



### Montana Soil and Water Conservation Society – Annual Technical Conference

Our Annual Conference entitled *Plan, Prepare & Pass It On* will be held at the Northern Hotel on February 5-6th, 2019 in Billings, MT

**Day One** of the event will feature family business consultant **Jolene Brown** who will share leading-edge best practices and moderate a panel of local experts who will answer your questions regarding Montana law, taxes and estate planning.

**Day Two** will begin with updates on national agricultural topics, followed by interacting with a panel of successful farm and ranch businesses with regards to how they utilize planning to develop yearly strategic plans and bring in the next generation to the business so they can be economically sound and be able to transfer the business to the next generation.

This conference is intended to build strength in agricultural business through techniques to plan biologically, economically and successionaly. To learn more about this conference, please visit our website at <http://mtswcs.org/> or contact Montana Soil and Water Conservation Society chapter members directly.



#### CHECK OUT THIS LINK.

“Plan, Prepare & Pass It On”  
Event on February 5, 2019 in  
Billings, MT with Jolene Brown

<https://youtu.be/3L8D-maKwao>

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## Grazing Successes in Pondera County- Kelli Coleman

With a national spotlight on soil health, producers in Pondera County are focusing more and more on this topic. Historically, soil health studies in Pondera County have focused solely on cropping systems, with little to no emphasis on grazing. Producers in Pondera County also want to know how incorporating grazing in cropping systems will affect the system; how different grazing strategies affect soil health, and is there a correlation between soil health and herd efficiency. Pondera County Conservation District, NRCS, DNRC and MT SWCS partnered on a Grazing Land Conservation Initiative (GLCI) grant to investigate all these questions by monitoring four distinctly different grazing systems found throughout Pondera County. The project explores the correlation between herd efficiency and soil health in grazing.

The four grazing systems included in this project are:

**System 1:** A diverse grazing rotation with expired CRP pastures, native range pastures, cover crops and aftermath grazing on cropland. System 1 bases rotation on pasture and herd conditions, so the grazing rotation varies and includes a range from 10-day moves to 30-day moves. This system has collected NUTBAL data and maintained grazing records since 2010. In 2017, the proposed plan of collecting four samples 5 days after the herd was moved into a new pasture was modified to follow the main herd (60 head) and the replacement heifer herd (25 head). The heifers were ran with 30 head of lease cows, making the two herds similar in size. In 2017, data were collected 7 times on the main herd and 3 times on the heifers, from June 1st to October 19th. We collected data beyond the original scope to establish a benchmark for as much of the ranch as possible, follow herd efficiency through the entire grazing season and monitor soil microbial activity into a warm moist fall following a very dry summer.

**System 2:** A 21-day rotation on grass pasture with predominately pubescent wheatgrass, smooth brome, and crested wheatgrass. In 2017, on System 2 we ran a 30-head herd of 3-year old lease cows from June to October, and purchased a temporary electric fencing system to sub-divide pastures. In 2017, data were collected 7 times on the herd; again, beyond the original scope but to capture the entire grazing season.

**System 3:** A predominately native range grazing system, with a two irrigated hay fields and few dry land hay pastures. Since 2010, this system has followed a rest rotation grazing plan, where approximately 1/3 of the acres are rested during the growing season each year. Typically, the main herd is moved every 30 days. System 3's main herd is 120 cow/calf pairs, it has 6 bulls, 25 replacement heifers and 6 horses that are considered when planning the grazing rotation. In 2017, the proposed plan to intensify this rotation from approximately 30-day to a 14-day rotation was not achieved due to not having access to a temporary fencing system to sub-divide pastures and drought conditions causing insufficient water in some pastures. The herd was moved following the 30-day plan with data collected 6 times, five days after the cows were moved to new pasture. The conservation district secured funding to purchase a one-mile temporary fencing system which will be used in the 2018 grazing season.

**System 4:** A predominately native range grazing system. This System has one large pasture divided in thirds, so the herd is typically moved every 14 - 30 days. We have collected photo monitoring data on this pasture since 2012. In 2017, System 4's herd (35-head) was rotated every 30 days and 6 NUTBAL samples were collected 5 days after the herd was moved into a new pasture along with 3 Soil samples and data from 3 photo monitoring plots.



