitation in the Northern Plains

Stoy Sustainable socio-economic, ecological, and technological scenarios for achieving global climate stabilization through negative CO₂ emission policies

Federal Grants

USDA Animal And Plant Health Inspection Service (APHIS)

Littlefield Rearing of *Aceria drabae* for the biological control of whitetop
Littlefield Redistribution of Biological Control Agents for Russian Knapweed

USDA Bureau of Land Management (BLM)

Brookshire, Ewing & Powell Multi-scale analysis of the effects of prescribed fire on terrestrial ecosystem dynamics in the Missouri and Musselshell River Breaks, central Montana

USDA Forest Service (USDA FS)

Lawrence & Holbrook Habitat-use patterns of Canada lynx in spruce-beetle impacted forests of the Rio Grande National Forest in southern Colorado

Mangold & Frame-Martin Montana Noxious Weed Education Campaign

Weaver Using controlled-release formulations of Northern Tamarix Leaf Beetle aggregation pheromone to target Tamarix stands

USDA National Institute of Food and Agriculture (NIFA)

Dyer (PSPP), Keith, Lehnhoff & Menalled The physiological mechanisms and management of herbicide-resistant *Avena fatua*

Engel & Miller Assessing the resiliency of integrated crop-livestock organic systems in water-limited environments under current and predicted climate

O'Neill Increasing sustainability of *Megachile rotundata* populations on alfalfa seed farms using floral resource management strategies.

US Geological Survey (USGS)

W. Cross (Ecol), Ewing & Payn Using weathering geochemistry to understand the sources of baseflow water supply in rivers across mountain-basin transitions in the Upper Missouri Watershed

Payn Understanding how beaver mimicry restoration influences natural water storage in Missouri River headwater streams

Private, University, Regional and Other State Grants

Battelle Memorial Institute - Pacific NW National Laboratory (DOE)

Li Enhancing the representation of river dynamics in GCAM hydrology

Li Developing a new reservoir water temperature module within the IMMM framework

Li Adding MOSART-sediment and MOSART-BGC into ACME

Confederated Tribes of the Umatilla Indian Reservation

Poole Interpreting model outputs of water temperature data within the context of diel and annual hysteresis patterns.

Poole Hyporheic Temperature Model Development and Assessment

Koch Biological Solution

Engel Evaluation of biological exudates on winter wheat.

Montana Academy of Science

Hartshorn & Dillard Rethinking rehabilitation of semiarid lands dominated by *Alyssum desertorum*

Montana Department of Environmental Quality

Sigler Volunteer water quality monitoring support 2016-17

Mosquito Research Foundation

Peterson Risks to Pollinating Bees from Adult Mosquito Control

North Dakota State University

E. Davis & Menalled Controlling volunteer canola

South Dakota State University

B. Bauer (MSU Ext) & Mangold Extension Climate Curriculum, A Primer for Weather Extremes in the Northern Great Plains

University of Montana

Ewing & Maxwell Understanding the hydrologic and socioeconomic impacts of water use and resource allocation in agricultural regions under different climate and policy scenarios

Utah State University

Menalled Sustainable Agricultural Professional Development Program, 2015-2016

LRES 2016-2017 Scholarship Recipients

Annin Scholarship

Nicholas Pombo

Anthony C. Gaffke Scholarship

Faith Doty

Olivia Firth

Bill & Anita Jones

Agricultural Scholarship

Mathew Bain

Emma Bode

Emma Lathrop

BMCF Agricultural Scholarship

Jeana Ratcliff

CHS University Scholarship

Todd Schlotfeldt

Cliff Montagne LRES Scholarship

Mathew Bain

Clyde & Helen Erskine Excellence in Ag Scholarship

Noelani Boise

Dr. Arthur H. Post & Margaret Post Scholarship

Bryce Murphy

Farmers Business Network Scholarship

Jerad Hoy

Anna Werkhausen

First Security Bank of Belgrade Scholarship

Faith Doty

Frank F. Munshower Scholarship

Emily Pierson

Gallatin Valley Ag Committee Scholarship

Olivia Firth

Kamut International Organic Agriculture Scholarship

Kelly Kjorlien

Koebel Family Scholarship

Michael Wint

Land Resources Stewardship Scholarship

Noelani Boise

Jessica Christ

Krista Ehlert

Kendall Franks

Kelly Kjorlien

Braden Leach

Land Resources Stewardship Scholarship

Chance Noffsinger

Sarah Spear

Damion Lynn

Newman Family & Friends Scholarship

Emma Bode

Newman/Abbott Nutrition Undergraduate Scholarship

Conner Mertz

Nielsen Pedology Graduate Student Scholarship

Florence Miller

Ted & Thelma Fosse Scholarship

Braden Leach

Chance Noffsinger

Wyman E. & Ruth M. Nyquist Scholarship

Thomas McGrath



Opportunities to Support LRES

A gift to the department is a great way to support student and faculty endeavors. Donations can be earmarked for student scholarships or internships, graduate fellowships, undergraduate and graduate student programs, endowed professorships, and more.

For information about making a donation to the Department, please contact Kevin Brown, MSU Alumni Foundation, College of Agriculture, Director of Development (406-994-4815 or kbrown@msuaf.org).