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Methane Collection Equipment. The device attached to this cow samples her breath using a capillary tube near her nose which is connected to an evacuated (vacuum) canister made of PVC.

What's new?

- 01** Research Update
- 02** Extension Update
- 03** Education Update
- 04** New Team Members

<https://usu.edu/smart-foodscapes/>

Project Goal

The long-term goal of this project is to improve the economic and environmental sustainability of beef production systems in the western U.S. through the establishment of islands of multifunctional diversity in the landscape. During the second year of the project, significant progress was achieved on our research, extension and education objectives.

Plant Species Establishment In order to test prospective plant species planted in dense stands for smart foodscapes, about **two dozen legumes and non-legume forbs and crested wheatgrass** were evaluated at four replicated study sites across Utah in 2023. In Ephraim, students harvested about 55 kg fresh weight of crested wheatgrass (CWG) from a stand planted the previous August. In Clarkston, students harvested forbs (alfalfa, birdsfoot trefoil, sainfoin and small burnet) totaling about 30 kg fresh weight. The grass and forbs were stored frozen and then **freeze dried, milled, and shipped** to Dr. Batistel at the University of Florida for use in **in vitro rumen fermentation studies**. The same four forbs were sampled monthly from June through October in all five replicated plots at Clarkston.

Other small plot studies are located in North Logan, Cedar City and Panguitch, all with four replications of 23 herbaceous forbs. The graduate student who is carrying out the establishment study also conducted a germination study of seeds of 18 shrub species. Dr. MacAdam successfully cultivated specimens of a number of these species in the greenhouse and transplanted them into a pilot study at the Clarkston farm in late October of 2023.

Modeling Exercise using MINDY The objective of this effort was to simulate the effect of different grazing management approaches by contrasting grazing frequency (once a week, two weeks, and month) and dietary proportions (5, 10, 15 and 20%) of either sainfoin or birdsfoot trefoil in beef mother cows grazing on a "sea" of grass. Dr. Gregorini conducted the virtual experiment using MINDY, a validated mathematical simulation model of the grazing pattern of a cow. The study consisted of **25 simulation scenarios** (treatments) to model these various conditions of grazing management. The model gave **outputs of animal performance and environmental impact** in terms of methane production and urinary N excretion, which were compared to a control scenario (only grass).

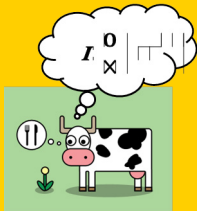
Preliminary results show that the greater the dietary proportion of legume (15 and 20%), the greater the animal production in terms of body weight and milk yield. In addition, at the greatest level of legume in the diet, the least frequent allocation (i.e., monthly) provided the least environmental cost/impact per unit of increment in animal production. Thus, low allocation frequency to legumes (i.e., once a month) at **20% in the diet** was identified as the **simplest option** for farmers to manage islands of legumes in order to **maximize production** while achieving the **lowest levels of environmental impact**.



Cow-calf pairs in a "sea" of grass.



Harvested forbs.



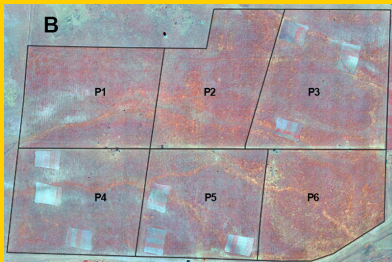
Visualization Dr. Ramsey's team collected and processed natural color and color infra-red drone imagery to begin monitoring the status of the established islands of diversity at our USU research farm in Richmond.



A. A Natural color orthomosaic

was generated from imagery collected on August 14, 2023, using a DJI Mavic 2 Pro unmanned aerial system (UAS). The 55-acre grass (Meadow brome)-dominated pasture at the USU Richmond farm shows nine "islands" of 0.3 acres each, distributed in three different fenced paddocks (P3, P4 and P5). Islands are seeded with strips (131x98 ft each) of: 1-Alfalfa, 2-Birdsfoot trefoil, 3-Sainfoin, 4-Small burnet, and 5-Forage kochia. Paddocks P1, P2, and P6 are just grass (control).

