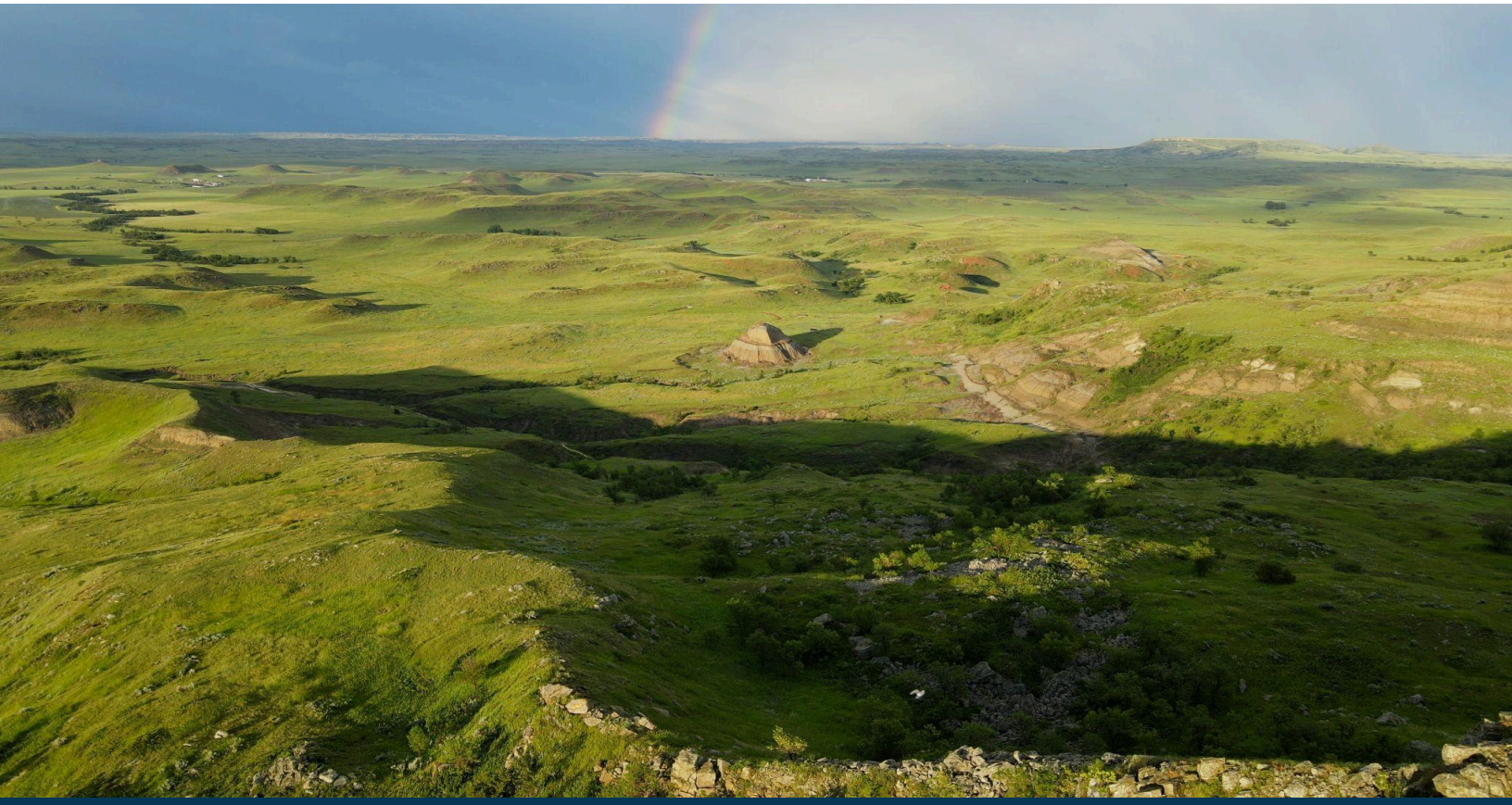
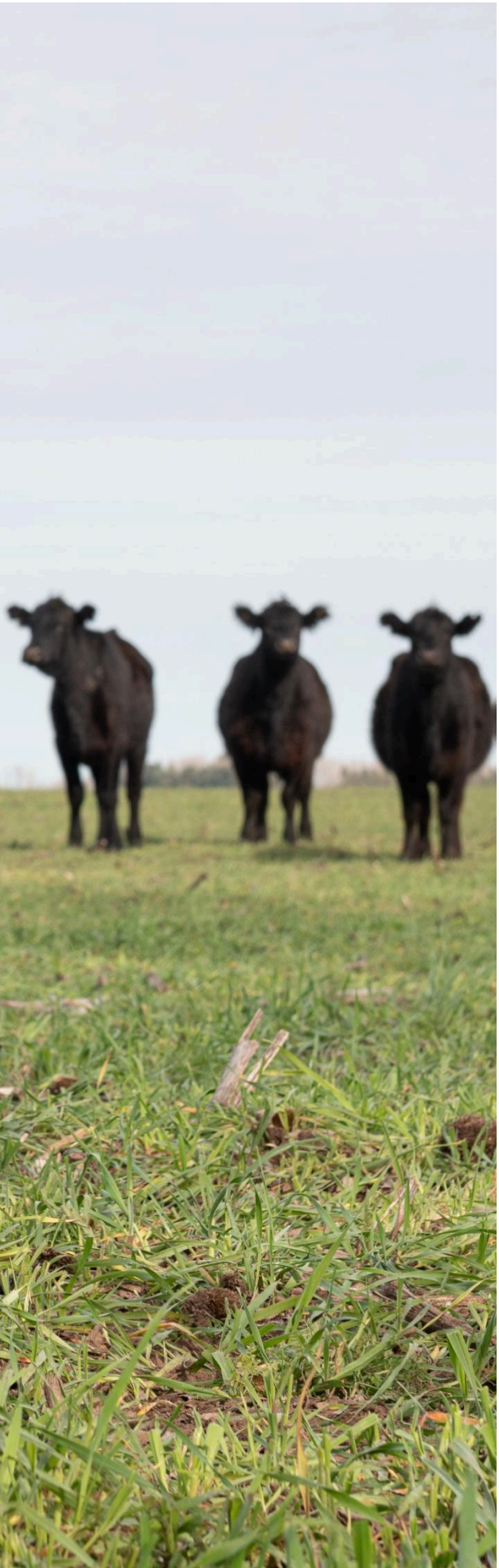
Innovating Sustainability:
A Blueprint for Carbon-Smart Beef Product

