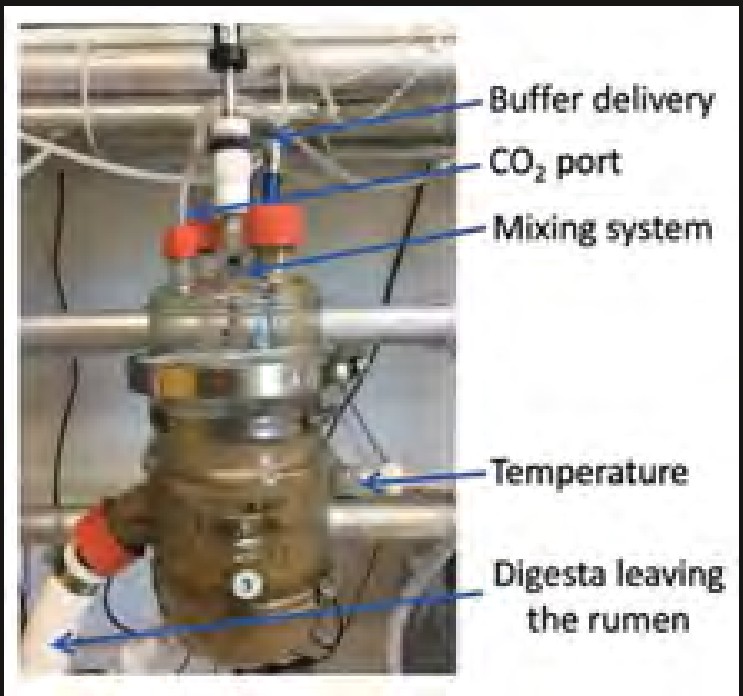
Sept 2024

SMART FOODSCAPES

ISLANDS OF PERENNIAL LEGUMES AND FORBS

USDA National Institute of Food and Agriculture
UNITED STATES DEPARTMENT OF AGRICULTURE

USU STATE



Continuous Culture Fermentation System. This device allows us to test various nutrient combinations in vitro, simulating the digestive process of a cow.

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

What's new?

2024 Summer Retreat

To kick off the 2024 annual meeting, Resha, the project manager, knocked it out of the park with our 2024 annual meeting dinner at the USU art museum. Her curated menu and drink pairings were a culinary masterpiece. The food was so good, it could have rivaled the art on the walls. After dinner, the group watched our Smart Foodscapes introductory video and new career videos developed by the Education Team. →

The next day, the group embarked on a field trip to visit the 3-year-old plant research site of Jennifer MacAdam in Clarkston. Jennifer, an experienced forage physiologist, has been experimenting with a variety of herbs in Utah's unforgiving climate. Her experiments have yielded some interesting results, particularly with sainfoin, which thrives at different ecosites across the state. →

Our next stop on our field trip was Juan Villalba's research site in Richmond where we visited the "islands" of diversity with legumes and forbs, across a "sea" of grass. The islands presented established strips of sainfoin, forage kochia, small burnet, and alfalfa. The legume birdsfoot trefoil didn't establish and members of the advisory board recommended alternative species to seed. →

In the afternoon, the group headed to the USU Sorenson Legacy Foundation Center, where Dr. Jessica Schad and PhD student Zubair Barkat presented their research on ranchers' views of smart foodscapes. The education team led by Drs. Kathy Trundle and Rita Hagevik gave presentations about their model about smart foodscapes, and curriculum design to improve students' understanding of biodiversity, environmental impacts, and sustainable beef production systems. →

Subsequently, the group walked to Edith Bowen Laboratory School, where students from K-first grade gave presentations on legumes, forbs and grasses, nature journaling, citizen science projects on birds, and garden projects. Finally, the group had a garden tour with students and teachers. →

On our last day, we talked about what we learned over the past days and had a lengthy discussion about what is to come. Listen to it here: https://www.youtube.com/watch?v=4T8-ukZLvXQ

Project Goal

In our quest to transform beef production in the western U.S., our project aims to create vibrant hubs of multifaceted diversity across the landscape. Year two has marked a significant stride forward as we delve into groundbreaking research, extend our knowledge to the community, and enlighten minds through education.

Plant Species Establishment

Dr. MacAdam's objective is to evaluate different plant species for their suitability in smart foodscapes using experimental plots.

