SMART FOODSCAPES

ISLANDS OF PERENNIAL LEGUMES AND FORBS

Feb 2025

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

National Institute of Food and Agriculture
U.S. DEPARTMENT OF AGRICULTURE

Research Update

Feb 2025

Dr. MacAdam's Work on Smart Foodscapes and Plant Species Testing

- **Plant Species Testing:** Dr. MacAdam conducted plant counts across several Utah locations (Cedar City, Panguitch, Ephraim, North Logan, and Clarkston) over multiple years. She collected data on yield and forage quality of seven of the most promising legumes and non-legume forbs as well as crested wheatgrass.
- **Native Shrubs Cultivation:** She cultivated **eight species** of native shrubs in greenhouse containers for transplanting: Alderleaf mountain mahogany, Antelope bitterbrush, Black sagebrush, Curlleaf mountain mahogany, Fourwing saltbush, Gardiner's saltbush, Shadscale saltbush, and Stansbury cliffrose. These shrubs are being hardened for transplanting at Godfrey Farm in Clarkston in fall 2024.
- **Upcoming Plans:** The study will expand by adding skunkbush sumac and yellow rubber rabbitbrush in the spring.

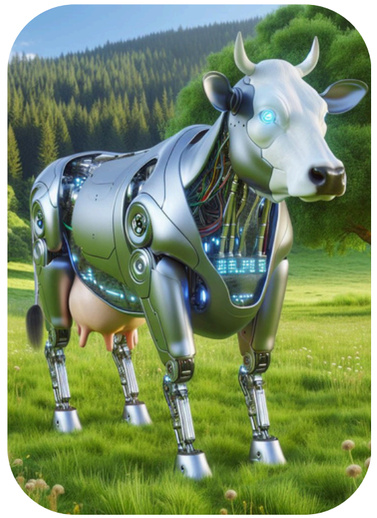
This research contributes to the development of smart foodscapes by testing various plant species and their performance in different locations, as well as cultivating native shrubs for further study.

In June, Dr. MacAdam participated in Bee Camp at Edith Bowen Lab School, educating elementary students about what we do to provide flowers for bees that will keep them healthy and provide food that they like at the right time and place.

10 *New species will be tested starting in 2025*

Shrubs play an important role in providing both structural and chemical diversity to animals' diets.

Dr. Gregorini's Research Update



- Dr. Gregorini's paper on Test Complementarities - Model MINDY has been accepted with moderate revisions by the Journal of Agricultural Science Cambridge.
- The modeling effort shows that higher legume inclusion (20% of the diet) increases secondary production and reduces environmental impact. When legumes are allocated monthly, this provides the lowest environmental impact per unit of animal production (kg LW and milk yield) and may be the easiest grazing strategy for farmers to manage, potentially boosting profitability.

Dr. Batistel's Research Update

- Dr. Batistel completed the continuous fermenter study and most statistical analysis. Microbiome data analysis is pending. This in vitro testing is based on candidates selected in Dr. Gregorini's in silico testing.

Research Update

Feb 2025

Dr. Villalba's Grazing Study

- **Study Design:** A study at the Richmond USU farm involved dividing a 55-acre pasture dominated by meadow bromegrass into six 9-acre paddocks, with three serving as control (grass-only) and three as treatment areas. The treatment paddocks were seeded with strips of five different forage species: alfalfa, birdsfoot trefoil, sainfoin, small burnet, and forage kochia. The establishment of these species was monitored in June 2024, with sainfoin showing the highest establishment rate at 96%, followed by forage kochia (61%), small burnet (54%), alfalfa (46%), and birdsfoot trefoil (12%).
- **Grazing Study:** Despite legumes and forbs being under establishment, we tested the effects of some of the legume bioactives by adding these chemicals to a supplement in a new grazing study. Black Angus cow-calf pairs were assigned to control or tannin-treated paddocks, with tannins added to a corn-based supplement. Key measurements included animal weights, activity levels, methane emissions, fecal and urine samples, and herbage biomass.
- **Preliminary Results:** No significant differences were shown in cow activity or biomass removal between treatments. However, blood urea nitrogen (BUN) levels decreased more in the tannin treatment group, suggesting **reduced ruminal proteolysis**. This study suggests that low levels of tannins in supplements may help improve nitrogen utilization in cattle grazing low-quality grass without affecting their grazing behavior or environmental impact.

