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Land Resources and Environmental Sciences
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This Spring issue is dedicated to celebrating our outstanding students, staff, and faculty – all of whom make our programs so successful while preparing our students for their futures as professionals recognized for their expertise across land resources and environmental sciences. I hope you enjoy reading about our students’ many accomplishments as well as the many examples of excellence and classroom engagement in our department.

“Believe there are no limits but the sky”
-Miguel de Cervantes

Students, my warmest regards to each and every one of you; please stay in touch to let us know about the great things you are doing.

-Tracy Sterling, Professor & Department Head, LRES

LRES Recognition

MSU Awards of Excellence

LRES regularly produces a crop of outstanding students, and this year is no exception. Two seniors, **Alexandra Thornton**, Sustainable Foods & Bioenergy Systems major, Agroecology option and **Emma Bode** Environmental Sciences major, Geospatial & Environmental Analysis option were recognized at the 34th Annual Awards for Excellence. Forty MSU students are recognized each year for their 3.5 or greater grade point average, their campus leadership, and their community service. Students select a mentor to be honored with them; Thornton selected Professor **Fabián Menalled**, and Bode selected Assistant Professor **Tony Hartshorn**.



Emma Bode and Tony Hartshorn



Ali Thornton and Fabián Menalled

MSU Excellence in Service Award

The MSU Employee Recognition Awards program was revised to honor those who emulate MSU's pillars of service excellence: Competence, Safety, Reliability, and Courtesy.

Ana Murphy was awarded the Employee of the Year Award for Safety and received a pin and a \$500 gift. As described in the nomination letter, Ana has contributed to our 'safety first' culture by defining and upholding the highest standards of ethical conduct, respecting diversity, practicing confidentiality, alerting supervisors when processes could be improved, and creating a climate of trust so individuals feel safe bringing forward problems or mistakes which need her solutions, as well as clarifying standard operating procedures for tracking millions of dollars of on- and off-campus flows of funding. Ana's respect for our diverse students is also ubiquitous and her attributes also help ensure that students are learning best practices so that reimbursement requests are processed as soon as possible, and out-of-pocket expenses for salary-lean students are quickly covered. Examples of the 30 quotes which supported the department's nomination are in box above and another follows: "Ana is like the lighthouse to the sailors, guiding us LRES students through treacherous waters safely into shore. I would be sunk without her help".

"It is utterly amazing how Ana maintains such a chipper work-day attitude. She's right smack dab in the eye of the hurricane that literally has hundreds of invoices constantly swirling around."

NACTA Awards

The National College of Agriculture (NACTA) Teaching Award of Merit recognizes those individuals whose efforts represent the very best in agricultural higher education and inspire all of us to achieve the higher levels of excellence. The department recognized the following awardees, chosen by the College of Agriculture, at our LRES Graduation Celebration on May 6th.



Tony Hartshorn, Assistant Professor Soil Science, received the NACTA Teaching Award of Merit for his strong commitment to contributing to student success and educational excellence, from teaching myriad students, providing hands-on experiences, modernizing our facilities, pursuing and landing pedagogical research grants, and providing non-stop outreach to excite everyone about soils. He launched his teaching program by offering ENSC 245 (Soils) course with its 250 students from 50 majors in 11 lab sections with fall field trips across the Gallatin Valley and mentoring a stable of undergraduate and graduate students as TAs who guide the enrolled students through their lab and field exercises. Student remarks

include: "Tony was a great teacher and I really appreciate the enthusiasm about soils; the class was very interesting and I learned a ton; he is an awesome professor with an effective and unique approach; another MSU asset! He has inspired me in an incredibly positive way in regards to my college and future career." Additionally, Tony has developed five other courses and regularly takes students to conferences where they can learn from professionals. His enthusiasm is contagious, inspiring all across the University to engage in meaningful student discovery and learning opportunities.



Meryl Storb, LRES Ph.D. candidate, received the NACTA Graduate Student Teaching Award of Merit for her major role in redesigning the labs for our course in Watershed Hydrology. Meryl not only took the role of teaching the labs with enthusiasm, but went far beyond expectations in efforts to develop or polish the lab exercises. Meryl also handled final design of all homework assignments and the subsequent grading associated with lab activity. Student comments praised Meryl's teaching style and availability, as well as the general effectiveness of including hands-on exercises that reinforced the material from lecture. Meryl's patience with the inherent challenges and heuristics of developing a new class were also remarkable. Her major professor Rob Payn says: "Any credit for a successful re-launch of the Watershed Hydrology class at MSU belongs as much to Meryl as it does to me."

