

Plant Science Says



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The Department of Plant Sciences and Plant Pathology

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Flenniken Lab Presents at the American Bee Research Conference **By Michelle Flenniken**

Michelle Flenniken and Laura Brutscher, Microbiology and Immunology PhD candidate in the Flenniken lab, presented their research at the American Bee Research Conference (ABRC). The Conference was hosted by the American Association of Professional Apiculturists (AAPA) in Ponte Vedra, Florida, from January 6-9 and bee researchers from the U.S., Canada, and Great Britain attended the conference. ABRC was held in conjunction with the 2016 American Beekeeping Federation Annual Conference and Tradeshow, a larger event attended by beekeepers, salespeople and others involved in the beekeeping industry.

Michelle presented results on the relationship between honey bee colony health and pathogen incidence and abundance (recently published in the journal *Apidologie*). Laura presented on her research investigating the transcriptional responses of virus-infected bees (manuscript in preparation). The keynote speaker was Dr. Geraldine Wright from the Institute of Neuroscience, Newcastle University. Dr. Wright presented data that demonstrated that both bumble bees (*Bombus terrestris*) and honey bees (*Apis mellifera*) prefer to feed from sugar water spiked with neonicotinoid insecticide versus sugar water alone (published in *Nature*, 2015). Dr. Steve Pernal from Beaverlodge Research Farm, Beaverlodge, Alberta presented on the results of an extensive temporal study on colony health located in three distinct geographical locations in Canada throughout a year. He found that Fumagillin®, a fungicide originally

used to treat *Nosema apis* infections in hives, was effective in treating *Nosema ceranae*, which is currently the most prevalent species in North America. Dr. Hongmei Li-Byarlay, from North Carolina State University, discussed her work investigating the effect of long-distance transportation on honey bee health. She found that "migration" of hives reduces individual bee life span and increases oxidative stress. Thirteen graduate students participated in the student presentation competition and Laura won first place. It was an interesting and enjoyable meeting and we look forward to the next American Bee Research Conference.

Bug Buffet 2016 Hosts 747 Guests **By Florence Dunkel**

The numbers were great, but so were the tastes, textures, and serious conversations on Friday, February 26, in the Student Union Building on the MSU campus. Before the public streamed into the lounge, 60 four- and five-year olds arrived for a special seating at 11 a.m. with their



Dunkel welcomes University preschoolers and their teachers with edible insect facts.

teachers and a few parents. This may have been the most important moment of the week.

Dr. Florence Dunkel asked the preschoolers, "It takes less than a gallon of water to raise a pound of crickets. How much water do you think it takes to raise a pound of beef steak?" One child's answer was "One thousand." She had the right order of magnitude! The answer is 5,800 gallons of water. Exit polls after the pre-school buffet included a 4-year old sharing, "I have never liked to touch insects, but I like to eat them!"

As of last year, The Bug Buffet is now a week-long series of events and workshops. This year, the International Street Food Bazaar opened the week with an Edible Insect booth sponsored by the MSU Family and Consumer Science Student Association advised by Dr. Holly Hunts, students of BIOO 162CS taught by Dunkel, and the MSU University Food Service. Bridger bars were the new product, invented by Toots Taszut, MSU food safety officer, Donna Jackson, MSU catering chef, and their MSU University Food Service team.

Bridger bars were just the outstanding beginning of a creative overflow from MSU Catering and everything was beautifully displayed by Amber Wivholm. It was difficult to choose a favorite among the seven offerings:



Orzo cricket salad created by MSU catering chef, Donna Jackson was informal exit poll favorite new item.

Galleria (wax moth larvae) cocktail; Galleria quesadilla; herb Montana chevre with sweet and salty Galleria; orzo cricket salad; larval latkes with lemon sour cream and Galleria; white chocolate chip Galleria cookies; and mango cricket shakes. Exit polls named the orzo salad most often as a favorite.