Animals were sampled for blood, urine, feces, methane emissions, and rumen fluid.

Did you know?

The reason for wanting to **reduce ruminal proteolysis** is to improve the efficiency of protein use in cows. When proteins break down too quickly in the rumen, the cow may not be able to use all the resulting amino acids effectively. By slowing down this process, more protein can potentially reach the small intestine, where it can be absorbed and used more efficiently by the cow.

This approach **aims to improve the cow's nutrition** and potentially reduce the amount of protein needed in their diet, which could lead to **cost savings for farmers and reduced nitrogen waste in the environment**.

Methane Collection Equipment
for cow emissions being installed (top right) and canisters deployed in the field to measure background gases in the air (bottom right). These canisters are used to account for ambient gas levels when calculating emissions from cows equipped with similar canisters attached to halters.

Research Update

Dr. Dillon's Update on Smart Foodscapes Deployment to the Range

- Original plan to separate soil carbon (C) by organic matter (OM) pool was not feasible due to bulk densities. A **new sampling strategy has been adopted: "Space for time" approach**, re-sampling soils at project conclusion, grazed pastures serve as baseline, mineral-associated organic matter (MAOM) and particulate organic matter (POM) C will be compared between baseline and island treatments
- Differences in soil organic carbon (SOC) between baseline and islands will indicate carbon accrual over the experiment period.

This revised approach aims to measure the impact of Smart Foodscapes on soil carbon levels in rangeland environments.

Dr. Dahlgren's Research on Pollinators and Wildlife in Smart Foodscapes

- **Progress:** Vegetation has been fully established in plots, despite earlier climate challenges.
- **Upcoming Plans:** Motion cameras will be deployed for wildlife monitoring starting fall 2024, and pollinator monitoring will begin in 2025.
- **Wildlife:** The cameras have already captured various animals, including a coyote, mule deer, red fox, and white-tailed jack rabbit (shown below).

Extension Update

Feb 2025

Dr. Koontz's Cost-Benefit Analysis of Smart Foodscapes

- **Budget Development:** A new EPIC (Enterprise Profitability and Input Control) budget template tracks inputs, equipment, and costs for growing legumes and forbs in native pastures. You can access the decision tools here: https://abm.extension.colostate.edu/decision-tools/

- **Stochastic Partial Budget:** A stochastic partial budget is under development to assess the value of new forages relative to supplemental feeding needs. This model accounts for random variables such as weather, cattle performance, and fluctuating market prices (e.g., hay and calf prices). The goal is to quantify potential savings from reduced hay and feed purchases due to the availability of new forages.

- **Economic Optimization Model:** Progress is also being made on an economic optimization model for rotational grazing incorporating SFS forages. This model provides insights into the timing of rotations, paddock size, and the resulting costs and returns. Additionally, the model integrates carbon capture as a potential revenue stream, offering ranchers a supplementary income through carbon credits, alongside traditional revenue from cattle, haying, and other nontraditional goods and services.

This research aims to offer a detailed, long-term economic analysis of transitioning to SFS, providing ranchers with valuable tools to make informed decisions about forage management, grazing strategies, and the potential benefits of carbon capture.