LRES Outstanding Senior Awards

Katelyn Noland



Katie embodies multiple core values that we share as a department, as well as providing a compelling example of how our students can apply what they learn in our undergraduate degree programs for the greater good. Katie worked in

the Ewing laboratory on soils analysis for our Judith River Watershed groundwater nitrogen project. She took on laboratory tasks with ease, maintained her outstanding GPA and balanced a heavy course load, and demonstrated strong interest in research. Katie developed strategies for using soils as a metric of landscape process to explore how management of grassland and sagebrush steppe ecosystems can influence climate change resiliency, as mediated by soil hydrology and nutrient dynamics.

As a Montana University System Institute on Ecosystems summer intern, she developed a unique project in collaboration with the Wildlife Conservation Society, which was working with a network of 15 public and private bison and cattle grazing managers in the northern Great Plains on strategies for building ecological resiliency in these ecosystems through sustainable management of bison. Katie's efforts contributed to a manuscript now in review at Rangeland Ecology & Management, and she was chosen as the Montana student representative for the 23rd Annual National Science Foundation EPSCoR Conference in Nashville.

Katie's many accomplishments also include receiving the 2015 Torlief Aasheim Community Involvement Award, MSU Award for Excellence 2015, and the National Udall Undergraduate Scholarship honorable mention recipient for academics and leadership. She also served on the Gallatin-Park County Montana Conservation Voters Board, the MSU Campus Sustainability Advisory Council, the Network of Environmentally Conscious Organizations (NECO), MSU Sustainability Club President, MSU Bike Task Force Student Representative, City of Bozeman Community Alcohol Coalition Advisory Board and a planner and organizer for the Bozeman Climate Alliance events.

She is now working for Bozeman Green Build as photovoltaics system designer, interacting with CEOs and company owners across Montana, as well as using the engineering and math skills acquired for her degree to become proficient in modeling photovoltaic system energy production.

Nominator, Stephanie Ewing

Alexandra Thornton



Without any doubt, Ali is an exceptional undergraduate student with strong research interests in the ecology and management of invasive species. Since August 2013, Ali has been working as a Research Assistant in the MSU

Cropland Weed Ecology and Management Lab. During this period, she has assisted several in research projects including the performance of *Bromus tectorum* under predicted climate scenarios, the role of *Pyrenophora semeniperda* as a *B. tectorum* biocontrol agent, assessing the potential of targeted sheep grazing to manage weeds, and the evaluation of ecological and physiological implications of multiple herbicide resistance.

Reflecting her outstanding research interest and abilities, Ali has received several awards and grants including the 2011 California Scholarship Federation Award, the 2015 and 2016 Montana State University Undergraduate Scholars Program Research Grant, and the 2016 Montana State University Award of Excellence, and has done so while maintaining her outstanding GPA. She designed the proposal "Impact of nitrogen availability and time of inoculation on *Pyrenophora semeniperda* effectiveness as a biocontrol agent of *Bromus tectorum*." with Professor Menalled; for this project she received the 2015 Weed Science Society of America Undergraduate Research Award, one of the most prestigious national awards an undergraduate student could receive.

As a result of her efforts, she has presented the results at three MSU undergraduate research activities and will give an oral presentation at the 2016 Ecological Society of America meeting to be held in Orlando, FL, this coming August, and will help co-author a peer-reviewed publication to be submitted to *Invasive Plant Science and Management*. The Department looks forward to her continued success and working with her as she continues her research in Dr. Menalled's lab.

Nominators, Fabián Menalled & Bruce Maxwell

LRES Outstanding Service Award

Katie Noland

As an environmental scientist, Katie offers a perceptive and articulate view of the world and brings this same energy to bear on her work in our community, actively seeking to make the world a better place. Katie's leadership on sustainability issues – from bikes on campus to global climate change – is a model for all students and represents a lasting contribution to our community. Her involvement included serving on the board of the Gallatin-Park County Montana Conservation Voters Chapter and has repeatedly published on state political and climate issues in the Bozeman Daily Chronicle. Katie's compelling testimony as a fifth generation Montanan with a background in farming and ranching, and as a student of environmental science, was part of an outstanding hearing that motivated passage of the bill to the senate floor, where despite many predictions of failure, it passed. The educational benefits to the fourth graders and the entire cohort involved in the hearing are profound. Throughout her time at MSU, Katie has consistently demonstrated a commitment to environmental sustainability through her employment and volunteer efforts, leadership in student organizations, and active participation in community events, research endeavors and advocacy to the state legislature. Her tireless efforts to use her education for both expanding knowledge and active pursuit of the public good are unquestionably deserving of our recognition and celebration.



Photo Credit: Bozeman Chronicle

Nominator, Stephanie Ewing

Promotion and Tenure

Congratulations to **Stephanie Ewing** and **Paul Stoy** for earning tenure and promotion to Associate Professor. Their achievements were recognized at President Cruzado's Celebratory Dinner receiving a plaque and President Cruzado's gold pin on April 26th. Additionally, **Rob Payn** earned retention. Please take a moment to congratulate our accomplished faculty! Please join us as we continue our tradition of celebrating these milestones together at Colombo's on May 10th at 5pm.



