

Plant Science *Says*



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Ryan Thum Joins Faculty

Dr. Ryan Thum is joining our faculty as an Assistant Professor. He comes to us from Grand Valley State University in Muskegon, Michigan. His appointment is 65% research and 35% teaching and he will start his appointment on August 16, 2014. Among the courses Dr. Thum will be teaching are BIOB 375 - General Genetics and BIOB 420 - Evolution. Further details will follow in the August newsletter.

Lab Focus

The Montana Winter Wheat Breeding Project

By Phil Bruckner



The Montana Winter Wheat Breeding Project is an applied genetics and cultivar development program housed in the PSPP Department. The cultivar development program is a cooperative effort

between Montana Agricultural Experiment Station and the wheat producers of Montana to develop improved cultivars of winter wheat adapted to Montana's climate and cropping systems. The core breeding team which includes Phil Bruckner, Jim Berg and Ron Ramsfield has worked together for nearly 20 years. Currently the project also includes David May, an M.S. graduate student studying root lesion nematodes, and two undergraduate students, Lai Yee Phoon and Connie Miller. Although the research program is primarily field based, a combination of field, greenhouse, and laboratory efforts are necessary for successful cultivar development.

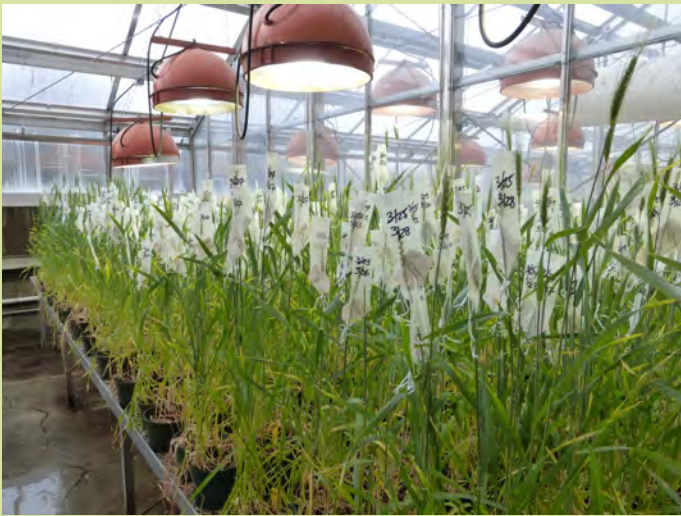
Winter wheat is genetically very similar to spring wheat, differing only by a few genes that control the requirement for vernalization (requirement for cold temperatures to induce flowering) and likely a set of genes that enhance cold tolerance and permit survival over the low temperature winter season.

Planted in September, winter wheat emerges in the fall, ideally with 4 to 6 leaves before the cold arrives. The plant then requires 5 to 6 weeks of consistent cold weather to flower and head. No-till practices have positively impacted winter wheat as the residue-trapped snow offers more insulation and moisture than it did under fallow conditions. The growing cycle is completed in July and August when farmers harvest the wheat – usually earlier than spring wheat. Because it completes its life cycle under more favorable conditions, winter wheat has a higher yield per acre than spring wheat in Montana. Montana grows about 2 to 2.5 million acres of winter wheat each year (40-45% of Montana's wheat crop) averaging about 45 bushels per acre. Most of Montana's wheat crop is exported to Pacific Rim countries for human consumption as bread or noodle products.

Primary breeding objectives include increased yield potential, winter hardiness, wheat stem sawfly resistance, herbicide tolerance (Clearfield), and end-use quality.



Ron Ramsfield, Jim Berg, and student worker, James Loo, harvesting replicated winter wheat plots at the Post Farm.



Shoot bags containing heads of crossed winter seed in the winter 2014 greenhouse cycle. Each bag represents a unique cross.

Secondary objectives include improved agronomic characteristics, adaptation, pest resistances, and stress tolerances that will enhance reliability and productivity of winter wheat production in Montana. Plant breeding is a long-term process requiring up to 12 generations (years) from the initial cross until a new cultivar is identified, tested, and released. In the research program a new cycle is initiated each year by hybridizing superior parents, creating genetic diversity necessary to develop high yielding cultivars. Sequentially across breeding cycles, as the parents improve, so do the progeny. Simultaneously, a breeding cycle that began 12 generations ago is completed each year with the successful release of an improved cultivar or the promise to try to do a better job in the next breeding cycle.