Differences in color across the pasture represent variations in grass cover and species.



B. A Color infrared orthomosaic

generated from imagery collected by the same UAS filtered to the near infrared of the same pasture taken on August 15, 2023.

Differences in color across the pasture represent variations in grass cover and species.

Deployment of Smart Foodscapes to the Range

Dr. Villalba's team conducted the following activities. Twenty-four black angus cow-calf pairs (4 pairs in each of the 6 paddocks) were selected to graze the 55-acre grass-dominated pasture at the USU Richmond farm described in the previous section. The nine "islands" of diversity containing alfalfa, birdsfoot trefoil, sainfoin, small burnet and forage kochia were fenced to prevent cow grazing during establishment. Despite islands being under establishment, we tested the effects of some of the bioactives in the establishing plants by adding chemicals (condensed and hydrolyzable tannins) to a supplement in a grazing study.

During grazing, the team determined body weights, spatial distribution and behavioral activity, methane emissions, rumen microbiome, blood urea nitrogen and antioxidant status, fecal and urine outputs.

Dr. Dillon developed a soil sampling protocol and Dr. Villalba used it to collect baseline soil samples by identifying paired areas within each paddock (island and grass-3 plots; or just grass-3 plots) of similar size and on similar soil type. Within each area, 30-m transects were used to take five random samples using a Giddings probe with a 5-cm diameter core. Each core was sampled by depth at 0-10, 10-20, 20-40, 40-60, and 60-80 cm. Samples are being analyzed for soil organic carbon fractionation and soil health based on the Colorado STAR program.



Horacio Blanchard collecting soil samples using a Giddings probe.



Herding cows for daily sampling.



Cows consuming supplement at pasture.



Drs. Rusty Stott and Lexi Sweat collecting rumen fluid.

The extension team disseminated information to rangers through Extension Program conferences, schools, and events as described below.

- 01/11/2023 Weber River Confluence conference (100 attendees)
- 1/21/2023 Duchesne County Cattleman's (200 attendees)
- 2/8/2023 Carbon County Crop School (40 attendees)
- 2/9/2023 San Juan Crop School (25 attendees)

Matt Palmer conducted a grazing school in Box Elder County over the summer.



Grazing school in Box Elder.

Assessing Adoption and Perceptions of Smart Foodscapes

Dr. Schad's team has focused on three primary activities:

1. **Analyze the survey data** collected during the winter of 2023 with ranchers in Utah about their initial perceptions of smart foodscapes after watching the short introductory video created by the group (<https://usu.edu/smart-foodscapes/>).
2. **Conduct interviews with ranchers** about smart foodscapes to gather further insights into what might influence them to try them, what they perceive barriers to be, their sense of place, etc.
3. **Mentor PhD student Zubair Barkat** in crafting the first draft of a survey to be sent out via mail to ranchers in the region during the summer of 2025.



Dr. Schad interviewing rancher.

Working with Producers on Smart Foodscapes and Demonstration Sites

To this end, in April through July, **three plots in different areas were seeded** with various plant species with varied success in plant establishment. In September, in meetings with landowners, **two additional plots were identified** totaling 1 acre in Dog Valley and a .5 acre plot in Mt. Pleasant, Utah.



Establishing new forbs.

Summer Camps

Building on the success of the 2023 Bee Camps in Logan and Price, Utah, the Education Research Team is **planning two summer camps** for elementary students during summer 2024: Price (June 3-7) and Logan (June 10-14). The camps will take place in partner schools and be led by Co-PIs (Campbell, Hagevik, Trundle, Vela, Villa) in partnership with project teacher partners (4) and Undergraduate Research Assistants (Findlay, Sanders, Sanders). The camps will allow the team to **research the efficacy of the project STEAM curriculum**, with a focus on biodiversity of pollinators, specifically native bees, and Smart Foodscapes. A project researcher will be invited as a guest speaker at each camp.