Further Recognition



cover of *Journal of Insect Science*.



Bob Peterson received the Excellence in Online Teaching Award,

honoring faculty who have made significant contributions to inspirational online teaching.



Melody Schimpf completed the Financial Development certificate, which is a series of 11 courses that are 2 hours long each. Congratulations Melody!



Paul Stoy received the prestigious NSF CAREER award, "The role of ecosystem management on boundary layer development and precipitation in the Northern Plains", to study biometeorology in agricultural areas of Montana and the Dakotas. Paul will also be continuing his Alexander von Humboldt Fellowship entitled "Mecha-

nisms of water transport between Earth's surface and the atmosphere: underlying changes in evaporation and transpiration at the plot scale: a data-intensive approach" at the Max Planck Institute of Biogeochemistry in Jena, Germany this Summer.

Mikindra Morin, an LRES M.S. graduate student, is now the Project WET USA assistant. She's working with

the senior USA program manager and Project WET partners across the US to strengthen water education.

Shavonn Whiten, (LRES Alum, M.S. 2014) has been selected to participate in the 2016 Graduate Summer Opportunity to Advance Research (GSOAR) Program at the National Institutes of Health. Congratulations Shavonn!



Tracy Sterling received the Women's Faculty Caucus Distinguished Mentor Award. This award recognizes her extraordinary efforts in mentoring faculty at MSU.



Bill Inskeep worked with other MSU faculty to bring in the Keck Award (\$1M) which will expand the study of Yellowstone microbes.



Dr. Jerry Nielsen shared his legacy and naming of Scobey as State Soil. Find the video here <https://www.youtube.com/watch?v=faCwC7e9Imw>



Jeff Littlefield received recognition from Governor Steve Bullock for helping develop Montana Forest Pest study manual.



Scott Powell weighed in on the use of drones in agriculture in an article in *Signature Montana*. Powell says, "I see them becoming a tool that will be widely used in agriculture in the next five years."

Scott was selected as a faculty fellow for the Center for Faculty Excellence. In this capacity, he attended the Online Learning Consortium Conference in New Orleans.



William Kleindl started an LRES postdoctoral position in January on a project awarded to Paul Stoy by the National Science Foundation to integrate forest management practices in Earth system models.



Tobias Gerken started a postdoctoral position in January to continue his work on the U.S. Department of Energy funded 'GoAmazon' project to quantify the role of plant volatile emissions on precipitation events in the Amazon. He recently published a manuscript describing the importance of stratospheric ozone delivered by storms to atmospheric chemistry near the surface



with **Amy Trowbridge** and other investigators in the U.S. and Brazil. Tobias will also contribute to Montana Wheat and Barley Committee and Hatch Multistate projects on modeling surface-atmosphere exchange and atmospheric boundary layer dynamics of different cropping systems in MT.

TEAM LRES recognized for Excellence in Service & MSU Employee of the year--**Merry Pacey** won in 2011, **Melody Schimpf** won in 2014, **Linda McDonald** won for Courtesy in 2015, and **Ana Murphy** won this Spring for Safety. Congrats to you all and go Team LRES!



Clain Jones received the Great Plains Soil Fertility Leadership Award. Clain was nominated by fellow faculty member **Rick Engel**.



Joe Holbrook has recently joined the Spatial Sciences Center as a post-

doctoral researcher studying endangered Canada lynx habitat, joining the team with Rick Lawrence, Shannon Savage, and John Squires at the Forest Service Rocky Mountain Research Station. Joe comes to us from the University of Idaho, where he was an NSF-IGERT Fellow.



Tony Hartshorn won The Native American Retention and Recruitment grant (NARR) from the Office of the Provost for his project "Mind the gap: re-alignment of school land for underserved students"



Mathew Bain, Environmental Science-Soil & Water option, was recognized as Udall Scholarship Honorable Mention at President Cruzado's Scholarship Reception on May 4th. Congratulations Mathew!



Cathy Zabinski presented her work, "Roots and Microbes: The world beneath our feet" in the Provost's Distinguished Lecturer Series in April.



Emma Bode (Environmental Science Major, Geospatial & Environmental Analysis option) won the 2015 Science as Art Contest with her image of an Aspen tree created by classifying and editing the Gallatin County soils GIS data in ArcMap. It is displayed in the Dean's office.

We'd love to hear from you!

To share your research and/or professional accomplishments in an upcoming newsletter, please contact:

-**Tracy Sterling**, Department Head, tracy.sterling@montana.edu

-**Jessie Sheperd**, Administrative Associate, lresfrontdesk@montana.edu

Jeff Patriarche Reflects on his Antarctic Experience

Fall semester 2015 I traveled to Victoria Land, Antarctica, where I spent nearly 3 months working and living in the coldest and driest desert on our planet. As a graduate student in the Land Resources and Environmental Sciences Department, I was fortunate to be offered this incredible opportunity. This was an adventure of firsts. I experienced so many new things on this trip I felt compelled to share a few.