A proof of concept to develop and track carbon credits within the beef supply chain

May 2024





Executive Summary

EcoBalance Global's proof of concept at the Open A Angus Ranch represents a significant advancement in sustainable agriculture, focusing on the creation of EcoSmart beef through innovative carbon management and regenerative grazing practices. This project, strategically located at the border of North Dakota and Montana, commenced in 2022 and involved 108 head of cattle. Each animal was meticulously tracked from birth using advanced GPS ear tags provided by 701x, ensuring precision and consistency in data collection.

Core Outcomes of the Pilot Project

- **Creation of EcoSmart Beef:** Central to the project was the production of EcoSmart beef, achieved through a comprehensive framework that integrates soil carbon storage into the beef supply chain. This product not only meets high environmental standards but also sets a new benchmark for product quality and sustainability in the industry.
- **Foundation for Carbon Credit and Risk Management:** The project successfully demonstrated the capability to develop, track, and manage carbon credits within the beef supply chain. This foundation is critical for expanding EcoBalance Global's reach into other commodities and enhancing carbon credit-risk management strategies.
- **Regenerative Grazing and Enhanced Soil Carbon Storage:** By implementing regenerative grazing plans crafted by expert land managers and soil scientists, significant improvements in soil health were achieved. These practices increased soil organic carbon, enhancing the land's resilience and sustainability.
- **Robust Tracking and Verification System:** Utilizing cutting-edge geospatial AI and blockchain technology, the project ensured precise tracking and third-party verification of carbon credits and beef products. This system guarantees the integrity of the product claims, providing transparency and confidence to consumers and stakeholders.

This proof of concept has successfully demonstrated that sustainable ranching practices, integrated with advanced technology, can result in high-quality beef products that are environmentally responsible. The insights and methodologies developed through this project lay a robust foundation for expanding these practices across other commodities, setting the stage for broader applications in sustainable agriculture and carbon management. This white paper details the processes undertaken, the results achieved, and explores the potential for scaling these innovations globally.

Introduction

Global risks and value potential in grasslands

Temperate grasslands represent one of our most important natural resources, spanning approximately 40% of the land surface of the earth. These lands are vital for providing goods and services such as: preserving native wildlife habitat, reducing water and sediment runoff, purifying water, promoting recreational activities, and supporting traditional ranching economies. Grasslands and savannas harbor nearly as much biodiversity as rainforests.[1] It is estimated that only half of original grasslands in the Great Plains remain intact today, with an annual two percent loss by conversion to cropland.[2] Due to tillage and heavy industrial fertilization practices, more than 75 billion tons (Pg) of soil are eroded every year from arable lands worldwide.[3] There are also environmental concerns on grasslands, with the GHG emissions associated with current traditional management practices for grazing livestock, such as cattle.[4]

Nevertheless, global agricultural soils can remove more than one billion tons of CO_2 from the air annually and store it as biomass and soil organic carbon.[5] If managed regeneratively, some researchers estimate that grasslands have the potential to store thirteen billion tons of carbon per year.[6]