Figure 1 Measuring grazing heights in June on System 1



Figure 2 Cattle aftermath grazing irrigated triticale/pea hay field on System 3



Figure 3 Measuring grazing heights in September on System 2

During 2017, herd efficiency was analyzed using the Nutrition Budget Analyzer (NUTBAL) test. Soil samples were collected and analyzed to monitor the soil biological profile of the pasture; tests included the phospholipid fatty acid (PLFA) test, the Haney test, and a soil moisture measurement. Sampling occurred throughout the grazing season (June to October) to adequately track the activity of soil biology and the rumen efficiency of the herds.

In 2017, valuable benchmark data were collected on all four systems. This data includes: NUTBAL samples, soil biology/health samples, soil moisture samples, soil temperatures, air temperatures, GPS location of fields sampled, percentages of pasture utilization at time of sampling, growth stages for forbs and grasses, supplements being used, wildlife present and photos of the grazed and un-grazed heights of the 3 predominant grasses species, the pastures and the herds.

In 2017, NUTBAL samples only taken five days after the cattle were moved into a new pasture. When reviewing the 2017 data, we feel that taking NUTBAL samples as the cattle are moved out of the pasture is a missing piece of data that should be collected in the future. By collecting these additional samples, a more complete trend of herd efficiency will be obtained. Also, baseline range assessments and permanent monitoring transects were planned for 2017 but were not completed. These assessments and transects will be established in the future on representative pastures during the grazing season on each ranch.

The data collected in 2017 suggests that incorporating cover crops in the grazing system affects rumen efficiency in a positive way. In October 2017, the herd in System 1 grazed on the full season cover crop and adjacent rangeland; when sampled the rumen efficiency was optimal, suggesting that when cattle are given free choice on diverse plant

communities they thrive, even in late season. The 2017 data also shows that when rumen efficiency was in the optimal zone, the soil microbiology is most active (based on soil respiration and presence of upper level microbes).

While the one year of data collected in 2017 is valuable, collecting at least two additional years of data will provide a more accurate correlation between herd efficiency and soil health. As the project continues, samples will be taken halfway through the herd's time in the pasture and as the herd is moved out of the pasture; the rationale for this additional sampling is that we would like to capture a more complete picture of rumen efficiency after 30-day moves in System 4's rotation to be able to compare it to the shorter rotations of the 3 other systems. We expect to support the idea that by moving the herd more frequently, the rumen efficiency will not experience as dramatic ups and downs. On System 1 and System 2, we also expect to see that incorporating grazing into a cropping system or intensifying a grazing rotation, will improve soil health. Soil health improvements will be monitored with the Haney Test soil health score and the microbiology activity with the PLFA test. We also expect that as soil health improves the herd efficiency will also improve. Herd efficiency will be tracked through Digestible Organic Matter (DOM) / Crude Protein (CP) ratio in the NUTBAL test. We hope that when comparing the results from the Haney tests and PLFA tests to the NUTBAL results, we will see a correlation between soil health and herd efficiency. We will also use the Haney Test soil health score data collected on all these samples to establish an average score on pasture and rangeland for Pondera County. Having this localized average score will allow Pondera County producers a better gauge of the soil health on pasture and rangeland.



Figure 4 Cattle grazing cover crop in July on System 1

## Culture, Climate, and Conservation

**73rd International Annual Conference**  
**Albuquerque Convention Center**  
**July 29-August 1, 2018**  
**Albuquerque, New Mexico**

**2018 Annual Conference**  
**Presenting Sponsor**

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New Mexico's rich culture and diverse landscape makes it the prime location to celebrate the 73<sup>rd</sup> SWCS International Annual Conference theme, Culture, Climate, and Conservation. Bordered on the east by the Sandia Mountains, to the west by Petroglyph National Monument, and with the Rio Grande flowing through its center, Albuquerque possesses many of the natural features characteristic of New Mexico, a state of mountains and mesas, deserts and forested wildernesses. Whether you're exploring the downtown Convention Center site, venturing into Spanish-influenced Old Town Albuquerque, or learning about local pueblos and native traditions, the blend of cultures and lifestyles serves as a reminder of the many stakeholders that are part of and affected by land management decisions.