The first time I ever drove a vehicle on the opposite side of the road (legally) was touring the south island of New Zealand with fellow LRES grad student Madie Willis, prior to our deployment to Antarctica. It didn't take long for steering from the 'passenger seat' and driving on the left side of the road to feel natural, however, I don't think we ever used the turn signal without accidentally turning on the windshield wipers first.

From New Zealand we travelled to McMurdo Station located on Ross Island. McMurdo is the primary US research base in Antarctica, and with a population of about 1000 people; it is the largest 'city' on the continent. Positioned at 77° S latitude during the southern hemisphere's summer, I didn't see the sun set until I left the continent in early January. This was my first experience with 24 hours of daylight, but it felt natural fairly quickly. Time becomes irrelevant when the sun doesn't set. For example, hiking back to camp at 1 am from the summit of Holiday Peak felt like a pleasant evening stroll. On sampling days, crawling out of my tent at 3:30 a.m. (to ensure time for coffee) didn't seem any more difficult than normal because the sun was already waiting for us.



Jeff Patriarche, Amy Chiuchiolo, & Madie Willis on summit of Mt. Voslips. The Taylor Valley to the right.

The first time I spent each night in a tent for nearly a month straight was during our first trip to the Dry Valleys. The constant sunlight would 'warm' our tents, but sub-zero temps and strong katabatic winds kept things interesting.

A few mornings I woke up with frost on my sleeping bag and a few nights I thought my tent (and I) was going to blow away. Most nights I was so exhausted that the cold, the wind, and constant sunlight were afterthoughts to getting a good night's sleep.

Helicopters moved us long distances from McMurdo to the Dry Valleys and between camps. Riding in a helicopter felt more like riding on a dragonfly than flying in a plane. I had never even stood next to helicopter before traveling to Antarctica. By the time I left, loading and unloading hundreds of pounds of gear and boarding helicopters while the rotors were spinning seemed commonplace.

I have never drilled a hole for ice-fishing, but I now feel pretty confident that I could get the job done. We used Jiffy drills to gain access to the lake water trapped an average of 4m below the permanent ice cover of each lake. Hidden layers of ancient sediment and pockets of slush complicated this otherwise simple process. Not only was it the layers within, but the ice surface itself added its own complications. Wind erosion and sublimation have left the lake surfaces scoured and warped, looking like something from another planet. Sci-fi movie sets would be put to shame if compared to the surface of Lake Miers or Lake Hoare.

It just seemed like everything in Antarctica was more difficult. Prior to my trip to Antarctica I had never done lab work in the dark. When filtering lake water samples to obtain a measurement of the light-sensitive chlorophyll contained within the photosynthetic microorganisms living in these isolated lakes, it was necessary to shield them from light exposure. For us, this meant spending long hours in a 'dark lab' pushing our low-light vision to its max. I have enough trouble remaining meticulous and organized when the lights are on.

Traveling to Antarctica truly was a life changing experience. It's an event that alters the way you look at yourself and the way you approach challenges. Something that divides your life into a before and after: the way things were before Antarctica, to the way things are now. This is a trip my adviser, Dr. John Priscu, has been making for 30 years, and my friend, super-tech, and fearless leader while in Antarctica, Amy Chiuchiolo, has been making for 12. The amount of physical effort and logistical planning that goes into accomplishing all that we did, simply put - is astonishing. This was a journey of firsts, many more than I could list here, and I certainly hope it's not my last trip to 'The Ice.'

Jeff Patriarche, LRES Grad Student

GSO Activity: 6th Annual LRES Research Colloquium

On April 26, 2016, the LRES Graduate Student Organization (GSO) hosted a successful 6th Annual LRES Research Colloquium. This is the key LRES function that provides students, staff, and faculty members a snapshot of the impressive diversity of research being conducted within the department.

The event offered 23 students the opportunity to present their research (9 posters and 14 oral presentations) and socialize with good food and drinks in a professional meeting atmosphere. The colloquium began with a poster session followed by oral presentations and finished with a thought-provoking keynote talk by MSU Philosophy professor, Dr. Prasanta Bandyopadhyay. In the context of Stephen Hawking's quote "Philosophy is dead", Dr. Bandyopadhyay discussed philosophy and philosophy of science and gave his perspective on Hawking's famous/infamous comment.