Ian Toews, from Victoria, British Columbia, producer of the first documentary in North America featuring edible insects, was the guest film producer-in-residence for the week. He began the week with a series of workshops and a sneak peek, the first in the U.S., of *Bugs on the Menu*, the 80-minute documentary soon to be on venues such as Netflix and public TV. By the end of the week, Toews had held seven workshops where he interacted with hundreds of MSU students in the School of Film and Photography, Department of Health and Human Development, and in University Core courses taught by Dunkel in Biology (BIOO 162CS) and Agriculture (AGSC 465R).

We learned from Toews how to normalize edible insects for the Euro-American palate. We shared figures of the environmental footprint of over 2000 species of food insects versus the several species of vertebrates that became major sources of protein for Europeans and Euro-Americans. We pondered gratefully the traditional ecological



Cricket powder produced by Aspire, Texas food cricket farm, makes high protein mango smoothies, the all-time MSU favorite.

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BIOO 162CS student leaders in the Bug Buffet week's activities relax with Dr. Dunkel in the Leigh Lounge after guests depart (from left): Danielle Robleo; Juliana Santos Camara; Claire Zahner; Anastascia Pinnoci; Dunkel; Naomi Bottomley; Michael Martinez; and Johnathan Terzi.



Sebastian Stokhof de Jong, PSPP Research Assistant in Dunkel's lab (left), assists BIOO 162CS students, Michael Martinez, Claire Zahner, and Naomi Bottomley with explaining carbon footprint numbers for young visitors at the Bug Buffet.

knowledge that survived to provide this path to our own human survival in the 21st century.

Sponsoring the Buffet, the international Producer-in-Residence, and related activities this year were the College of Agriculture, the College of Health and Human Development, the College of Arts and Architecture, the MSU University Food Service, and the Office of International Programs. Door prizes were provided by

Joe's Parkway and Third Millennium Farms, British Columbia, Canada. Clearly, the sources of support are a statement regarding the integrated importance of edible insects--in environmental and human health, in agriculture production, international food security, and as a subject of film documentaries.

Dr. Florence Dunkel initiated the Bug Buffet 28 years ago with a single item on the menu, Montana grasshoppers, *Melanoplus sanguinipes*, sautéed in butter and served on bread made in the grain lab from Montana hard red wheat. This year, Dunkel chaired the committee that set the agenda for the week. Members of the planning committee were: Associate Provost for International Programs, Dr. David Dimaria; Associate Professor of Family Consumer Science, Dr. Holly Hunts; Program Coordinator for Sustainable Foods and Bio-Energy Systems (SFBS), Anna Dieffenderfer; Manager of the Plant Growth Center, David Baumbauer; Director of the MSU School of Film and Photography, Dr. Dennis Aig; and undergraduate students in SFBS Sebastiaan Stokhof de Jong and Jack Duchin and in Cell Biology and Dr. David Sand's laboratory, Tim Gould. For more information, visit www.foodinsectsnewsletter.org.

Awards for Excellence

The MSU Alumni Association and the Bozeman Area Chamber of Commerce hosted the thirty-fourth annual Awards for Excellence Program on Tuesday, February 16 2016. The evening, dedicated to excellence, is designed to recognize students who have outstanding records of achievement in academics (must have a 3.5 gpa or higher and senior standing), extracurricular activities and service to the University and the Bozeman community. These students are selected by the academic college Deans as the most outstanding in their colleges. Forty of MSU's top seniors were honored this year along with a mentoring faculty person, selected by each student honoree, to also receive an Award for Excellence. The faculty Award for Excellence, in particular, has come to mean a great deal, as it is recognition directly from a student on whom they have had an incredible impact.



In our Department, Cassia Wagner chose Mark Young as her mentoring faculty person. She states, "While working in Mark's lab for the past three years, I learned that a cardinal rule of research is to have fun. That rule well exemplifies why I

chose to honor Mark because a good mentor does far more than simply instruct. Good mentors ignite enthusiasm and feed passion, whether it's sending students to research facilities in Germany or providing support for back country skiing trips. Good mentors challenge their students, whether it's giving them their own virus to study or forcing them to write first author papers. Good mentors take the time, whether it's an hour talking about what to do after college or writing too many recommendation letters on way too short notice. Mark has done all these things and more. Perhaps more importantly, he's given me an example of approaching each challenge with energy, kindness and optimism—a lesson that will stick with me for some time to come."