Strategically, selection and testing efforts are conducted in environments representative of Montana's winter wheat production areas. The project uses eight sites in Montana and North Dakota for research and development, and another 10-15 on-farm sites for terminal cultivar performance testing. The Agricultural Research Centers throughout Montana offer different growing conditions and different production hazards. Growing lines under extreme conditions (severe cold, high wheat stem sawfly, severe stripe rust) help identify elite lines with necessary or exceptional phenotypic traits. The Post Farm in Bozeman, although not typical of the majority of Montana's winter wheat production area, is the headquarters for the project. The Farm offers low risk and ideal growing conditions with less severe winters, few hail storms and a mild September for planting. This results in high

crop yields, more efficient phenotypic selection, and greater seed availability after selection for testing and evaluation purposes.

In early generations, heads from selected plants are composited, bulk threshed, screened for kernel plumpness, and advanced to the next generation. The primary selection generation is the F6 generation with headrow selection at Bozeman (~30,000 headrows). Approximately 2500 selected lines are bulk harvested and evaluated in observation nurseries grown around the state in an attempt to expose germplasm to selection pressure that will help identify elite lines for selection. Initial screening for end-use quality is completed at this point with evaluation of protein content, protein quality, and polyphenol oxidase activity

Based on selection for specific breeding objectives (e.g. stem solidness, herbicide tolerance, stripe rust resistance), disease and quality screening results, winter survival, and agronomic performance at individual locations and across locations, a cohort of ~100 lines is selected for preliminary yield testing. Over a five year testing period (Preliminary, Advanced, & Intrastate trials) this cohort of 100 lines is sequentially reduced to 30, 8, 3, then 1 superior line with cultivar release potential. Milling and baking quality is evaluated by the Cereal Quality Laboratory at the Preliminary, Advanced, and Intrastate levels of performance testing. Seed multiplication and purification begins when a line enters the Intrastate trial to produce 20 bushels of



'Warhorse', a new (2013) solid-stem winter wheat variety, at the Western Triangle Agricultural Research Center Field Day, July 7th, 2013.

pure breeder seed by the time of cultivar release. Potential cultivar releases are evaluated for agronomic performance, pest resistances, molecular marker genotype, end use qualities, etc. in cooperative regional performance nurseries. Germplasm for special projects or emergency objectives can be accelerated using single seed descent, molecular markers, or contracted doubled haploid procedures to speed generation advance. Likewise production of breeder seed is accelerated where warranted using earlier linerow derivation and/or Arizona winter seed increase.

The MSU Winter Wheat Breeding Program has introduced 21 cultivars of winter wheat since 1992. The varieties include *Vanguard*, *Rampart*, *Genou*, *Yellowstone*, *Norris*, *Decade*, *Judee*, and most recently *SY Clearstone 2CL*, *Warhorse*, and *Colter*. Genetic improvements have included improved grain yield potential of >1% per breeding cycle, deployment of competitive solid-stem cultivars for management of wheat stem sawfly, reduced plant height, enhanced stripe rust resistance, and deployment of 2 gene-Clearfield winter wheat cultivars for enhanced jointed goatgrass and cheatgrass management. In Bruckner's opinion, "Our real report card is the variety utilization reports. If the product isn't better the producers won't use it." Major cultivar successes by this criterion include Rampart (3.8 million acres), Genou (3.5 million acres), and Yellowstone (2.4 million acres). A non-successful cultivar is released with great hope, then never heard of again.



Jim Berg standing in a field of Judee Winter Wheat.

Bruckner credits the success of the wheat breeding program to the Montana Wheat and Barley Committee/Montana wheat producers and the Montana Agricultural Experiment Station who provide funding for the breeding program and to the commitment of his associates Jim Berg and Ron Ramsfield. Also critical to the success of the breeding effort is a much larger set of cooperators that are involved in different aspects of the program, including plant pathologists, entomologists, agronomists at the various research centers, cereal quality laboratory staff and more.

PSPP Celebrates Graduation

On Friday, May 2, the Plant Sciences and Plant Pathology Department held a reception and awards ceremony for our graduates in 108 PBB/Mathre Courtyard. The graduates received the following books: Landscape Design graduates - "The Artful Garden: Creative Inspiration for Landscape Design"; Crop Science and Sustainable Crop Production graduates - "Weeds of the West"; Plant Biotech and Plant Biology graduates - "Plant Biotechnology: The Genetic Manipulation of Plants". Horticulture Science graduates received loupes (magnifying glass). All the graduates received a cowbell and pin from the College of Agriculture, as well as a coffee mug and geranium from the Department.