Also, the raffling off of an array of great door prizes generously provided by local businesses added a fun element to the afternoon. Besides the oral presentation competition, we also had a poster competition this year. Poster judges were Drs. Andrew Hansen and Wyatt Cross from Ecology Department and oral presentation judges were Drs. Matt Lavin, Alan Dyer and Ryan Thum from Plant Sciences and Plant Pathology Department and Laura Burkle from Ecology Department. Many thanks to the judges who kindly donated their valuable time to the LRES Colloquium.

One more addition this year was cool LRES T-shirts! With some help from Jeff Patriarche, Tessa Scott designed the shirts. The GSO planning committee, judges, and colloquium participants each received a shirt for making the event a success. Several shirts were also given away as door prizes.

Although all presenters were very competitive and it was difficult to decide the winners, Dayane Reis, Adam Sigler, and Ali Thornton won an iPad mini, a 2-person tent, and a Fitbit for their first, second, and third place awards, respectively. Similarly, Isaac Stafstrom and Ali Thornton won a 1TB external hard drive and a portable speaker as first and second place prizes, respectively. Congratulations to those winners and many thanks to all oral and poster presenters! All presenters did a great job!

The LRES Department and the Office of Activities and Engagement are very much appreciated for generously funding this great event. Many thanks to the GSO planning committee for their tireless hard work to make the 6th Annual LRES Research Colloquium a huge success!



Keynote speaker: Dr. Prasanta Bandyopadhyay; MSU Philosophy Professor

GSO Leadership:

Subodh Adhikari, Christopher Brown, Jeff Patriarche, Collin Preftakes, Nar Ranabhat, Tessa Scott



Winners recognized for 5-minute oral presentations: Left to right Ali Thornton (3rd), Adam Sigler (2nd), Dayane Reis (1st)

Organizers & Presenters



Dorj Sukhragchaa presenting

Mine Design, Operations, & Closure Conference

For more than 20 years, the Montana Department of Environmental Quality's Hard Rock Mining Bureau has organized a Mine Design, Operations, and Closure Conference, held every May at Fairmont Hot Springs. This year, for the first time, students in Tony Hartshorn's ENSC460 (Soil Remediation) course received departmental support to attend both a full day pre-conference workshop as well as the 2.5 day conference.

In order to help maximize student readiness for this conference (also known as reducing 'novelty space'), Hartshorn required all attending students to attend the full-day fieldtrip to the Deer Lodge Valley as well as complete research projects. Consistent with course themes, student projects tackled soil remediation across a wide range of contexts, from erosion control on a reclaimed bentonite mine near Cody, to post-fire erosion control, to creek E. coli control in Bozeman, to radioactive soil remediation at the Old Glory Mine, to mercury control along Fred Burr Creek, to the proposed Black Butte copper project, to method development for using worms as Pb-sensitive bioindicators, to long-term prospects for a silver Superfund site.

Tony Hartshorn, Assistant Professor, Soil Science



Ken Brockman, US Bureau of Reclamation, explaining the nuances of soil remediation on Stucky Ridge to ENSC460 students in the shadow of the Anaconda smelter (background), April 2016.



↑ Student presentations ENSC460 April 2016



MSU delegation visits CATIE in Costa Rica



Viewing sustainable foods program's produce

L to R: David, Annie, Charles, Valerie, President Cruzado

In late March, an Montana State University delegation (PSPP: Mike Ivie and his wife LaDonna, Chemistry: Valérie Copié; LRES: Tony Hartshorn; Office of International Programs: David DiMaria; College of Agriculture: VP & Dean Charlie Boyer and his wife Annie Telloian; President Waded Cruzado) traveled to the Center for Tropical Agriculture (CATIE) in Costa Rica to explore pathways toward a joint PhD program. Highlights included visiting CATIE's heirloom, living coffee collection; everyone tasting the sweet pulp that surrounds every cacao bean, from which all chocolate on the planet ultimately flows; and excellent discussions related to life cycle analyses of rangeland management practices as well as efforts to build pest-resistant varieties of coffee.

Tony Hartshorn, Assistant Professor, Soil Science

Mangold chosen as LEAD21 representative

LEAD21 provides leadership and professional development training for faculty and professionals within the land-grant university system with a focus on colleges of agricultural, environmental, and human sciences. The program lasts approximately nine months and consists of three, week-long sessions that occur at different locations throughout the U.S. Since LEAD21's inception 11 years ago, MSU College of Agriculture has selected two people to attend through a nomination and application process. I was lucky enough to be chosen to attend in 2015-2016 along with Matt Rognlie from MSU and about 85 participants from other land-grant universities throughout the country.

Our first session was held in Minneapolis, MN, in June 2015, and it was "all about me!" Through a series of on-line assessments that I took leading up to the session, I learned about my strengths and weaknesses concerning personality, emotional intelligence, change preferences, and conflict resolution. One of the more interesting exercises was a 360 evaluation in which I received input from supervisors, peers, direct reports, graduate students, and stakeholders. I left the session with a personal development plan to work on over the course of the program.