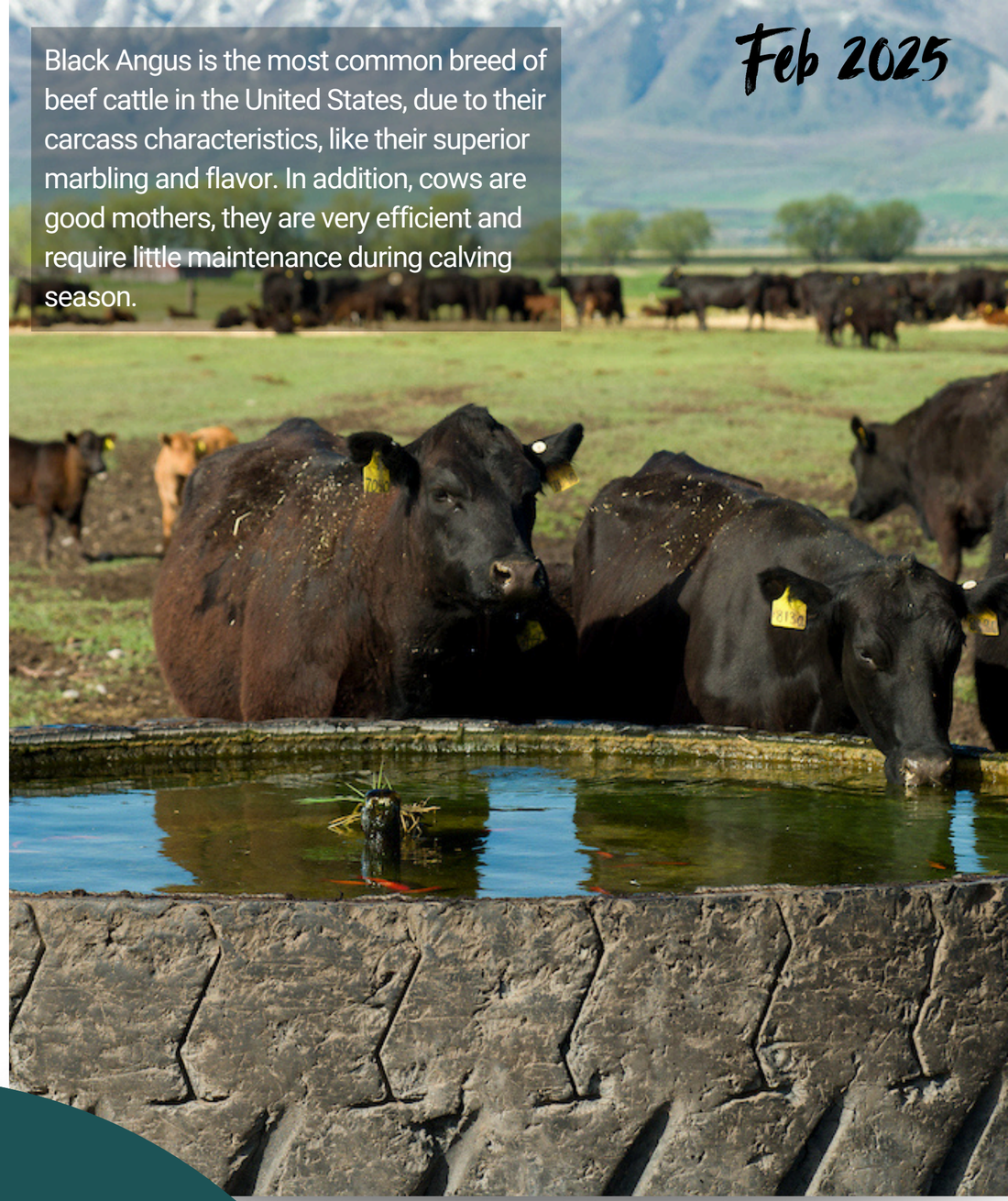
Extension Update

Dr. Schad and PhD research assistant **Zubair Barkat**'s progress on assessing adoption and perceptions of Smart Foodscapes:

- **Published Work:** Research note "Ranchers' Views of Smart Foodscapes: Applied and Methodological Insights" accepted in Rangeland Ecology & Management
- **Conference Presentations:** Presented survey results at the Rural Sociological Society meeting in Madison, Wisconsin (July) and submitted two abstracts for the 2025 Rangelands conference.
- **Manuscripts in Progress**

1. "Land, Legacy, and Livelihood: Beyond Dollars—How Senses of Place Influence Utah Ranchers' Economic Decision Making" (nearly ready for submission to Rangelands)
2. "Feminist Standpoint Theory Meets Rangeland Social Science" (nearing submission as a Viewpoint article to Rangelands)
3. "Nostalgia as a 'Red Thread': Linking Memory, Identity, and Land in the Sense of Place for Working Landscapes" (aimed for Society & Natural Resources)
4. "Leveraging Digital Discoveries: YouTube Content as Hidden Gems in Rangeland Social Science Research" (in early stages)

This research focuses on understanding ranchers' perceptions and adoption of Smart Foodscapes, utilizing various methodologies and exploring related sociological concepts.