For the third year in a row, one of our graduating seniors received the Outstanding Senior Award for our Department and the College of Agriculture. Hannah Estabrooks was the recipient of both of these awards this year.

Congratulations Hannah!

Following are the names of all those that received diplomas and awards.

Faculty Awards

Tracy Dougher

The Horticulture & Turf Club Teacher of the Year Award

Graduate Students

Jay Kalous - Ph.D., Plant Genetics

William Duke Pauli - Ph.D., Plant Genetics

Patricia Mathabe - Ph.D., Plant Science

Undergraduates

Biotechnology - Plant Systems

Nathaniel Ellis - B.S., Honors

Ronak Patel - B.S.

Joseph Schaar - B.S.

Logan Standley - B.S., Honors

Environmental Horticulture - Horticulture Science

Hannah Estabrooks - B.S., Highest Honors, ASHS Collegiate Scholars Award, ASHS Outstanding, Undergraduate Student in Horticulture

Lucas Parriman - B.S.

Kia Simshaw - B.S., Highest Honors, ASHS Collegiate Scholars Award

Jackson Walls - B.S.

Environmental Horticulture - Landscape Design

Grant Beagles - Minor in Horticulture Science, B.S.

Jordan Dennis - B.S.

Samantha Jo Smith - Minor in Horticulture Science, B.S., Honors

Plant Sciences - Crop Sciences

Justin Berg - B.S.

Lisa Henderson - B.S.

Timothy Schutter - B.S.

Plant Sciences - Plant Biology

Briana Bode - B.S., Honors

Nathaniel Ellis - B.S., Honors

Logan Standley - B.S., Honors

Sustainable Food & Bioenergy Systems - Sustainable Crop Production

Benjamin Hughes - B.S., Honors

Tyler Nyman - B.S., Honors

Congratulations to each of you and we wish you all the best in your future endeavors!

Please see the last page of this newsletter for pictures of our graduation celebration.

Hannah Estabrooks Wins Hort Award

The American Society for Horticultural Sciences has chosen Hannah Estabrooks as one of two recipients of the 2014 ASHS Scholars' Scholarship Award. This national scholarship recognizes outstanding horticulture students based on their academic, leadership, and service achievements. Recipients are chosen from an elite group of students nominated by their university for the ASHS Outstanding Undergraduate Horticulture Student Award. Hannah will be honored at the annual meeting in Orlando, FL on July 28 at the Opening Plenary Session and with a poster announcement displayed during the entire conference.

Farm Fair

By Eileen Carpenter

For those of you who have never experienced Farm Fair, it is a three day event put on by the Gallatin Valley Ag committee and the Belgrade and Bozeman Chamber of commerce, open to all fourth graders in Gallatin County as an opportunity to experience life on a farm, learn about where their food comes from and the importance of agriculture in their lives. Farm Fair has been hosted by the Brainard family at their Manhattan farm for the past ten years. (This year in honor of farm fair's 10th anniversary many of the presenters sported ties under their carharts and overalls). There were over 1000 student attendees from all Gallatin county schools. Students spent the day visiting 16 different stations learning about: animals including pigs, sheep, horses, poultry, and getting hands on experience milking cows and goats; ATV safety, forestry and water cycles, beekeeping, textiles; and crops. They got to make homemade ice cream, go for a horse drawn cart ride and dig for potatoes. Many of the presenters were from our own Plant Sciences and Plant Pathology Department along with some past graduates. Heather Rimel, Montana Seed Growers Association,



Susie Siemsen, Laboratory Supervisor in the Potato Lab, teaching fair attendees about potatoes.

was one of the organizers of the event. Ron Larson, Phil Bruckner, Jim Berg, Mary Burrows and Larry Holzworth spoke on grains. Kevin Wanner, Ruth O'Neill, Laura Brutscher Whitney Taylor & Lynn Flaming ran the bee station. Hillary Parkinson addressed weeds. Becky Burkenpas, a student from the seed lab, narrated the horse ride. Susie Seimsen, Becky Huntsman and I, along with students Kim Siemsen and Chrissy Landre, talked about potatoes. (Nina was busy floating the Smith river and could not join us). It is always fun interacting with students, seeing their enthusiasm for learning, responding to their questions and hearing their reactions to all that they learned. One student, when asked why he thought we plant disease free seed potatoes, explained that if we planted diseased potatoes they would spread disease to all the other potatoes which would then infect all the other crops and then kill all the plants in the world and we would have nothing to eat. I now have a new perspective on my job and the value of seed potatoes! In the end I think all the students left with a greater appreciation of agriculture and where their food comes from.