To unlock the nutritional secrets of potential forage crops, Dr. MacAdam's team harvested alfalfa, birdsfoot trefoil, sainfoin, and small burnet every month from June to October 2023. These young plants, growing strong in their second year at the Clarkston site, were meticulously processed. They freeze-dried and ground them into a fine powder before analyzing their nutritional profile using near-infrared spectroscopy (NIRS). For comparison, they also examined a seasoned crested wheatgrass sample from Ephraim.

To delve deeper into the potential benefits of these plants, they are investigating their tannin content. Birdsfoot trefoil and sainfoin are currently being analyzed for condensed tannins, while small burnet will soon undergo testing for hydrolyzable tannins.

Modeling Exercise using MINDY

Dr. Gregorini's team is testing complementarities in silico - Model MINDY.

A manuscript describing model MINDY was submitted to the Journal of Agricultural Science.

In Vitro Testing

Dr. Batistel's team is doing in vitro testing with plant species suggested by MacAdam's research, in proportions optimized by Dr. Gregorini.

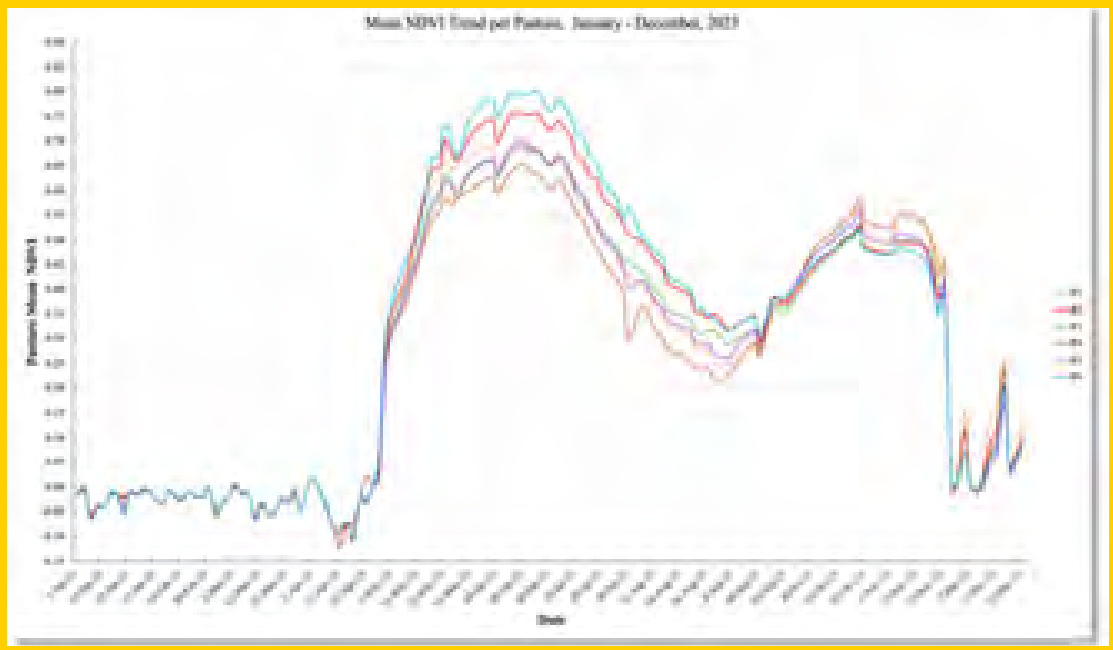
Dr. Batistel's team used a continuous culture fermenter system to mimic the rumen environment in a lab setting. Their goal is to see how different combinations of forages affect rumen fermentation (including volatile fatty acids and ammoniacal nitrogen), microbial growth, enteric methane, and nutrient digestibility. The forage combinations they are testing are:

1. Crested wheatgrass (75%) + alfalfa (25%)
2. Crested wheatgrass (75%) + sainfoin (25%)
3. Crested wheatgrass (75%) + small burnet (25%)
4. Crested wheatgrass (75%) + small burnet (12.5%) + sainfoin (12.5%)
5. Crested wheatgrass (75%) + birdsfoot trefoil (8.3%) + small burnet (8.3%) + sainfoin (8.3%)