The second LEAD21 session was held in Kansas City, KS, during October. This session focused on team dynamics. We worked through team exercises in groups of 5-10 people, including an on-line simulation of a climb to Mount Everest! My team didn't make it to the top but we also didn't lose anyone! One very useful exercise for me was describing and then receiving feedback from other participants on a leadership dilemma I was facing in my job.

The final LEAD21 session occurred in February 2016 in Washington, D.C. The final session centered on understanding organizations, building collaborations, and leading change. Similar to the second session, we worked

through simulations in small teams and held stimulating and thought-provoking conversations about strengths and weaknesses in land-grant universities and how we might rise to meet challenges in the 21st century. This was my first visit to Washington, D.C., and I was moved by the beautiful memorials, monuments, the Capitol, and other architecture.

Throughout the sessions, each participant was part of a three to four-person, peer-coaching group. This small group became a sounding block for the duration of the program, not only for the in-person sessions but also through conference calls held in-between sessions.

LEAD21 is a commitment of time and energy, but for me it has been one of the best investments I've ever made on a professional level. Many thanks to the Department of Land Resources and Environmental Sciences and the College of Agriculture for giving me the opportunity to attend!

Jane Mangold

Assoc. Professor & Extension Specialist, Rangeland Ecology



Before Obama and the Rolling Stones, LRES landed in Cuba



Just a few weeks before Obama and the Rolling Stones visited Cuba, I was invited to join President Cruzado to participate at the 10th International Congress of Higher Education, Universidad 2016, held between February 15-19 in Havana, Cuba. For me, this was an incredible opportunity not just to visit the Habana Vieja, stroll along the Malecón in a '55 Chevy convertible, and be amazed by the Cuban musicians; but to talk with Cuban colleagues, visit research and teaching institutions, and learn how science and technology is being done in other places. Ultimately, the goal of this trip was to start collaborative teaching and research interactions between MSU and Universities across Cuba.

During my trip, I had the opportunity to visit the National Center of Agricultural Health (Centro Nacional de Sanidad Agropecuaria, CENSA), the National Institute of Agricultural Science (Instituto Nacional de Ciencias Agrícolas, INCA), and the Centre for Genetic Engineering and Biotechnology (Centro de Ingeniería Genética

y Biotecnología). Perhaps because USA scientists and researchers are still a rare commodity in Cuba, I was even interviewed by the National Cuban TV!

Currently, there is only one Cuban undergraduate student at MSU. Hopefully, the connections and experiences gained throughout this trip will help bridge the gap between MSU and Universities and research institutions in Cuba. There are myriad teaching and research opportunities available and I am looking forward to continuing this dialogue.

Fabián Menalled, Professor and Extension Specialist, Weed Ecology

ENSC 460 Spring Field Trip



On a recent crystal-clear Saturday morning in April in the parking lot just north of Linfield Hall, senior Paul Rychener (Land Rehabilitation) turned the key in the minivan. Nothing happened. It was an inauspicious start for the ENSC 460, *Soil Remediation*, fieldtrip to Opportunity, Montana. Luckily, his classmate senior Drew Fuchs (Earth Sciences) rummaged through his trunk, pulled out jumper cables, and minutes later, the caravan of four vehicles was headed west on the interstate. About 2 hours later, our crew of ~20 students pulled through a gate about 1 mile east of the towering Anaconda smelter and was met by Ken Brockman, Bureau of Reclamation, his wife Cathy and their dog Burley. We spent the next 5 hours touring the ~5-square mile complex that is technically referred to as BP-Arco Waste Repository (http://www.buttectec.org/?page_id=101). Also known as Opportunity Ponds, this landscape geochemical/geoengineering experiment averages 20 feet of smelter tailings, the fine-textured, bright-orange, sometimes still-metal-rich material left over after copper extraction. In some areas, up to 80 feet of tailings await remediation or re-processing; in other areas, tailings have been capped with sediments excavated from behind the Milltown Dam about 10 years ago, and then recapped with uncontaminated cover soil. These are some of the legacies of what was once the largest copper smelting operation in the world;

today, this area ranks as a "Hellafund" site--comprised of four distinct Superfund "operable units" (http://www.buttectec.org/?page_id=95). Tour highlights included a backhoe pit in a northern D cell, details on the largest constructed wetland(s) in Montana (created during presumably permanent "borrow" operations), and a Stucky Ridge reclamation review. Our fieldtrip concluded in the town of Opportunity, just north of the Beaver Dam Park established in 2012 (http://mtstandard.com/news/local/beaver-dam-park-in-opportunity-officially-dedicated/article_b4839604-85e7-11e1-bf2c-0019bb2963f4.html), where Mill Creek has exposed some of the same bright-orange smelter tailings just inches below the soil surface.