Carbon accounting at the ranch scale for grazing lands includes measured emissions, measured sequestration, and modeled avoidance. Typically, carbon accounting on a ranch consists only of measuring emissions.[4] However, grazing lands sequester carbon from plant and microbial activity as soil organic matter (SOM) in the form of dissolved organic matter, mineral associated organic matter, and particulate organic matter.[7] When combining the emissions and sequestration, grasslands with properly managed grazing by cattle have the potential to be carbon negative.[8] In the United States, it is estimated that grazing lands that implement regenerative grazing techniques sequester 0.3 tC/ha (0.5 tCO_{2e}/acre) per year.[9]

[1] Murphy, B. P., Andersen, A. N., & Parr, C. L. (2016). The underestimated biodiversity of tropical grassy biomes. Phil. Trans. R. Soc. B, 371(1703), 20150319.
[2] https://www.worldwildlife.org/projects/plowprint-report
[3] Borrelli, Pasquale, et al. "An assessment of the global impact of 21st century land use change on soil erosion." *Nature communications* 8.1 (2017): 2013.
[4] https://www.fao.org/news/story/en/item/197623/icode/
[5] https://climate.mit.edu/explainers/soil-based-carbon-sequestration
[6] https://bio4climate.org/article/grasslands/
[7] Cotrufo, M. Francesca, and Jocelyn M. Lavallee. "Soil organic matter formation, persistence, and functioning: A synthesis of current understanding to inform its conservation and regeneration." *Advances in agronomy* 172 (2022): 1-66.
[8] Frank, A. B. “Six Years of CO2 Flux Measurements for a Moderately Grazed Mixed-Grass Prairie.” Environmental Management 33, no. 1 (2004): S426–31.
[9] Bai, Yongfei, and M. Francesca Cotrufo. “Grassland Soil Carbon Sequestration: Current Understanding, Challenges, and Solutions.” Science 377, no. 6606 (August 5, 2022): 603–8.

Over 70% of the world's grasslands have been converted to agriculture, primarily row-cropping.[10] However, row cropping typically involves tillage, fertilizer application, and pesticide application that reduce biodiversity, oxidize and release SOM carbon, reduce soil biota, and exacerbate soil degradation.[11] In the Upper Great Plains of the United States, it is estimated that over a twenty year period, 35.6 tCO_{2e}/ha, or 14 tCO2e/a, have left the soil and entered the atmosphere after correcting for leakage and uncertainty.[12]

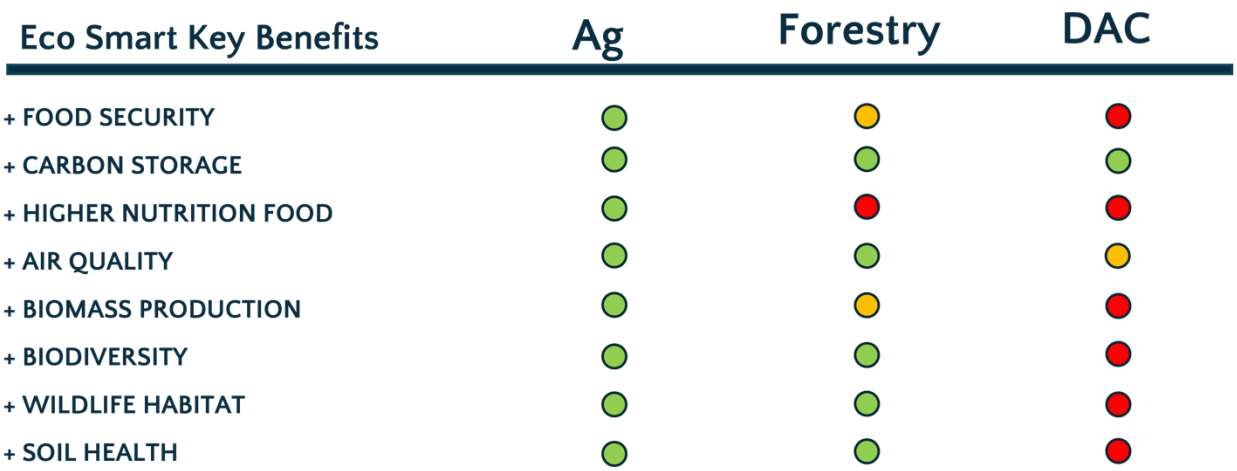


Figure 1: Agricultural carbon storage projects stack myriad benefits for food production and environmental quality when compared with forestry and direct air capture (DAC)

[10] Foley, Jonathan A., Navin Ramankutty, Kate A. Brauman, Emily S. Cassidy, James S. Gerber, Matt Johnston, Nathaniel D. Mueller, et al. "Solutions for a Cultivated Planet." Nature 478, no. 7369 (October 2011): 337–42.
[11] Six, Johan, Christian Feller, Karolien Denef, Stephen Ogle, Joao Carlos de Moraes Sa, and Alain Albrecht. "Soil Organic Matter, Biota and Aggregation in Temperate and Tropical Soils - Effects of No-Tillage." Agronomie 22, no. 7–8 (2002): 755.
[12] Ahlering, Marissa, Joseph Fargione, and William Parton. "Potential Carbon Dioxide Emission Reductions from Avoided Grassland Conversion in the Northern Great Plains." Ecosphere 7, no. 12 (2016): e01625.