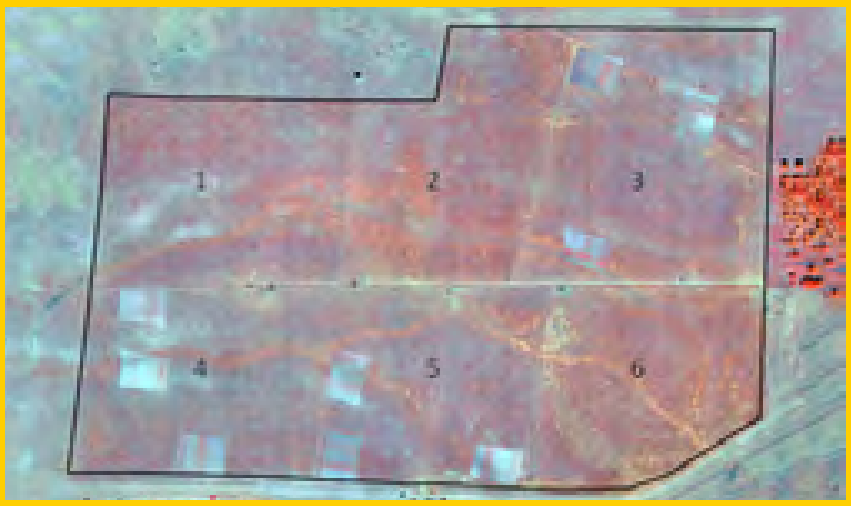
Spatial Design and Visualization

Dr. Ramsey's team is trying to better understand how cattle roam and graze across Richmond's pastures, Dr. Ramsey and Iddy Muzzo spent the winter and spring developing a cutting-edge method.

As part of this project, they harnessed the power of satellite imagery. Using data from the Sentinel-2 spacecraft, they tracked pasture greenness throughout 2023. These phenological curves reveal the seasonal changes in plant growth for each paddock, providing valuable insights into pasture health and potential cattle use and foraging behavior.



The pastures with the highest and lowest NDVI curves are represented by the graphic to the right, respectively, pasture #6 at the southeast corner and pasture #1 in the northwest corner. →



Deployment of Smart Foodscapes to the Range

Dr. Villalba's team is testing chemical analysis measured blood urea nitrogen (BUN) in cows grazing a grass landscape supplemented with condensed and hydrolyzable tannins. Nutritional analysis of grass samples (fiber, lignin, nitrogen) were conducted from July to September 2024. Methane collection in grazing cows using the SF6 technique (picture on the right) was also conducted in 2023 and during the 2024 field season.

Lab work included forming composites of urine and feces from the study for nitrogen emissions analysis. Urine samples were analyzed for total nitrogen, urea-N, and creatinine, while fecal samples were analyzed for nitrogen and fiber. Statistical analyses of these parameters, along with cow behavior data from accelerometers and GPS collars, are ongoing.

A summary of this data was made for presentation at the American Society of Animal Science Annual Meetings in Calgary, Alberta, July 21-25, 2024. Collaborations with Co-PI Douglas Ramsey, USU faculty Kezia Manlove, and Stephan VanVliet are aiding in GPS data analysis and metabolomic analyses of plasma to assess cow health.

Dr. Dillon's team is analyzing soil samples. Dr. Villalba and his students gathered soil from the smart foodscape plots at various depths: 0 to 10 centimeters, 10 to 20 centimeters, and so on, up to 60 to 80 centimeters. The hydraulic Giddings soil probe used to collect deep soil samples is shown in the pictures on this page. These soil samples were sent to Cquester Analytics for testing to measure organic matter, carbon, and nitrogen levels. Unfortunately, there's been a problem with the soil density measurements, which is impacting the carbon results. They are working with Cquester to find a solution.

Assess Adoption and Perceptions of Smart Foodscapes

Dr. Schad and her PhD student, Zubair Barkat, have been busy unraveling the perspectives of ranchers across the state. They spent the summer of 2023 conducting in-depth interviews, and have since transformed those conversations into a comprehensive report. Zubair has shared preliminary findings at the graduate student meeting and presented the research at both the Rural Sociological Society conference in Madison and our annual project meeting in May. To make this information accessible to a wider audience, they're also crafting a concise one-page brief.