The research to be shared and stories to be told from across the nation will fit right into this location where conservation spans resource concerns, cultures, and landscapes. In addition to learning about some of the management challenges and partnership opportunities that face ecosystems worldwide, participants will experience the vibrant culture of New Mexico through Local Forum and Flavor event, witness conservation efforts first-hand through tours, and will hear from leading speakers in the conservation field. Specialty tracks that will focus on rangeland and forest restoration as well as the use of technology to advance conservation will also be offered at this year's conference. Collectively, all of these areas of focus will provide a forum for conservation professionals from around the world to come together to discuss successes and challenges, combat shared obstacles, and accelerate conservation efforts.

## Soil Acidity is Causing Crop Failure in some Montana Fields: Is yours next?

Farmers in several Montana counties are experiencing nearly complete yield loss in portions of their fields due to soil acidity (low pH). Top 6-inch soil pH testing may not definitively identify soil acidity problems. Most fields with low pH problem areas also have larger areas with higher pH that buffer the pH value when soil samples submitted to labs are mixed with 6-8 subsamples per field. Also, the lowest pH is generally in the top 2 to 3 inches, not the top 6 inches, further masking the issue. MSU soil scientists have now identified fields in 15 Montana counties with soil pH levels below 5.5, some as low as 3.8. Because many Montana soils have pH levels greater than 7.0, soil acidification received little attention until recently when yield-limiting acidity was identified in Chouteau County.

At pH levels below 5.0 naturally-occurring soil metals (like aluminum and manganese), become more soluble and can stunt root and shoot growth. Young plants in acidic areas are often yellow (see photo) with club or "witch's broom" roots (see photo). Substantial yield losses occur at pH levels below 4.5. Most sensitive crops are barley, durum followed by spring wheat.

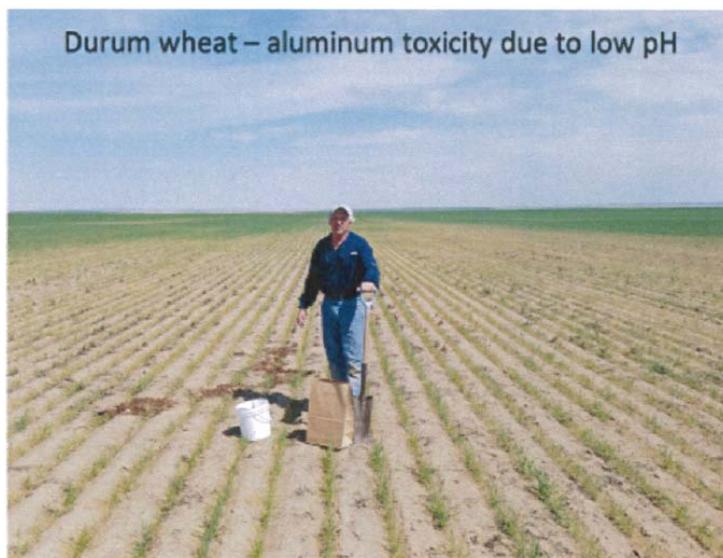


The major cause of acidification appears to be ammonium fertilizers, including urea, applied in excess of crop uptake. No-till concentrates the acidity near the surface where fertilizer is applied.

Selecting aluminum-tolerant crop varieties might help for a few years, but liming appears to be the main strategy to correct the acidity problem. Do what's in your power now to prevent yield and economic losses, because liming is expensive and spreader equipment is not readily available. Prevention includes rotations with crops with lower nitrogen needs, such as pulses (peas, lentils) and perennial forages, and using practices that encourage efficient nitrogen use.

Acidity problems usually start in low lying areas of a field (where yield has been historically been high), and then acidity symptoms spread outward. To identify if you have an acidification problem, look at your top 6-inch soil test. If the pH is consistently above 7.5, it's unlikely you have a problem. If it is below 6.0, you likely have areas with pH below 5 and have yield limiting acid problems.