Extension Update

Dr. Thacker and Mr. Palmer: Smart Foodscapes Demonstration Sites and Grazing School

Dr. Thacker and Mr. Palmer have made significant progress in their work with producers on Smart Foodscapes and demonstration sites. All demonstration plots have been **seeded**, and data collection is now underway.

- **Establishment Progress:** Initial visual checks were performed early in the summer, and later in the growing season, they revisited each plot to assess the establishment of various species and the abundance of weeds. This assessment was conducted using the **frequency grid method**, which estimates the percentage of seeded plants and weeds by counting the number of squares with plants within a grid placed at four locations within the seeded strip. Data from these assessments were compiled can be viewed in the table below.

Grand Average Establishment of Seeded Species and Weeds

Species:	Establishment (%)	Broadleaf Weeds	Grasses
Alfalfa	2.6	32.6	19.6
Sainfoin	41.6	46.3	15.4
Small Burnett	33	32.9	32.3
Cicer Milkvetch	0.5	54.5	45.5
Birdsfoot Trefoil	3	18	54

- **Grazing School:** On June 4-5, Dr. Thacker and Mr. Palmer hosted a **two-day grazing school** in Kaysville, Utah. The event featured **hands-on, experiential learning** with presentations on grazing science and pasture management, providing valuable education for local producers.

This update demonstrates progress in establishing and assessing smart foodscape demonstration sites, as well as efforts to educate producers through practical grazing schools.

Education Update

Feb 2025

Dr. Trundle's education team update on integrating smart foodscapes into school gardens and curricula:

Curriculum Development: Significant progress has been made to develop and finalize lessons for K-12 students and teachers.

- **Elementary:** 49 lessons completed, 1 in development: 15 arts, 6 citizen science, 10 mathematics, 18 science. Curriculum mapping and unit organization completed
- **Middle School:** 64 lessons in development and revision: 19 arts, 5 citizen science, 15 mathematics, 25 science
- **High School:** 66 lessons in development and review: 20 arts, 1 drama, 5 citizen science, 14 mathematics, 26 science

Research and Data Collection: Data were collected and analyzed from the elementary implementations. Data collection continues with middle and high school students.

Summer Camps: Elementary camps, where students learned about Smart Foodscapes, were hosted during the summers of 2023 and 2024. Camps are planned for middle and high school students during the summers of 2025 and 2026.

Ongoing Work: The team continues work on proposals for three children's book that focus on soil health, pollinator conservation, and sustainable beef production.

The team’s comprehensive approach integrates smart foodscapes into school curricula, combines research with practical implementation, and includes outreach through summer camps and professional development.

Education Update

Feb 2025

The team has produced 10 total career videos, with four new additions that spotlight two of our scientists. The collection includes two versions of each video- one that targets a younger audience (grades K-8) and one that targets an older audience (grades 9-12). These videos are available on the USU Quinney College of Natural Resources QCNR YouTube channel.

4 New Career Videos

Dr. Eric Thacker, Rangeland Extension Specialist

Dr. Juan Villalba, Rangeland Scientist

Dissemination Activities

Presentations and Publications

- Surbhi will present results from a replicated study on forage quality of various plants conducted at Clarkston in summer 2023.
- Nine research publications were published or in press in 2024 by Villalba's team.
- Three congress presentations, one invited presentation, and one lecture were also conducted by the research team.
- One conference presentation and one accepted publication by Dr. Schad.
- The education team published a book chapter and multiple journal articles (5 in print, 1 in press, 1 in review).
- In 2024, the education team conducted five research conference presentations, 13 practitioner conference presentations, one research conference keynote address, and four invited talks. The team has seven research and four practitioner presentations planned for 2025.

Meetings Hosted

- Smart Foodscapes Annual Meeting held from May 21-23, 2024.
- Researchers shared information at the Canyonlands Research Center science meeting.

Online Dissemination

- Two newsletters were disseminated in February and September 2024.
- The project website is continually updated with a new "Publications" section currently listing 28 publications.
- Eleven resource sheets for teachers and families are published on the Utah 4-H Extension website, with two additional in press.

Extension Activities

- A written summary was distributed to producers involved in the project.
- Further extension materials will be published when more data is gathered.

28 Publications Published

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

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Let's Nurture the Earth for Generations to Come.

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

You can find this publication on our news page or by googling USU Smart Foodscapes Newsletter 2025

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