Montana Ag Live! Schedule for June

June 1: Cathy Cripps, "It's Mushroom Time in Montana"

June 8: Mac Burgess, "Small Farms, High Value Crops, are they Feasible in Montana?"

Course Focus BIOO 220 - Botany By Norm Weeden



Want to really learn about the secret life of plants? Botany (BIOB 220) is the course you want to take! It is offered every Fall semester by either Dr. Fischer or Dr. Weeden and attempts to fill a gap between material presented in

introductory biology courses or BIOB 160 and upper division courses such as Plant Physiology (BIOO 433), Plant Development (BIOO 458), or General Ecology (BIOE 370). There is no formal lab with the course, but we do use the collection of live plants in the PGC to examine structures of the different groups of plants we discuss in lecture.

The course deals with all plants (organisms that have a genetically integrated plastid organelle) as well as touching briefly on organisms such as the cyanobacteria, fungi, and lichen. The course is NOT a memorization of Latin names, and plant taxonomy is generally limited to questions about large groups, such as "what are liverworts" or "how do ferns differ from conifers?" We answer these questions by looking at gross anatomy, morphology, and life cycles. We then look at how multicellular plants handle issues such as water balance (why do mosses grow in wet habitats?) and nutrient transport (how does starch made in leaf tissue end up in potato tubers?), intercellular communication (can the leaf or the root tell the top of the plant to form flowers?), response to light (why a bean plant near a street light will not flower), and reproduction (what is apomixis anyway?). The final third of the course focuses on the adaptations of plants to their environment (what plants grow in Antarctica And why?) in order to apply what we have learned about the physiology and morphology of plants to practical problems associated with growing in a particular environment.

2014 Montana Agricultural Research Center Field Days- Quick Guide	
Location	Date and Times
Central Agricultural Research Center - Moccasin Dave Wichman (406) 423-5421 dwichman@montana.edu	Monday, June 23 - starts at 9AM conclude with luncheon
Southern Agricultural Research Center - Huntley Ken Kephart (406) 348-3400 kephart@montana.edu	Thursday, June 26 - starts at 9:00 AM with tours at 9:30 AM and 1:30 PM
Northern Agricultural Research Center - Havre Darrin Boss (406) 265-6115 dboss@montana.edu	Wednesday, July 2 - starts at 3:00 PM with tours before and after dinner
MSU Post Farm - Bozeman Fabian Menalled (406) 994-4783 Menalled@exchange.montana.edu	Tuesday, July 8 - starts at 8:30 AM with tours before and after lunch
Western Agricultural Research Center - Corvallis Zach Miller (406) 961-3025 zachariah.miller@montana.edu	Tuesday, July 15 - starts at 4 PM; dinner at 5PM with tour after dinner
Northwestern Agricultural Research Center - Creston Bob Stougaard (406) 755-4303 rns@montana.edu	Wednesday, July 16 - starts at 2:30 PM with dinner after tour
Eastern Agricultural Research Center - Sidney Johannes Schneider (406) 433-2208 johannes.schneider@montana.edu	Thursday, July 24 - starts at 8:30 AM with lunch following the tour
Western Triangle Agricultural Research Center - Conrad Gadi V.P. Reddy (406) 278-7707 reddy@montana.edu	Tuesday, September 16 - starts at 4:00 PM with tours and a BBQ

Hopefully, the course is more fun than work, but it will be anything but boring. Plants are unique and amazing organisms and will surprise you even after years of study.



Giant rhubarb—will the student consume it or will it consume the student?!

Lonergan Accepts Job with Forest Service

By Erin Lonergan



I have accepted a job as a Botanist with the Klamath National Forest. The Klamath National Forest encompasses nearly 1.7 million acres in Northern California and Southern Oregon. The forest itself is diverse, ranging in elevation

from 450 to 8,900 feet and encompassing steep, rugged mountains and rolling hills of volcanic origin. As assistant botanist, I will be leading a crew of biological science technicians in conducting a variety of botanical surveys including threatened and endangered plant surveys, invasive species surveys, and surveys for critical habitat types.