On fields where standard soil test pH levels in the top 6 inches are below 7.5, scout for yellow seedlings and club roots. To verify that those symptoms are caused by low pH, analyze just the top 2 inches for pH, either with a field pH stick or probe, or lab analysis. Soil in the zone at the edge of poor growth areas should also be sampled to determine if the pH is on a downward trend on the margins, but do not yet exhibit symptoms. The potential is there for problem areas to grow in size. The field should be managed differently to prevent further acidification.



For additional information on this emerging issue, go to <http://landresources.montana.edu> and click on Soil Scoops where you will find two documents on soil acidification or on Presentations. Please contact your local Extension Agent, Dr. Clain Jones, MSU Extension Soil Fertility Specialist ([clainj@montana.edu](mailto:clainj@montana.edu), 994-6076) or MT Salinity Control Assoc. (406-278-3071 [msca@3rivers.net](mailto:msca@3rivers.net)) if you have any questions.

Acid Soil SPCH-12/MSCA Soil Acidity Article 040218

### **2018 MT SWCS Tom Pick Memorial Scholarship Winner**

Kile Denny, a junior from Colstrip majoring in Environmental Engineering at Montana Tech in Butte is the 2018 MT SWCS Tom Pick Memorial Scholarship winner. Since there were no freshman/sophomore applicants, the Scholarship Committee unanimously decided to award her that \$1000 as well. Kile is an outstanding student involved in many campus organizations relating to her major, has a very good GPA, and volunteers in the Butte community. For her 3<sup>rd</sup> summer internship, Kile is working for a local firm directly relating her work experiences to environmental engineering with EPA protocol and guidelines for sampling. She is a student member of MT SWCS and plans to graduate in December 2019.

**MT SWCS President's Message - Mark Henning**

I recently had the opportunity to hear Dr. Christine Jones, an Australian soil ecologist, in Plevna, MT at a workshop put on by the Little Beaver CD (see [www.amazingcarbon.com](http://www.amazingcarbon.com) for more on Dr. Jones). The take home message for me was *that decomposition will not build organic matter*. Conservation has focused on growing and maintaining surface residues (whether on crop or grazing lands), and while this is critical for protecting the soil, it does little to build soil organic matter. The reason is that soil life does its' job of decomposing plant materials, and most of the carbon in those residues goes back to the atmosphere as CO<sub>2</sub> via microbial respiration (although some of it is captured by plants and used in photosynthesis, but that is another article).

So how is organic matter built? Through the liquid carbon pathway. This can only be done through the symbiotic relationship between plants and soil microbes. This means there must be living roots in the ground for plants to give some of their photosynthate (sugar) to microbes. Only then can stable organic compounds be formed in the soil. This is the very brief explanation of this process. I encourage you to read some of Dr. Jones's articles.

Understanding this process leads to better conservation by producers and professionals. It means we don't have to assume that building organic matter must take a lifetime. If the 5 principles of soil health are applied- minimize disturbance, maximize plant diversity, keep living roots in the ground as many days as possible, keep the soil covered, and add livestock; then there is hope that organic matter can be built much faster than previously thought.

I'll leave you with an amazing comparison between season-long grazing and well managed grazing. Corey Swenson, who helps with our scholarship committee, runs horses in a multi-paddock twice over grazing system. We measured infiltration rates on his neighbor's land and then the horse paddock. The results, and photos comparing soil structure and color, demonstrate soil health principles in action.



Multi-paddock twice over grazing system



Season-long grazing

**Conversion to Inches/Hour:**

Inches of water applied	Swenson- twice through grazing	Neighbor- season long
1	162	2
2	62	1.3
3	35	-
4	23	-
5	18	-



*MSU College of Agriculture alumna Susan Massar has earned a Fulbright scholarship to Valdivia, Chile for nine months to study the impact of livestock grazing on agro-forest systems in Chilean Patagonia. MSU photo by Kelly Gorham*

BOZEMAN – The way Montana State University alumna Susan Massar sees it, if you can understand the distinct dialect of Chilean Spanish, you can understand just about anybody. Massar will use her fluency in Spanish, her study abroad experience and her Montana agricultural background next year as a Fulbright scholar in Valdivia, Chile.