In parallel, the team collaborated with Eric Thacker on a research note exploring ranchers' views on smart foodscapes. This article, drawing on data from a winter 2023 survey, has been submitted to the prestigious Rangeland Ecology & Management journal.

Work with Producers on Demonstration Sites

Dr. Eric Thacker, Sanpete Co. Agronomy Agriculture & Natural Resources agent Matthew Palmer and Dr. Thacker's graduate student, Sebastian Schreiber, are teaming up with Utah ranchers to transform their rangelands. Together, they've established a network of "demonstration plots" across the state, carefully chosen to represent Utah's diverse landscapes. By focusing on areas dominated by crested wheatgrass, they aim to maximize the impact of these experimental sites.

These plots are now taking root, and the team is closely monitoring their progress. They're tracking how these new plant communities fare under real-world grazing conditions and gathering insights from ranchers about the challenges and rewards of this innovative approach.

Check out the table below for particular plot and plant data. ↓

Plot and Plant Species Data Table

Location	Acres/Plot	Plots	Total acres	Date Seeded	Species Planted
Millville	0.4	1	0.4	11/30/2023	Alfalfa, Sainfoin, Small Burnett, Cicer Milkvetch, Birdsfoot trefoil
Park Valley	2.5	1	2.5	Prior	Alfalfa, Sainfoin, Small Burnett, Cicer Milkvetch, Birdsfoot trefoil
Coalville	0.8	2	1.6	4/20/2024	Alfalfa, Sainfoin, Small Burnett
Nephi	0.9	2	1.8	12/6/2023 & 2/28/2024	Alfalfa, Sainfoin, Small Burnett, Cicer Milkvetch
Mt. Pleasant	1	1	1	12/7/2023	Alfalfa, Sainfoin, Small Burnett, Cicer Milkvetch

Education in the Schools

Dr. Trundle, the team lead, and the Education Research Team worked with teachers to hold two summer camps in elementary partners schools. The team conducted research on the impact of the project's STEAM Curriculum on students' environmental knowledge, attitudes, and behaviors.

Year 1 Focus:
Nurturing Nature's Classroom: Transform school grounds into vibrant, edible ecosystems by integrating smart foodscape principles. Empower teachers with the knowledge and tools to cultivate these living laboratories.

Engaging Young Scientists: Ignite curiosity and critical thinking through citizen science projects embedded in garden-based learning across K-12 classrooms.

Year 2 Focus:
Wildlife Welcome: Evaluate how school gardens and extension foodscapes attract beneficial insects and wildlife, contributing to biodiversity.

Sharing the Bounty: Expand the reach of our work through targeted outreach initiatives to inspire and educate communities about the power of sustainable food systems.

The Education Research Team has actively disseminated their work to research and teacher practitioner communities through conference presentations (42 papers and workshops), published journal articles (4 in print, 1 in press, 2 in review, 1 in process), career videos (8 complete, 4 in progress), extension resource sheets (6 in print, 3 in press, 9 in progress), and book chapters (1 in print, 1 in press).

These dissemination efforts included team members, teacher partners, graduate and undergraduate research assistants. They currently are working on 3 proposals for children's books that will involve team members across the project.

Elementary School Installations

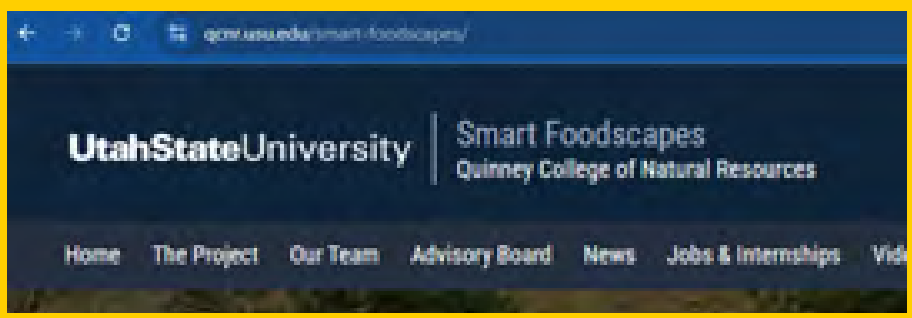
Currently, garden installations are underway at Pinnacle Canyon Academy and Carbon County High School. They've also made great strides with the gardens at EBLS, Wellington Elementary, and Wahlquist Junior High. Each of these schools now boasts six raised beds, a shed, and a greenhouse, all fully installed. →

They're actively purchasing materials and moving forward with installations for Pinnacle Canyon and Carbon High School. Additionally, they're finalizing bailment agreements with Wahlquist, Carbon High, and Ridgeline High School to ensure smooth and successful garden setups.