Unlocking the role of cattle in responsible land management

Beef is oft maligned in the media and environmental groups who are concerned with ruminant emissions associated with livestock cultivation. While there is certainly room for improvements in traditional beef production systems, this perspective misses a crucial piece of the puzzle: The potential of well-managed grasslands and adaptive grazing practices to mitigate, and in some cases, reverse these impacts.

The underlying logic is grounded in the basic principles of photosynthesis, where carbon dioxide is absorbed by plants and allocated equally between above-ground biomass and root systems. Regenerative grazing practices, such AMP, optimize this natural process by maintaining soil cover and preserving perennial root systems year after year, enhancing the soil's carbon storage capacity. This type of ranch management has been dramatized by Woody Harrelson and others in the recent documentary "Kiss the Ground"[13].

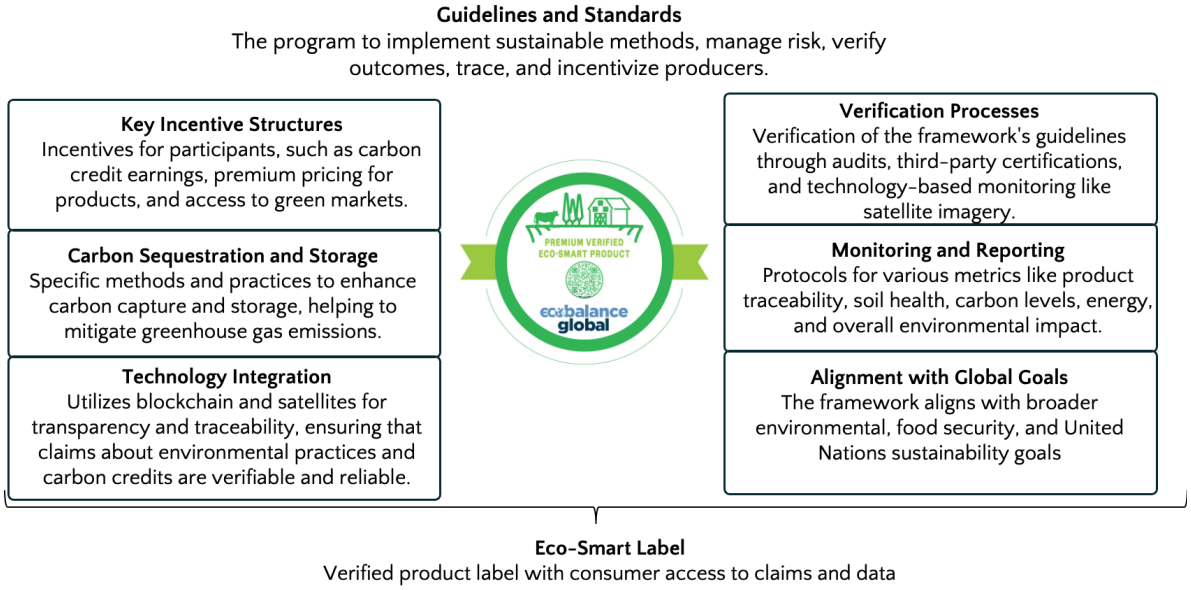
Beyond environmental, there are human health benefits associated with consuming beef that spends more time on grazing grasslands. Grass-fed beef contains up to five times as much healthy omega-3 than grain-fed beef,[14] higher vitamin content,[15] and more. Beef is also one of the most nutrient dense foods with around twice the caloric content by weight compared with rice and beans and is well known as an excellent source of B12 and iron.

Finally, the beef industry in the United States has decentralized production and a dynamic, complex supply chain with multiple points of transfer and verification. This makes for an excellent case study to test our ability to integrate sustainability certifications with traceability from cradle to grave with our Framework and Enterprise software.

[13] https://kissthegroundmovie.com/
[14] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8728510/
[15] https://understandingag.com/nutritional-comparisons-between-grass-fed-beef-and-conventional-grain-fed-beef/

Objective

The objective of this proof of concept was to demonstrate a flexible Framework to incentivize responsible land management and provide sustainability customers with proof of sustainable development through third party verification and certificates. It will show that our software platform and team are robust enough to trace products through the beef supply chain and manage a carbon credit portfolio.