Mark states, "Cassia is an exceptional person in all ways. She is smart, creative, curious and passionate about life and learning. She has grown into an amazing young scientist that has gone from the discovery of an entirely new virus to an understanding of its molecular structure. It has been an honor to work and laugh with Cassia along the way. She is the kind of student that makes coming to the lab every day a delight."

Congratulations Cassia and Mark!

Montana State Extension IPM Program Retreat Chico Hot Springs By Laurie Kerzicnik

Several PSPP faculty and professional staff went to Chico Hot Springs February 4-5 for a

program update for the Extension IPM program. The attendees from PSPP included Mary Burrows (program leader), Eva Grimme, Laurie Kerzicnik, Toby Day, and Jessica Rupp. Other MSU members of the IPM team that attended were Cecil Tharp, Fabian Menalled, Jane Mangold, and Noelle Orloff. We were fortunate to have two of our stakeholders join, Dan Picard (retired MSU Extension Agent) and Sarah Eilers (Nitro Green). Some of our priority areas for the grant include *IPM Implementation in Agronomic Crops*, *IPM Implementation in Communities*, *IPM Support for Pest Diagnostic Facilities*, and *IPM Education for Pesticide Applicators*. We are in the 2nd year of a 3-yr grant cycle, so we discussed goals for the next cycle. We came up with several outcomes for the program, including more education and outreach to extension agents statewide, training programs for urban-related industries, and more social media-related trainings/education.

Flenniken Presents at the Bee Masters Course in Vancouver, February 2016

Michelle Flenniken was invited to give two seminars/teaching lectures at the Bee Masters course organized by the British Columbia Apiculture Specialist every two years. This course is designed for Advanced



Chihuly Garden and Glass Exhibit in Seattle (near the Space Needle)



See: <http://www.chihulygardenandglass.com/> - Highly recommended - check it out if you are in Seattle.

Beekeepers, who take an exam at the end of the week, so they are extra motivated to learn about bees and bee research. This course also serves as excellent forum for interactions between Canadian and U.S. bee researchers.

New Employees

Myron Bruce (Jessica Rupp)



My name is Myron Bruce and I am a new post doc in Dr. Rupp's lab. I have a microbiology bachelor's degree from Kansas State University and a doctoral degree in plant pathology from Colorado State

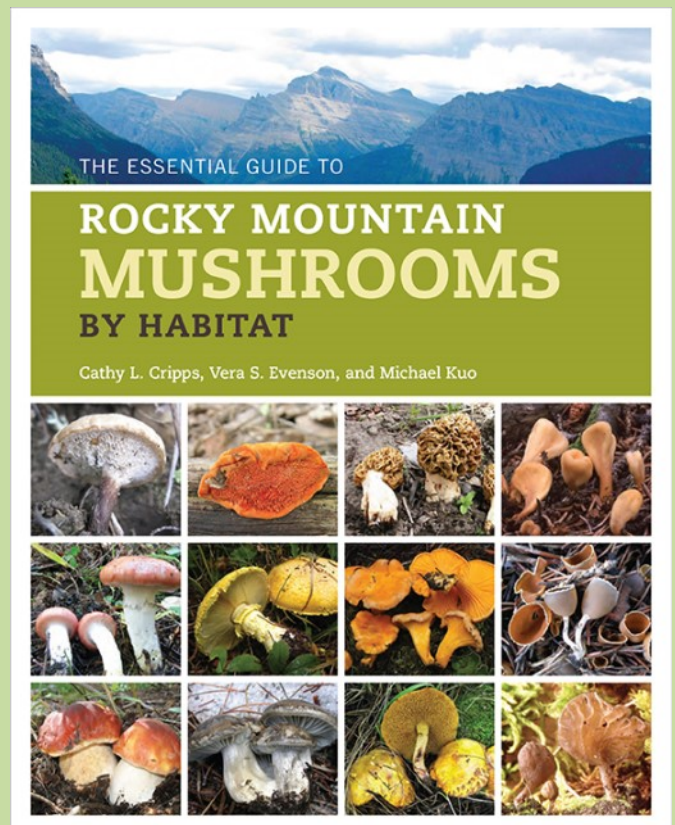
University. A lot of my experience has been in molecular plant-microbe interactions and I look forward to learning field aspects of plant pathology research, while maintaining projects with a molecular component.