Tony Hartshorn, Assistant Professor, Soil Science



Montana Noxious Weed Realtor Training

The *Montana Noxious Weed Education Campaign*, a multi-agency cooperative effort that is housed within the Department of Land Resources and Environmental Sciences at Montana State University, has a new on-line training course for realtors. Noxious weeds can impair wildlife habitat, increase erosion, impact hydrologic cycles, reduce productivity on farms and ranches, and decrease property values.

This course is intended to provide realtors with a broad understanding of noxious weeds and consists of five modules: “Noxious Weeds 101,” “Plant Anatomy and Identification,” “Noxious Weed Identification,” “Understanding Montana County Noxious Weed Control Act,” and “Integrated Weed Management.” While the course will not transform realtors into noxious weed experts, it will provide them with the basics so they can in turn direct buyers and sellers to tools and resources for appropriately managing noxious weeds and encouraging desired vegetation that meets land use objectives.

The course is certified through the Association for Real Estate License Law Officials and the Montana Board of Realty Regulation, and it is approved for four continuing education credits in the Environmental Issues category. The course went live on February 1, and so far 50 realtors

have enrolled in the course. Comments from realtors who have completed the course have been positive, for example, “Once I got started I didn’t want to stop!”, “Would love to see more of the same in the future if possible”, and “Best training I have taken on-line in a long time.”

The *Montana Noxious Weed Education Campaign* is a cooperative effort among state and federal entities and non-governmental organizations that educates the people of Montana about noxious weeds and encourages them to participate in integrated weed management. www.weedawareness.org

If you would like to learn more about the course, please contact Shantell Frame-Martin at shantell.frame@montana.edu (406-444-9491) or Jane Mangold at jane.mangold@montana.edu (406-994-5513).



Environmental Analysis Laboratory News

What happens when rocks and water meet? Erika Sturn would like to answer this question in our own backyard: Hyalite Canyon and the Gallatin Valley.

“It’s an encounter that can be quite exciting because it blends my geological background with some fresh perspectives that I might not have considered before,” Sturn mused, as she prepared soil samples for analysis in the Environmental Analysis Lab. Sturn arrived on campus in fall 2015 after starting in 2014 as an online MS student in LRES, advised by Dr. Scott Powell. She found the in-person experience exciting enough to stay on through completion of her degree in December 2016, joining the EAL as a Graduate Research Associate mentored by Dr. Stephanie Ewing for an ambitious professional paper project.



Originally from Billings, Sturn completed her undergraduate degree in geology at Rocky Mountain College in 2012 and has diverse work experience including a rumored episode as a gemologist. “While taking Isotope Biogeochemistry with me in fall 2015, Erika set an audacious goal for herself,” said Dr. Ewing. “She is looking to measure strontium isotopes in longitudinal low-flow samples from Hyalite Creek. I think it was her project on weathering for Paul Stoy’s class that got her fired up.”

Working with Dr. Ewing, Dr. Jane Klassen, and Dr. Robert Payn, Sturn has started with elemental analysis of Hyalite samples, and the results for ratios of calcium to strontium – an indicator of secondary precipitation of carbonate minerals in limestones and semi-arid soils – are promising. Sturn presented these results to the LRES seminar class this month, and will continue to hone her analytical skills in order to work on samples at the USGS in Denver later in the year.

Stephanie Ewing, Associate Professor, Soil Science

Agroecology and Environmental Science in Rural Morocco

From March 9th until March 22th, 2016, two students and I traveled to the village of Zawiya Ahansal in High Atlas Mountains of Morocco as part of a community engagement project. We worked on a number of ongoing projects associated with the Atlas Cultural Foundation, a Livingston based non-profit. The projects were directly involved with agriculture and environmental science. We helped plan, prepare and plant parts of a large community garden, including legumes. We spent time talking with farmers, observing and surveying farmers about inputs and pests, and toured a number of local markets. We planted a native giant reed (*Arundo donax*) in the bioswale for a laundry wash station that MSU architecture students designed and built with local craftsmen. We also gave guest lectures to local sixth graders on soil, climate, and plant biology; and MSU undergraduates recorded vegetation diversity along elevation gradients. The students presented their work to SFBS 146 and as a poster at the LRES research colloquium.

Tim Seipel, LRES Instructor & Post doctoral Researcher



Drew McGregor recording local vegetable diversity at the Monday market.



*Agroecology major Kendall Franks in an old growth, *Juniperus thurifera*.*



Wool drying after dyeing in the village of Taghia Morocco.