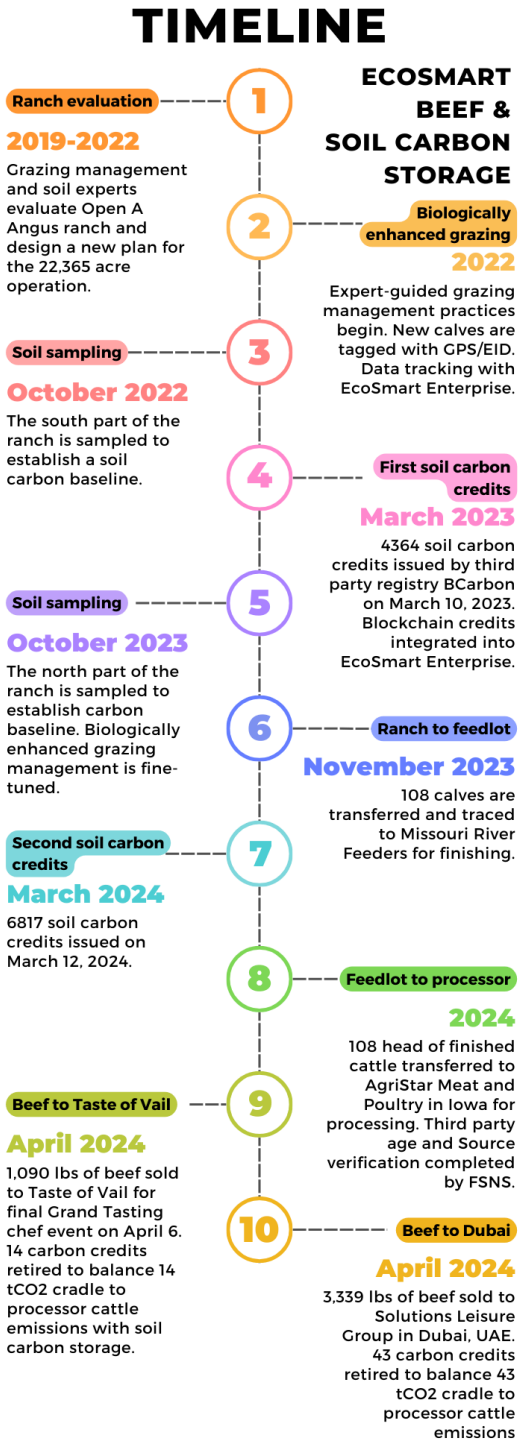
Scope of Document

This Carbon Inset Product Protocol combines established best practices for greenhouse gas emissions accounting with ground-truthed advancements in geospatial artificial intelligence for monitoring both the surface and subsurface of grassland soils. The BCarbon methodology[16] used for carbon credits accounts for soil organic carbon accrual using a ground-truthed geospatial digital twin of the lands involved. Rolling annual accounting is used to generate a carbon balance sheet for each head of livestock being born on, entering, grazing and ultimately leaving a certified ranch.

[16] BCarbon Soil Carbon Protocol, Version 2, Section C.2

Project Overview

What was done



2019-2022: Ranch Evaluation and Planning

A collaborative effort between grazing management experts and soil scientists led to the evaluation and redesign of the Open A Angus ranch. This 22,365-acre operation was analyzed to develop an improved plan for sustainable ranching and soil carbon storage.

2022: Biologically Enhanced Grazing Commences

In 2022, a new era began for the ranch with the introduction of expert-guided, biologically enhanced grazing practices. The birth of new calves marked a pivotal moment in the ranch's transformation, with advanced GPS/EID tags used for precise monitoring and data collection in partnership with EcoSmart Enterprise.

October 2022: Soil Sampling for Baseline Data

The south part of the ranch became the focus for establishing a baseline of soil carbon levels, a critical step in measuring the impact of the project's regenerative practices over time.

March 2023: First Soil Carbon Credits Awarded

Recognition of the ranch's pioneering efforts arrived in March 2023, when the first soil carbon credits were issued, indicating a positive shift in the ranch's environmental impact. This milestone was recorded in the BCarbon registry on March 10, 2023, and secured by blockchain technology.

October 2023: Extended Soil Sampling

Expanding the scope, the north part of the ranch

underwent soil sampling to ascertain the carbon baseline. This data further refined the effectiveness of the biologically enhanced grazing management.

November 2023: Cattle Transition to Feedlot

A significant transition occurred in November 2023, as 108 calves were transferred to Missouri River Feeders for finishing, symbolizing the next phase of the beef supply chain.

March 2024: Second Round of Soil Carbon Credits

By March 2024, the project's efforts bore fruit again with the issuance of 6,817 soil carbon credits, a testament to the sustained commitment to regenerative practices and environmental stewardship.

2024: From Feedlot to Processor

The year 2024 also saw 108 head of cattle move from feedlot to processor, ensuring that the cycle of sustainable beef production was maintained through to the end product.