Outside of the lab, I enjoy spending time with my dog, fishing, cooking, reading, and watching movies. As a post doc in Dr. Rupp's lab, I will be participating in field research on potato, sugar beet, and pulse pathogens, as well as a precision genome editing project in sugar beet.

The Essential Guide to Rocky Mountain Mushrooms by Habitat

By Cathy Cripps, Vera Evenson, and Michael Kuo

I am happy to present our new book which is a different kind of field guide. We have arranged the mushrooms by habitat zones that include: grasslands, arid-shrublands, cottonwood riparian, aspen forests, all different conifer forest types, burns, snowbank habitat, and the alpine. It is basically a myco-tour of our wonderful Rocky Mountain habitats with a little bit of ecology and mycology thrown in. We describe the flora and fauna (including terrific photos by Andy Hogg) for each zone and talk about how fungi interact with the living world. For edible mushrooms, there are yellow morels and oyster mushrooms that fruit in the cottonwood riparian in spring, king boletes (porcini!) that come up in lodgepole pine forests in the fall, and many more. We also include the unique sets of fungi that come up on 'burns' after forest fires, those that fruit near snowbanks in spring, and special alpine species found above treeline. We hope this book makes mushroom identification accessible to a wider audience of naturalists,



botanists, and forest managers, in addition to amateur mushroomers.

It is available from the publisher University of Illinois Press or from Amazon and will be officially published March 7, 2016.

Montana Ag Live!

The first program this spring will be on Sunday, April 3, and the panel will consist of members from The Montana Wheat and Barley Committee, the Montana Grain Growers Association, and the Montana Stock Growers Association. Discussion will center around "How the activities of these organizations relate to Montana's economy and also to the public's perception of Montana's ag products."

April 10— Heather Rimel, Manager of the Montana Seed Growers Association will discuss "Montana's seed industry and the importance of utilizing quality seed in order to produce superior crops."

April 17 - Monica Ebert, director of Montana's Wool Lab, will inform viewers on "The function of Montana's Wool Lab and its importance to the sheep industry in Montana and the region."

April 24 - Shannon Arnold, Associate Professor in Ag Education will discuss "Educating the Future of Agriculture including such successful programs as using horses to teach life skills to youths and adults."

Course Focus

HORT 336—Landscape Construction

By Jennifer Britton



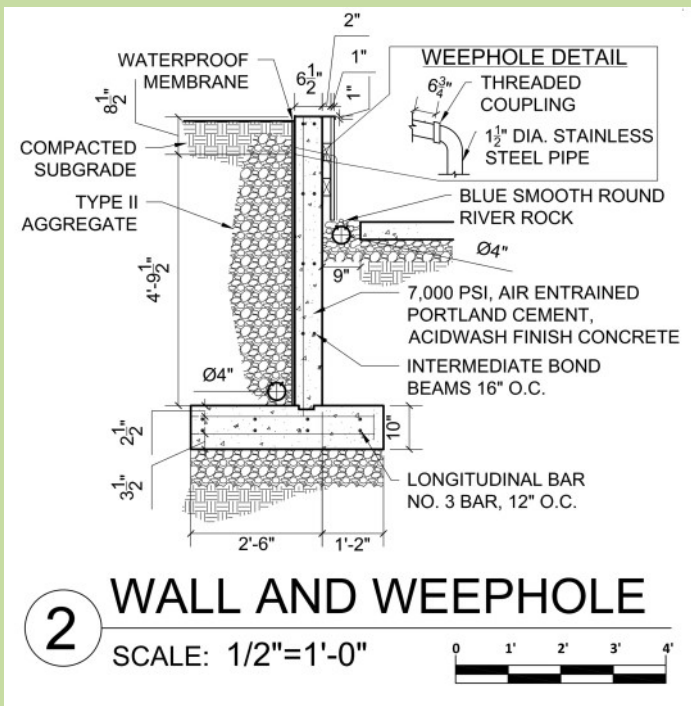
"A rock pile ceases to be a rock pile the moment a single man contemplates it, bearing within him the image of a cathedral."