Massar, who grew up on a farm and ranch that her great-grandparents homesteaded in Circle, graduated from MSU in August 2016 with a bachelor's in crop science from the Department of Plant Sciences and Plant Pathology in the MSU College of Agriculture, along with dual minors in natural resources rangeland ecology and Hispanic studies. She also gradu-

ated from MSU's Honors College.

At MSU, Massar was a Provost Scholar, one of the university's most prestigious scholarships. She now serves as a soil conservationist for the U.S. Department of Agriculture Natural Resources Conservation Service in Blaine County, where she works with private landowners on resource management and conservation planning and assistance.

Her work with the NRCS in north-central Montana is not unlike her Fulbright research project, which will take her to the Austral (Southern) University of Chile in Valdivia for nine months to study the impact of livestock grazing on agro-forest systems in Chilean Patagonia. Massar spent a semester at the same university during her study abroad trip in 2016.

"Just when I was getting comfortable with language proficiency and had made a group of friends in Chile, it was already time to go home," she said. "The opportunity to return with a Fulbright in an ag-related research capacity is amazing."

During her nine-months in Chile, Massar will study a species of trees found only in southern Patagonia, the *Nothofagus antarctica* or Ñirre tree, which is highly valued ecologically and culturally in Chile. The tree has become a threatened species as cattle production practices have removed large forests of Ñirre to establish pasture for livestock grazing.

Massar will use her Fulbright to research how to implement grazing guidelines that would protect the Ñirre and produce high-quality forage for livestock in forestlands, while improving ecological and economic sustainability.

"What's really fascinating about the project, I believe, is the opportunity to find balance between having forest and livestock on the same land unit in a sustainable system," Massar said. "I'm really looking forward to working with local researchers in a particularly gorgeous part of the world."

Massar said her job with the NRCS and engaging with Montana's agricultural community, coupled with her minor in rangeland ecology and Spanish and involvement on MSU's Range Club, have taught her the skills to apply range management theories strategically. As a member of the Range Club, Massar attended the Society of Range Management's annual conference three years in a row. At those conferences, Massar competed in the undergraduate range management exam and the plant identification exam, two rigorous tests designed to challenge the participant's knowledge of rangeland ecology, grazing management and site-identification of 100 common North American rangeland species.

Tony Hartshorn, associate professor in MSU's Department of Land Resources and Environmental Sciences, was a faculty mentor of Massar's in the Honors College's climate change seminar and departmental soils classes. Hartshorn is a former Fulbright Specialist himself, having conducted research in northern Peru in 2016.

"It was such a pleasure reading over Susan's Fulbright proposal application and being reminded of the uniqueness of not only her background, but her proposed research in silvopastoral (agroforestry) systems as well," Hartshorn said. "The Fulbright will enable her to compete for future international agricultural consulting opportunities, which are limited given their specialized nature."

Hartshorn added that Massar's Spanish fluency has helped her to connect on a community level in agriculture and science.

To keep up her Spanish, Massar reads a bilingual bible and Spanish novels, listens to podcasts and chats with friends via Skype. While a student at MSU, her ability to draw parallels between agricultural practices and rural communities in Montana and Chile was particularly impressive to Ilse-Mari Lee, dean of the MSU Honors College and one of Massar's faculty mentors.

"A Fulbright scholarship is based on the cultural and intellectual exchanges between two countries, and I can't think of a better representative of Montana than Susan," Lee said. "I have been deeply impressed by her intelligence, work ethic, infectious energy and natural curiosity. We're thrilled that Susan has been selected as a Fulbright U.S. Student Program research grant recipient. We know she will excel as she brings Montana know-how to Chile."

"I had some incredible opportunities for mentorship and networking from very different corners at MSU," Massar said. "I suppose having a major and minors that have little overlap allowed me to create a support system where I learned that one area of study really does affect another one, which has opened up



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