April 2024: Beef to Taste and Global Distribution

In April 2024, the project reached a culinary milestone at the Beef to Taste of Vail event, with 1,090 lbs of beef showcased. Furthermore, a significant international transaction occurred, with 3,339 lbs of beef sold to Solutions Leisure Group in Dubai, UAE, demonstrating the global appeal and market for sustainable beef.

The detailed sequence of events laid out in this timeline demonstrates a successful proof of concept for soil carbon storage and EcoSmart protein within the beef supply chain. Through rigorous planning, implementation, and tracking, the project has set a precedent for environmental responsibility in agriculture.

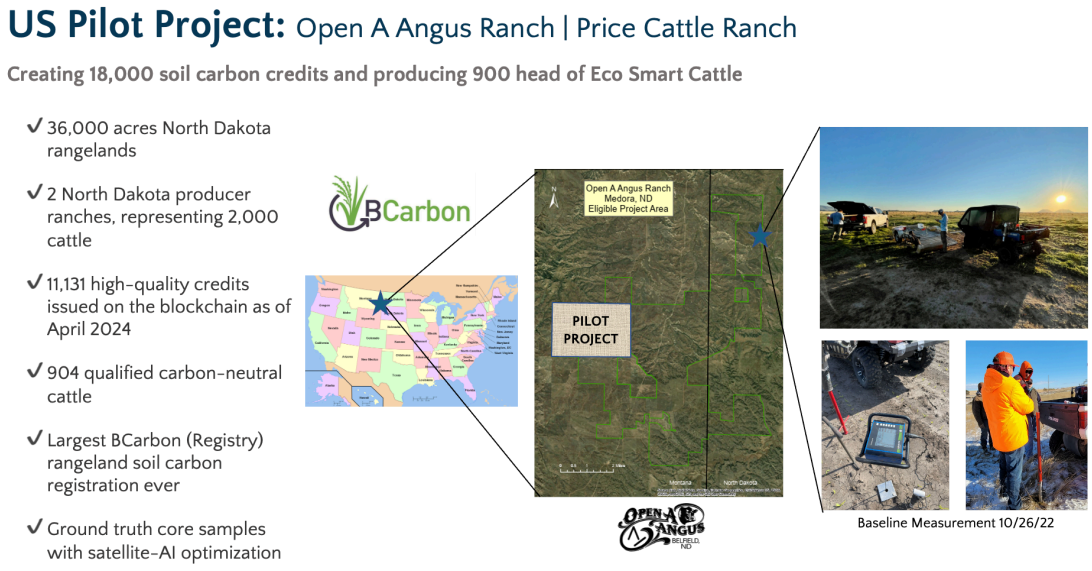


Figure 2: Soil sampling and carbon credit development

Sustainable Beef Supply Chain Model

In our completed EcoBalance project, we successfully implemented a closed-loop system for the production and distribution of EcoSmart beef, integrating soil carbon storage into every step of the supply chain. The following summarizes the process, as depicted in the attached figure:

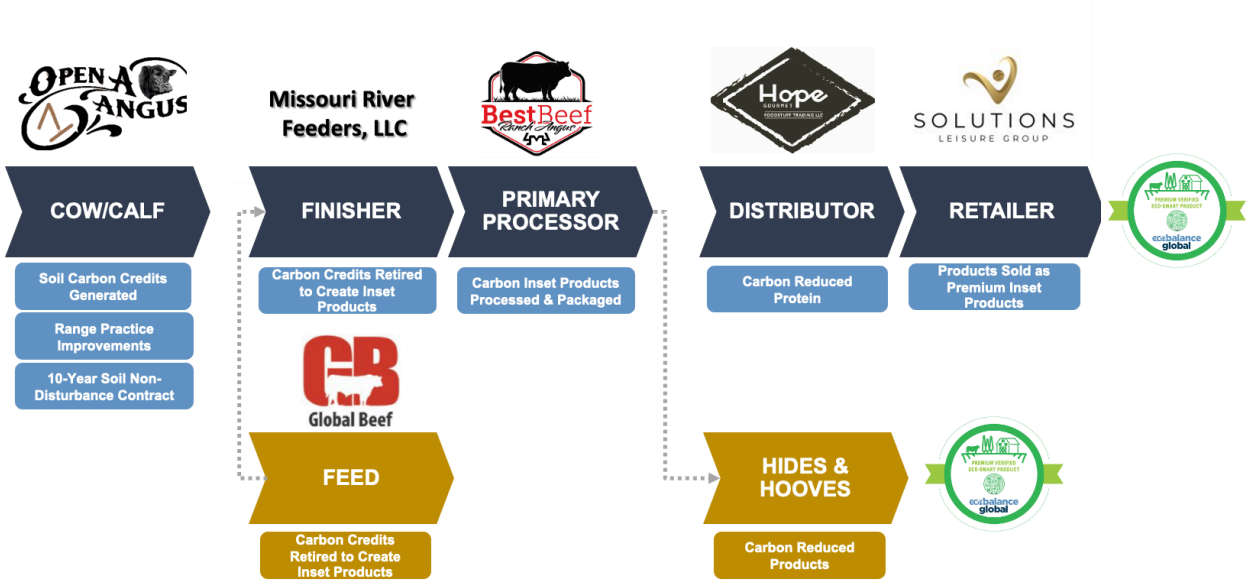


Figure 3: EcoSmart beef supply chain and certification

Cow/Calf Stage (Open A Angus Ranch)