They worked with The School of Teacher Education and Leadership (TEAL) Human Resources at USU to develop a Teacher Participation Role Statement, which teachers signed as an agreement for their engagement as participants in the project for years one, two, and three.

Website Update

SFS website was transitioned to Utah State University, Quinney College of Natural Resources and is being updated daily.



New Career Videos

We have two new career videos featuring our very own Dr. Jennifer MacAdam, our local Plant Physiologist. We always do two versions of these videos. One for kindergarten through 8th grade, targeting the younger crowd. These videos are usually a little more playful. The second video is for the older kids, targeting high school 9th grade freshmen to 12th grade seniors. View both of the videos below. ↓

Meet a Plant Physiologist - Grades K-8 ↑
https://youtu.be/z2MVCvvsd5w

Meet a Plant Physiologist - Grades 9-12 ↑
https://youtu.be/zeM0jAdiklw

Resource Sheets

Our education team has been in collaboration with USU Extension and Utah 4-H. We have published **six resource sheets** so far, with four more in press and eight more in progress. Share this site with your collegues, students, family, and friends, post them on your social media.

https://extension.usu.edu/utah4h/programs/gardening

Creating Sustainable School and Home Gardens:

- Create a Garden Anywhere
- Native Bee Homes
- Rain Barrels
- Raised Bed Gardening
- Vertical Gardening
- Welcoming Pollinators

Manuel Varela

Manuel, 26, from Mercedes, Argentina, grew up on his parents' farm, sparking his passion for agriculture and nature. He pursued Agronomy Engineering at the National University of Luján, graduating in 2023. During university, he became an assistant in the Conservation of Agricultural Systems course and later joined his city's Municipality Department of Agricultural Production.

Driven by a desire to gain expertise in sustainable production, Manuel engaged in research projects, internships, and postgraduate courses. He recently joined the Smart Foodscapes project, seeing it as a crucial initiative for developing knowledge aimed at sustainable farming. He believes that agricultural systems must aim to balance ecological viability with economic profitability to ensure a prosperous planet for future generations.

Tiago Retorto

Tiago Retorto, a 22-year-old Argentinean pursuing degrees in Agricultural Engineering at the National University of the Northwest Province of Buenos Aires and Agricultural Production at the University of Belgrano, brings a wealth of practical experience from a rural upbringing. His background includes hands-on work with Holstein cows in dairy farming and Hereford cattle in extensive beef production.

Currently engaged in researching the environmental impact of livestock, Tiago focuses on methane emissions and carbon footprint, exploring the potential of tannins to reduce emissions in animal diets. His academic journey and practical insights drive his passion for sustainable agricultural practices, aiming to innovate solutions for environmental challenges in livestock production.

Dr. Sebastian Lagrange

We are thrilled to announce that Dr. Sebastian Lagrange, a distinguished range scientist from Argentina, has joined our Smart Foodscape project as a visiting scholar. With a deep-rooted passion for sustainable livestock production, Dr. Lagrange brings a wealth of expertise to our team.

Hailing from the National Institute of Agricultural Technology (INTA) in Argentina, Dr. Lagrange's research has centered on harnessing the potential of tannin-rich legumes to improve livestock performance while reducing environmental impact. His previous work at Utah State University, where he earned his PhD in Range Science with a focus on Range Ruminant Nutrition, provides a strong foundation for his contributions to our project.

During his time at Richmond Research Farm, Dr. Lagrange will employ the SF6 technique to measure methane emissions from cows grazing meadow brome supplemented with condensed tannins. This research aims to demonstrate the efficacy of tannin supplementation in mitigating methane, a potent greenhouse gas, from ruminant livestock.

With over two decades of experience in ruminant nutrition and beef cattle production, Dr. Lagrange's insights will be instrumental in advancing our understanding of sustainable grazing systems. His proven track record in both research and extension will undoubtedly benefit our project and the broader agricultural community.

Questions? resha.whitaker@usu.edu