LRES visits Bohart Ranch



The first annual LRES Bohart Ranch Day Social (Monday, Jan. 18) was well attended this year with almost 30 faculty and students showing up for a fun-filled day. The morning was spent cross-country skiing or snowshoeing on the trails above Jane's Gate. A number of students partook in the "where's Waldo scavenger hunt" led by Jeff Littlefield and no one got lost (at least that we know of). Lunch from Frank's Gourmet Deli was then served at the Warming Hut at the upper end of the meadow with prizes for the most successful Waldo hunters. My only disappointment, and it was minor, was the snow. There was actually too much fresh powder on the



trails. Unfortunately due to the ski race the Bohart groom crew could not get out to repack the trails. Let's look forward to making this an annual event. We are fortunate to have such a beautiful facility so close to town.

Rick Engel, Professor, Soil Science



STEM Learning in Browning, MT with Tony Hartshorn

Since Fall 2015, Tony Hartshorn, along with colleagues from the Department of Education (Nick Lux) and Extended University (Jamie Cornish), have been traveling to Browning, Montana where they have been working on establishing partnerships with K-8 schools, the high school, an alternative high school (Project Choices), and the Blackfeet Community College to promote informal STEM learning with pilot funding from the National Science Foundation. These partnerships led to an incredibly successful community STEM night held January 27 at the Browning High School. The “menu” of hands-on activities--from make-your-own shrinky dinks, to carbon-dioxide-filled balloons, to a portable “Yellowstone Hot Springs” display with different pH and temperature ‘hot springs’, to free robot-testing, to an ultra-high-resolution thermal camera, to build-your-own lava lamps--attracted at least 180 community members based on the door prize sign-up list.



Payn receives Faculty Seed Grant

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

The Montana State Water Plan recommends strategies that improve “natural water storage”, particularly in riparian and floodplain areas near streams. Beaver-mimicry restoration (BMR) seeks to simulate the natural effects of beaver activity in streams, and has become a popular approach to hydrologic reconnection of stream channels to floodplain and riparian systems. Proponents of BMR and authors of the State Water Plan suggest that restoration of incised streams will improve stream and riparian habitat, improve water quality (e.g., reduce excess sediment and nutrient loads), reduce stream temperatures in the summer, and improve natural seasonal storage in wetlands and local alluvial aquifers. The influences of BMR on biological aspects of ecosystem recovery have been well documented. However, the effects of BMR on natural water storage have yet to be tested directly, and the specific hydrologic mechanisms that would promote higher and cooler late summer flows remain poorly understood.



Rob Payn and **Andy Bobst** (LRES Ph.D. student) in the Montana State Watershed Hydrology Lab are partnering with The Nature Conservancy to build a program using existing and planned BMR activities in the Upper Missouri region as manipulative experiments toward a better understanding of the hydrologic consequences of stream restoration. Our objective is to couple field experiments with simulation modeling exercises to provide a scientific basis for the potential to increase natural water storage from BMR activity, and to discern the hydrologic mechanisms by which various time scales of natural storage may be created or enhanced.

Our strategy for initiating a program of hydrologic research integrated with BMR management is to design experiments around active construction that is taking place over the next two years. We will establish a template for experimental design and an equipment package that can be quickly deployed for pre-restoration data when the details of new BMR projects are decided. Project work over the next two years will investigate how BMR influences surface-subsurface hydrologic interactions by using replicated experimental before-after-control-impact design. Field research will be supplemented with sensitivity analysis of modeled surface-subsurface interactions, including assessment of the potential for increased evapotranspiration in the annual water budget. Monitoring will be conducted at two locations in the headwaters of the Jefferson River, where The Nature Conservancy is actively implementing BMR.

Rob Payn, Assistant Professor, Watershed Hydrology

Bachelor's Degrees Awarded Spring 2016

Environmental Sciences - Environmental Biology

*Torrin Daniels
Veronica Huertas*

Environmental Sciences - Soil & Water Science

*Abigayle Cutting-Smith
Christopher Kubicki, with Honors*

Geospatial & Environmental Analysis

Wyatt Anthony

Land Rehabilitation

Kaylee Schmitz, with Honors

Sustainable Foods & Bioenergy Systems-Agroecology

*Sebastiaan Stokhof de Jong
Elizabeth Svisco, with Honors
Alexandra Thornton*

Master's Degrees Awarded Spring 2016

Master of Science

Land Resources & Environmental Sciences

*Charles Holt
Megan Housman
Priyanka Kudalkar*

Entomology

Charles Hubbard

Online Master of Science

Land Resources & Environmental Sciences

*David Atkinson
Shannon Crossen
Rebecca Hollender
Amanda Macpherson
Rory McPherson
Robert Wyatt*

Doctor of Philosophy

Ecology & Environmental Sciences

*Alexander Michaud
Pamela Santibáñez Avila
Heidi Smith
Kimberly Taylor
Trista Vick-Majors*

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 professionals, and more. For information about making a donation to the Department, please contact Kevin Brown, MSU Alumni Foundation, College of Agriculture, Director of Development (406.994.4851 or kbrown@montana.edu).