The journey began at the cow/calf stage with Open A Angus Ranch, where soil carbon credits were generated through the implementation of regenerative grazing practices. These practices were verified and monitored by partners including EnvirometriX and the Food Water Wellness Foundation, ensuring that the soil improvements were quantifiable and significant. A long-term commitment was solidified through a 10-Year Soil Non-Disturbance Contract, signaling dedication to maintaining soil health and maximizing carbon sequestration.

Finishing Phase (Missouri River Feeders)

As the cattle transitioned to the finishing phase with Missouri River Feeders, carbon credits were strategically retired to create premium inset products. This process validated that the environmental impact of these products was neutralized within the supply chain, enhancing their market value as sustainably produced.

Processing and Distribution

Following this, the primary processor, which could be aligned with Best Beef, took over to process

and package the carbon inset beef products. These were then passed to the distributor, Hope Gourmet, who ensured the carbon-reduced protein products reached their destination. The Solutions Leisure Group, a retailer with a global footprint, finalized the chain by offering these premium inset products to consumers, who are increasingly seeking environmentally responsible options.

Additional Product Streams

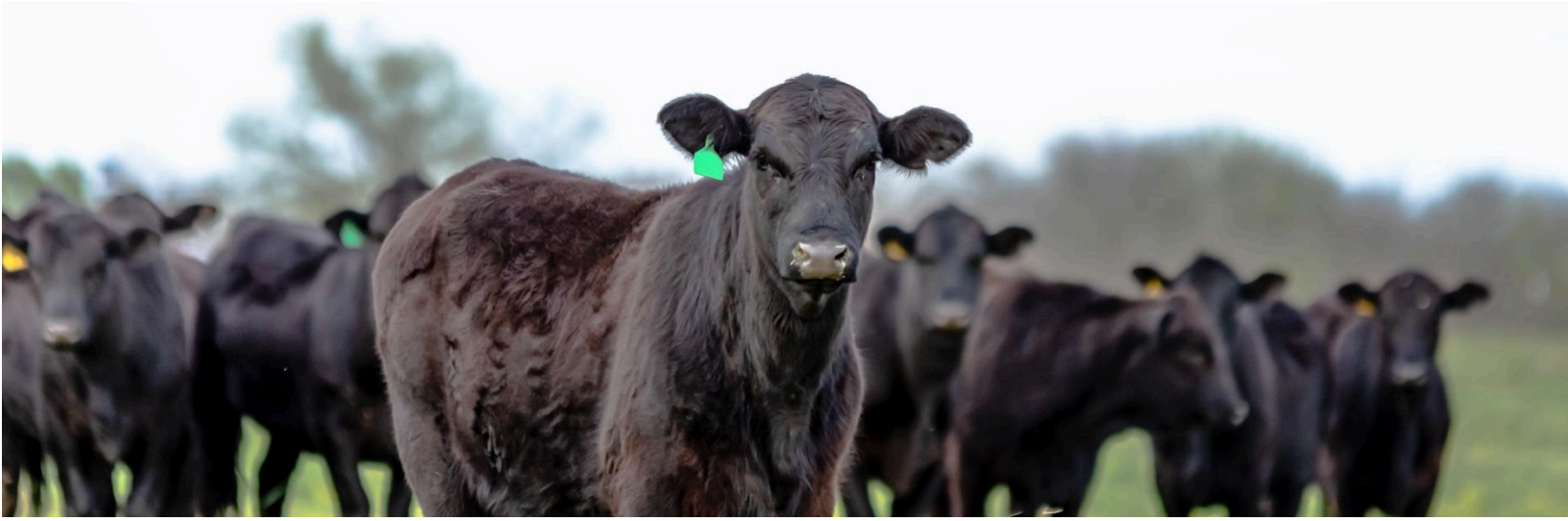
Furthermore, the project encapsulated sustainability in the utilization of by-products. Hides and hooves qualified for carbon-reduced products, demonstrating our commitment to waste reduction and full-circle resource use.

Integration and Verification

Integral to this process was the blockchain integration and tokenization provided by STE Solutions, which ensured traceability and transparency throughout the chain. The GPT-developed EcoBalance Framework served as the technological backbone, enabling robust management of the supply chain and carbon credit data. BCarbon's role as a third-party verified carbon credit registry was crucial in maintaining the integrity and trust in the carbon credits generated and retired throughout the project.