I have learned a lot during my time in the Plant Sciences and Plant Pathology Department and am very grateful for the opportunities I have had to learn, grow, and work with all of you amazing people. While I am going to miss Bozeman and all of you here in the plant sciences, I am very excited for this opportunity to further my career and explore new landscapes. Wish me luck in my new endeavors!

Passing on the Torch By Linnea Skoglund



It is time for a change-over at Schutter Diagnostic Lab. I am retiring June 6th. It has been great getting to know people in this department, community and across the state. I appreciate the chance to finish my plant pathology career doing my favorite job – diagnostics. I plan to take advantage of the beautiful Bozeman summer and then I will rejoin family and friends in northern Colorado. I wish all of you the best.

New Employees

Eva Grimme



I am delighted to join the Department of Plant Sciences and Plant Pathology as Plant Disease Diagnostician in the Schutter Diagnostic Laboratory. Some of you might remember me working from my time as one of Dr. Barry Jacobsen's

graduate students pursuing my Master's in Plant Sciences and later my Ph.D. in Plant Pathology. Following graduate school, I was happy to work for Dr. Cathy Cripps as a postdoc and that experience greatly enhanced my understanding of mycorrhizal fungi.

During the last five years, I have worked for Dr. Nora Olsen at the University of Idaho, Research and Extension Center in Kimberly, ID. There I focused on research to control potato tuber diseases under storage conditions. Furthermore, I had the opportunity to gain valuable insights into duties of an extension professional.

In my free time, I enjoy exploring Bozeman and the surrounding area with my son, Thomas. One of my goals is to finally learn to ski – so watch out next winter. I am looking forward to working with all of you, those I know and those I have yet to meet, and being part of the Schutter Diagnostic Lab team.

New Graduate Students



Hannah Estabrooks

Hannah Estabrooks

Growing up in Northern New Hampshire, my mother inspired me with the many plants she propagated and the large garden beds she maintained solo around my parents 24 hour mom-n-pop gas station. When not helping my mother, I was with my best childhood friend, the local golf course Pro's son. We spent endless

hours on the course, whether playing the sport, searching for golf balls, or building forts.

After high school, I attended the Hallmark Institute of Photography in Massachusetts, which I graduated from with many valuable lessons, but also a realization that although I loved photography as a hobby, it was not a career I wanted to pursue. For this reason my childhood memories led me to take a position at a golf course in a nearby town. I worked as a member of the course maintenance crew and found that the combination of outdoor work, early mornings (I saw the sunrise every day), and the camaraderie of the crew made for a job that I truly loved.

I spent a total of nine summers at five different golf courses, four in the Bozeman area. I enjoyed seeing the different qualities of each course and how the superintendent approached the challenges of maintaining the course in such a way as to keep both the golfer and the grass happy. Four years ago, I realized that I loved the work that I was involved in but wanted to know more about why we performed many of the tasks, and therefore began the Environmental Horticulture – Science program at MSU. I thoroughly enjoyed the program, met many amazing people, and am now very excited to begin my graduate program under the advisement of Mike Giroux. I will be investigating the possibilities of using Transcription Factors to increase leaf starch and yield in rice. This is a little known avenue of crop science and has the potential for shedding light on the important pathways of starch synthesis in rice as well as other plants.

A few other things about myself: I spent a summer in Hawaii earning my private helicopter endorsement (a testament to my love of running equipment) and exploring the diverse island plant life; during the winters of my golf course years, I worked as a snowboard instructor (a sport that I avidly love); and on a

summer days outside of school you would find me working on my yard, mountain biking, hiking, or camping – one of my all-time favorite activities!

Invited Talks

Kevin Wanner, International Working Group on Ostrina and other Maize Pests, , Chicago, Illinois. April 14-17, 2014. "Elucidating the molecular mechanisms of sex pheromone detection by moths using Ostrinia as a model" and "Wireworms, an increasing threat to small grain crops in the western United States".

Florence Dunkel. Insects to Feed the World Conference, Ede, The Netherlands. May 14, 2014. "Longitudinal changes in acceptance of edible insects by students at Montana State University".