For students in Environmental Horticulture pursuing the Landscape Design option, HORT 336-

Landscape Construction serves as an introduction to materials and construction methods. So what does this mean you ask? As designers, we communicate with permitting agencies and contractors through drawings: plans, sections, elevations, details. These drawings indicate the thickness of concrete, placement of rebar, deck fasteners, all things functional and aesthetic—basically every built element. We submit these drawings to permitting agencies such as the City of Bozeman where they review for code compliance, public safety, health and welfare. These same drawings, also called contract drawings, are used for bidding and legal accountability. Pretty important stuff when you consider the price tag attached to construction and moreover the cost of correcting mistakes.

To introduce students to landscape construction we meet for studio class twice a week on Tuesday and Thursday from 1:10-4:00. We begin with a basic understanding of construction documentation principles and compound on those little by little to give an overall understanding of the subject. The class curriculum mimics work they will experience in their future careers with studio projects organized around one site design - the grounds of a hypothetical office building. Students are tasked with creating a design required to contain paving, retaining walls, and fence. Each of these components becomes the semester's projects with students completing a coherent set of construction drawings in conformance with industry standards. We investigate structural qualities and limitations of construction materials and students participate in decision-making activities pertaining to their designs. Although we have brief lectures on relevant technical information needed to complete assignments, class time also provides opportunity for critique and feedback. Projects range from 2-5 weeks in duration with pin-up presentations for each project.

To have students experience construction forensics (when things go wrong), we take construction "walkabouts" on campus, where



Drawing by Willy Chandler, Landscape Construction student

students can see relevant construction practices and examine construction failures in -situ. Students also explore alternative building materials and sustainable practices through a materials research.

It is my goal that students leaving HORT 336 will have experience in investigating more than one answer to any construction project and develop extensive understanding into the generation of graphic plans. I hope students will have the ability to realize for themselves how their designs, selection of materials and installation methods effect people, environment and place.

Grants

David Sands, The Seed Sentinel: Indicator Plants to diagnose on farm soil bioavailable mineral deficiencies and optimize fertilizer use." Fertilizer Advisory Committee and Dean/VP Boyer.

Norm Weeden, "Introgression of the genes in SS-41 into commercial germplasm", Montana Department of Agriculture.

Mary Burrows, "Regional pulse crop diagnostic laboratory", Montana Department of Agriculture.

Invited Talks

Rebekah VanWieren, "The Student Farm Design Project: working landscape representations." MSU, College of Arts & Architecture Research Symposium. February 3, 2016.

Rebekah VanWieren, "Landscape Design for Aligning Cultural and Ecological Assets in Brownfield Reclamation." Montana Tech, Biological Sciences Department, Restoration Seminar Series. February 17, 2016.

Publications

Garg, A., Saify, T., Strobel, G., Kachchhava, H., Rowlands, R.T., Parkkh, N., Patil, B.D., and Srivastava, R. (2015) Activity guided optimization of medium components for enhanced production of vinca alkaloids by endophyte. J. Pure and Applied Microbiol. 9: 1383-1388.

**The Passing of Two Colleagues
By Don Mathre**



Dr. Al Scharen

Our department recently lost two colleagues who had had a long time relationship with us. Al Scharen, research professor emeritus, died on February 9 at his home in Texas. Al was born and raised

in Wyoming, got his B. S. from the University of Wyoming, and his Ph. D. in plant pathology from the University of Nebraska in 1960. He began his career in Beltsville, Maryland where he worked as a Research Plant Pathologist for the USDA-ARS. He transferred to MSU-Bozeman in 1972 and was housed in the new (at that time) Department of Plant Pathology on the 5th floor of Leon Johnson Hall. He was one of the world's authorities on the Septoria diseases of wheat. Even though he was paid by the USDA-ARS, we included him as a "regular" faculty member in the department. When he retired from the USDA, he was employed for several years by MSU to

administer the USDA-AID grant that we had on barley diseases.