You can view the 2023 Logan and Price bee camp videos to the right. >



Bee Camp, Edith Bowen, 2023



Updates on Education Outcomes

In partnership with 21 teachers in six partner schools (two elementary, two middle school, two high school), the research team developed, reviewed, revised, and are implementing STEAM integrated lessons. All six school gardens have been planned, and three are complete and in use. To date, the curriculum includes 50 elementary and 70 secondary lessons. Three online professional development modules have been developed using NearPod.

In collaboration with our project videographer, Andy Lorimer, the team has produced two career videos (featuring Co-PI Campbell, entomology), one for elementary and one for secondary students and teachers. Two additional videos are near completion (featuring consultant Krissek, geology), and filming of three project scientists (MacAdam, Thacker, Villalba) took place during summer 2023, with plans for additional filming during spring/summer 2024 (Delgran, Dillion, Hagevik). The team is working with a publisher to begin plans for a children's book.

You can view both of the entomology videos below.



New lessons developed.



[High school grades 9-12 video](#)



[Elementary school grades K-8 video](#)

Dissemination

In 2023, the Education Research Team disseminated project work through three published papers, one book chapter, 19 research conference presentations, 21 practitioner (teacher) conference presentations and workshops, and one research conference keynote address. The team organized and conducted two fieldtrips at a research conference. During the upcoming year, the team has 17 presentations accepted for the following international meetings: [ASTE](#), [NARST](#), [AERA](#), [NSTA](#), [NCTM](#).



Dean Winward
Professor
Southern Utah University
Cedar City, Utah

Our new Advisory Board Member grew up in northern Utah with farms all around him, Dean Winward enjoyed the outdoors and the hands-on nature of agriculture. After earning his bachelor's and master's degree in soil science, Winward began his teaching career at Fort Lewis College. Winward has now been at Southern Utah University for 29 years, teaching students about the agricultural field and how necessary it is to each one of us. Winward has always desired to be in a situation where he was consistently learning, and sharing his knowledge about agriculture. He enjoys all the classes he teaches.



Sebastian Schreiber
Ph.D. Student
Utah State University
Logan, Utah

Sebastian Schreiber is a Ph.D. student majoring in Range Science. He is dual advised by Dr. Eric Thacker and Dr. Juan Villalba. He has B.S. (Natural Resource Management) and M.S. (Animal Science) degrees from Angelo State University in Texas where he studied under Dr. Cody Scott, researching the effects of tannins on immune response in beef cattle. Sebastian has experience on working ranches in many states as well as with the NRCS and is excited to apply this background towards the Smart Foodscapes project.

Sebastian's aspects of the project will include analyzing GPS collared cattle data for evidence of selection for prototype Smart Foodscape plots, measuring and documenting the successes and challenges associated with the many "demonstration plots" being planted with the help of producers throughout the state of Utah, experimenting with the novel technology of virtual fencing in the context of Smart Foodscapes, and also a collaboration with Dr. Stephan Van Vliet on the epigenetic effects of the secondary compounds contained within Smart Foodscape plots, for which a grant proposal is currently in the works.



Andy Lorimer
Freelance Filmmaker
REN Media, LLC
Educator/CTE Director - Fast Forward Charter High School
Logan, UT

Andy has over 20 years working as a freelance filmmaker, creating promotional videos, commercials and short films. However his heart lies in documentary filmmaking and he is passionate about telling stories from everyday life. His most recent documentary films include The Borgstrom Brothers, A Veteran's Day Tribute, 100 Years of the Ellen Eccles Theatre, The Everest Project and Rising Tide: The Crossroads Project.

In addition to his work as a filmmaker, Andy has spent the last 18 years teaching film and media classes at Fast Forward Charter High School and at Utah State University. He finds great purpose in using his passion for filmmaking as a means to help students find renewed purpose in life by telling their stories, becoming creative problem solvers, and finding acceptance.

Andy is currently creating Stem Careers: A Smart Foodscapes Series, which will introduce primary and secondary education students to various experts within the sciences as a means to educate and inspire them to look that direction with future endeavors.

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