Also, at the same conference, Sebastian Stokhoff de Jong, mentored by Florence and an undergraduate student majoring in Sustainable Food and Bioenergy Systems, presented his poster entitled, "Trends in emerging American and Canadian edible insect businesses". There were 450 participants from 45 countries. Disciplinary origins ranged from entomologists, psychologists, microbiologists, physicians, veterinarians, nutritionists, to federal government regulatory officers, chefs, designers, architects, and entrepreneurs. It was a most amazing combination of people - creativity, science, enthusiasm for sustainability all in one place!

Grants

Kevin Wanner and Mohanty. USDA. "Elucidating the Molecular Mechanisms of Pheromone and Odor Signaling in Olfactory Neurons."

Irene Grimberg, Mary Burrows, Fabian Menalled. MSU Native American Recruitment and Retention Initiative. "Pathways to College".

Extension Horticulture Mathre Courtyard Makeover By Toby Day

The Mathre Courtyard planting area is getting a makeover from previous years to include annuals from the Horticulture 232 class, Herbaceous Identification. Many of the annuals will have information cards pertaining to a specific annual that was grown by each student in the class. The remainder of the annuals are left over from

the class and were donated from local and wholesale nurseries.

On Friday, May 30, Master Gardeners of all ages from Gallatin County came to revitalize the garden and bring the soil level to grade. We will be planting the annuals one evening the first or second week of June. I will have Irene send out an email for anyone that would like to help plant!

If you have any questions, feel free to call me anytime at 994-6523.



Toby Day giving instructions to a group of Master Gardeners that volunteered to add soil to the Mathre

100 Years of Extension: the Smith-Lever Act of 1914

By Toby Day

On May 8, a black walnut tree was planted on the west side of Taylor Hall to commemorate the 100 years of Extension. While the Land-grant University system was founded in 1862 with the Morrill Act, it wasn't until the Smith-Lever Act of 1914 that the Cooperative Extension was established. The Smith Lever Act was introduced by then Georgia Senator Hoke Smith and North Carolina Representative A. F Lever to "expand the vocational, agricultural, and home demonstration programs in rural America."

It was a unique cooperative agreement that included a partnership between the Federal, State and County governments and a funding mechanism that included support from each level of government. That cooperative agreement still stands today and is testament to the forward thinking of the government at that the time. Funding for Land Grant University Extension programs nation-wide still

receive funds from the USDA, their perspective States, and from local county funds. This allows professional educators (in Montana, we still call them "agents") to be placed in local communities and to serve the needs of those communities. As late as 1994, Tribal Colleges were included to increase Cooperative Extension's ability to serve Native American communities as well. In Montana, there are over 60 MSU Extension offices throughout the state and over 200 faculty and staff that serve their local Counties and Reservations. That number does not include the dozens of faculty and staff on campus at Montana State University and throughout the state that support the agents and staff in local communities. I encourage you to look at our website <http://www.msuxtension.org/localoffices.cfm> and see the many different locations and program areas that MSU extension serves and has been serving for over 100 years.



MSU President Waded Cruzado and MSU Executive Director of Extension Jeff Bader help plant the MSU Extension commemorative tree west of Taylor Hall (Photo by

June Birthdays

- Jill Scarson 3
- Ron Larson 6
- Li Huang 12
- Jennifer Britton 12
- Ron Ramsfield 15
- Jackie Kennedy 15
- Luther Talbert 18
- Eileen Carpenter 22
- Bill Hoch 25



Recipe of the Month

Green Power Mojito Smoothie

3 cups ice cubes, or as desired
2 c baby spinach leaves or to taste

1 (7 oz) can crushed pineapple

1/2 c water, or to taste

1 banana, broken into chunks

1 orange, peeled and segmented

10 fresh mint leaves, or more to taste

1 lemon, juiced

1 lime, juiced



Blend all in blender until smooth.

Hystad and Knutzen Tie the Knot

Steve Hystad and Shawn Knutzen tied the knot in Moab, Utah on May 17, 2014. The minister, Duke Pauli, served as officiant. Congratulations Steve and Shawn!



***Please go to the next page
for photos of the PSPP
graduation ceremony and
reception!***

PSPP Graduation - Spring 2014!



Back Row: Jordan Dennis, Justin Berg, Timothy Schutter, Tyler Nyman, Joseph Schaar, and Nathaniel Ellis
Front Row: Grant Beagles, Samantha Jo Smith, Lucas Parriman, Lisa Henderson, Brianna Bode, and Hannah Estabrooks