After living north of Bozeman in the Bridger Mountains, he and his wife Vicki, built a retirement home in Port Isabel, Texas, where he passed away.



Dr. Gene Ford

The second colleague we lost was Gene Ford who passed away on February 7 in Salt Lake City from a rapidly growing brain tumor. Gene grew up in New Jersey where his family operated a garden nursery. He graduated from Cornell University with a degree in horticulture, and then

got his Ph.D. in plant pathology from UC-Berkeley where he was a student colleague with Dave Sands. His major professor (William Snyder) at Berkeley was the world's authority on the fungus *Fusarium*. Following graduation, Gene went to work for United Brands in Honduras working on *Fusarium* disease of bananas. For reasons unclear to me, he left the field of plant pathology and moved to Alaska where he worked in road construction and later developed a truck garden in Tok. In the mid 1980's he reconnected with Dave Sands and began spending his winters in Bozeman working on a variety of projects in the Sands, Cripps, and Strobel labs. He was an expert in how to culture and identify fungi using classical methods and was willing to share his expertise with students and faculty alike. His most recent project was to isolate the nitrogen-fixing actinomycete *Frankia* in conjunction with Bill Hoch.

Starting Seeds Indoors

By Toby Day, Extension Horticulturist

This week I will be starting my petunias indoors so that I have my own transplants for my garden. If I have the time, I try to grow about 500 starts. I will also start my garden

vegetables indoors in the next few weeks leading up to spring. There are some considerations in growing indoors and I found a short informative factsheet from Colorado State University's *Plantalk* (<http://www.ext.colostate.edu/ptlk/1034.html>) that sums up growing starts indoors:

"Starting seeds indoors is a simple and inexpensive way to enjoy many plant varieties not commonly found in garden centers. Seeds can be started in containers found around the household – plastic trays or cups, egg cartons, and the like – or in seed starting trays or peat pots from the garden center. Regardless of what container is used be sure it has holes for drainage.

A commercially available seed starting mix or fine textured potting mix will provide a sterile, weed-free medium in which to start the seeds. Plant seeds according to package directions. It is generally recommended that most seeds be started four to eight weeks prior to the last killing frost.

After planting the seeds, water them in with a fine mist hand sprayer and cover lightly with a layer of plastic. Until the seeds germinate, keep them in a warm location away from bright sunlight. Most seeds prefer temperatures between 70-75°F to germinate. Seeds in the Solanaceae or nightshade family germinate better if soil temperatures are close to 80°F. As the seedlings emerge, remove the plastic and move the container closer to a bright window or light. For proper growth, seedlings require adequate light. If a bright window location is



unavailable, suspend a fluorescent light fixture three to four inches above the new plants. A combination of one cool white fluorescent tube and one warm white tube will provide the broad spectrum of light needed. For best growth, keep the lights on 12 to 16 hours daily.

After seedlings grow and develop true leaves, fertilize with a quarter-to half-strength water-soluble fertilizer to stimulate healthy, even growth. As soon as the seedlings are large enough to handle, carefully transplant seedlings into their own small pots to provide them room to grow. Take care not to expose seeds and seedlings to cold drafts, or allow them to wilt. Watch for signs of disease. Too much moisture, high temperatures and poor light weaken the plants and make them susceptible to the damping off fungus."

If you are thinking of starting your plants indoors this year, check out all the great fact sheets from University extension sites with a search engine site with the words "starting seeds indoors extension." To schedule the timing to start your transplants, MSU has a great fact sheet called "Can I Grow that Here."

(<http://store.msuextension.org/publications/YardandGarden/MT199308AG.pdf>) This worksheet gives times to start different garden plants given your first and last frost and when they should be put into the garden. You can find first and last frost average dates for your area at <http://www.mtmastergardener.org/climate.html> Starting transplants from your garden. <http://www.lessnoise-moregreen.com/>

Photography Exhibition By Jill Scarson

Beginning February 29th and continuing through March 3rd, my photography exhibition, "Painting with Fire and Ice: The Thermal Features of Yellowstone," will be held at MSU's The Exit Gallery. Yellowstone National Park is known throughout the world for the grandeur and majesty of both its unique wildlife and the sweeping landscapes.

However, most visitors never notice Yellowstone's microscapes, the world in miniature that lies right at their feet. The thermal features not only serve as visible evidence of the hidden volcanic activity that drives the Park's ever changing landscape, but more importantly, they function as an amazing microcosm of Yellowstone through which we can better explore and understand Yellowstone as a whole.

In my work, I focus primarily on natural light and color to emphasize both the texture and intimate details that exist within Yellowstone's thermal features. I strive to make my art reflect the organic forms and brilliant contrasts that I see with my naked eye and to create them in a way that will force the observer to take a more intimate and panoptic view of Yellowstone's world, within and below. With this series, I hope to highlight Yellowstone's microscapes; life on an infinitesimal scale, life that is largely unknown, left unseen and greatly misunderstood.

One of the images (see below) that will be on exhibit has been chosen for publication in a special Yellowstone edition of National Geographic Magazine in May. Please join me for the Artist Reception on Thursday, March 3rd from 5:00 to 6:30 pm at The Exit Gallery in the Strand Union Building. <http://calendar.msu.montana.edu/events/18840>



This Photo by Jill Scarson will be in the May issue of National Geographic.

Recipe of the Month

Lentil/Pea Dal Soup - contributed by Jamin Smitchger

We enjoyed this recently at a Friday coffee - delicious!

1 cup chana dal or yellow split peas
4 cups water
2 Roma tomatoes, quartered



1/4 cup canola oil
1/2 teaspoon cumin seeds
1 teaspoon brown or black mustard seeds (optional)
5 large cloves garlic, sliced
1 medium yellow onion, finely chopped, *and/or* 1 or 2 hot green Thai or Serrano chiles, stemmed and halved lengthwise and 10 fresh or thawed curry leaves, blotted dry with paper towel
3/4 teaspoon ground turmeric
1 teaspoon ground coriander
1/2 to 1 teaspoon ground cayenne (use the maximum if no fresh chiles are used)
1/2 to 3/4 teaspoon salt
1 tablespoon unsalted butter
3 tablespoons chopped cilantro, leafy tops only

Put the dal and water into a 4-quart pot and bring to a boil over high heat. Skim the scum and then add the tomato. Lower the heat to simmer. Cover and cook until the dal is soft and broken up, 40 to 60 minutes. Remove and discard the tomato skin pieces, and then gently whisk to further blend the dal and tomato. The dal will break up a bit.

You can make the dal a day in advance up to this point. Let it cool completely and refrigerate. Return it to room temperature before moving forward. Add a splash of water when bringing it up to a simmer as it's bound to thicken a lot from sitting overnight.

Bring the dal to a simmer and have a lid ready before proceeding. Heat the oil in a medium skillet over medium-high heat until nearly smoking. Add the cumin and mustard seeds and partially cover to shield yourself

from the sizzling drama. Decrease the heat to medium. After the seeds stop sputtering, uncover.

Add the garlic and onion (or the chilies and curry leaves). If you used onion, cook, stirring for a good five minutes, until the onion has turned a dark brown. If you opted for the chilies and curry leaves, you only need to cook them with the garlic for about one minute, or until the chilies and leaves are fragrant and slightly blistered.

Regardless, turn off the heat and stir in turmeric, coriander, and cayenne. Add to the simmering dal. Stir in the salt and butter. Remove from the heat and set aside for 5 minutes to develop the flavor. Taste and add extra salt, as needed. Transfer to a shallow bowl, garnish with cilantro, and enjoy with rice, naan, chapati, or warm whole-wheat tortillas.

See more at: <http://www.vietworldkitchen.com/blog/2011/01/basic-yellow-split-pea-dal-recipe.html#sthash.I1RCAt4A.dpuf>

March Birthdays

Andrea Varella	11
Uta Shuhr	21
Erin Gunnink-Troth	24
Matt Lavin	20
Andreas Fischer	25
Charles Hart	25
Nina Zidack	26