Summary

This EcoBalance initiative has not only shown a reduction in the carbon footprint of beef production but also established a scalable model for other supply chains seeking to enhance their environmental responsibility. The successful implementation of this project is a testament to the collaborative efforts of all partners involved and serves as a beacon for future sustainable agriculture endeavors.



EMISSIONS

Eco Smart Framework SDG Value Streams

Food Security
Drought resilience, increased production, water quality

Carbon Storage
Enhanced photosynthetic surface, deeper roots, soil organic carbon formation

Higher Nutrition Food
Healthier grass, timed grazing with native grasses

Air Quality
Dust capture, reduced surface temperature, lower BVOC emissions

Biomass Production
Timed grazing stimulates growth and preserves perennial grasses

Biodiversity
Native grasslands have huge variety of plant species

Wildlife Habitat
Preservation of prairies for birds, Soil health

In a ranch to feeder to packer value chain, cattle emissions primarily arise from two sources: enteric fermentation and manure management. Enteric fermentation refers to the digestive process in the cattle's rumen, where microbes break down feed and produce methane (CH_4) as a byproduct, which is a potent greenhouse gas. Manure management involves the decomposition of cattle waste, which also generates methane emissions, although this decomposition process is much different when distributed over grass than in a feedlot system.

Regenerative ranching practices aim to mitigate and offset these greenhouse gas emissions by implementing sustainable land management techniques. These practices focus on improving soil health, biodiversity, water quality, drought resistance, and carbon sequestration. By adopting regenerative practices such as rotational grazing, cover cropping, and conservation tillage, ranchers can enhance the health and carbon content of the soil. Healthy soil acts as a carbon sink, sequestering atmospheric carbon dioxide (CO_2) and reducing the net greenhouse gas emissions.

When properly implemented, regenerative ranching practices have the potential to sequester enough carbon to offset the greenhouse gas emissions generated in the cattle production process. By maximizing carbon sequestration in soils and enhancing ecosystem resilience, regenerative ranching contributes to a more sustainable and climate-friendly beef industry.

In a landmark study funded by the USDA, Rotz et al., calculated that operations associated with raising a calf from cradle to ranch gate equates to on average 18.5 kg CO_{2e} per kg dressed weight, and farm gate to consumer is 6.1 kg CO_2 per kg edible beef. In other words, on average a head of beef cattle raised in the United States emits approximately 8.4 tons CO_{2e} from farm to table.[17]

[17] Asem-Hiablie, S.; Battagliese, T.; Stackhouse-Lawson, K. R.; Alan Rotz, C. A Life Cycle Assessment of the Environmental Impacts of a Beef System in the USA. Int J Life Cycle Assess 2019, 24 (3), 441–455. https://doi.org/10.1007/s11367-018-1464-6.

Putman, Rotz, and Thoma later went on to update the GHG footprint from farm to U.S. consumer of 42.7 kg CO_2 per kg of consumed beef in 2023. [18] This number is lower than WWF's "79 to 101" kg carbon dioxide per kg of consumed beef[19] better encompasses the US supply chain. Note that these numbers do not include soil carbon storage and were not intended to be used in isolation.

Cotrufo et al. report that on average, grazing land in the United States accrues 0.5 tCO_{2e} per acre-year in the top 30 cm.[20] Therefore, with implementation of regenerative grazing practices and a soil inventory stock is taken, verified carbon credits from the same land may be used to "inset" the emissions of a head of cattle.

[18] Putman, Ben, C. Alan Rotz, and Greg Thoma. 2023. "A Comprehensive Environmental Assessment of Beef Production and Consumption in the United States." Journal of Cleaner Production 402 (May): 136766. https://doi.org/10.1016/j.jclepro.2023.136766. https://www.sciencedirect.com/science/article/pii/S0959652623009241

[19] https://www.worldwildlife.org/publications/measuring-and-mitigating-ghgs-beef

[20] Cotrufo, M. Francesca, and Jocelyn M. Lavallee. "Soil organic matter formation, persistence, and functioning: A synthesis of current understanding to inform its conservation and regeneration." *Advances in agronomy* 172 (2022): 1-66.

The Framework for livestock

In order to achieve this, the Framework for “insetting” carbon credits into a livestock related product entails the following:

1. **Enrollment** of ranches with contracts and clear geospatial boundaries.
2. **Blockchain supply chain and carbon credit management** for holding and tracking data, billing, trading, deal entry, and blockchain to connect products with carbon credits.
3. **Verification** for traceability, enrollment, shipments, and products.
4. **Third party registries for carbon credits** with soil carbon methodologies and training for implementation of regenerative grazing practices that are additional and have positive impact on the land.
5. **Product carbon footprint** standards using tier 2 scope 3 data created with USDA/university partnerships.
6. **Clear product definitions**

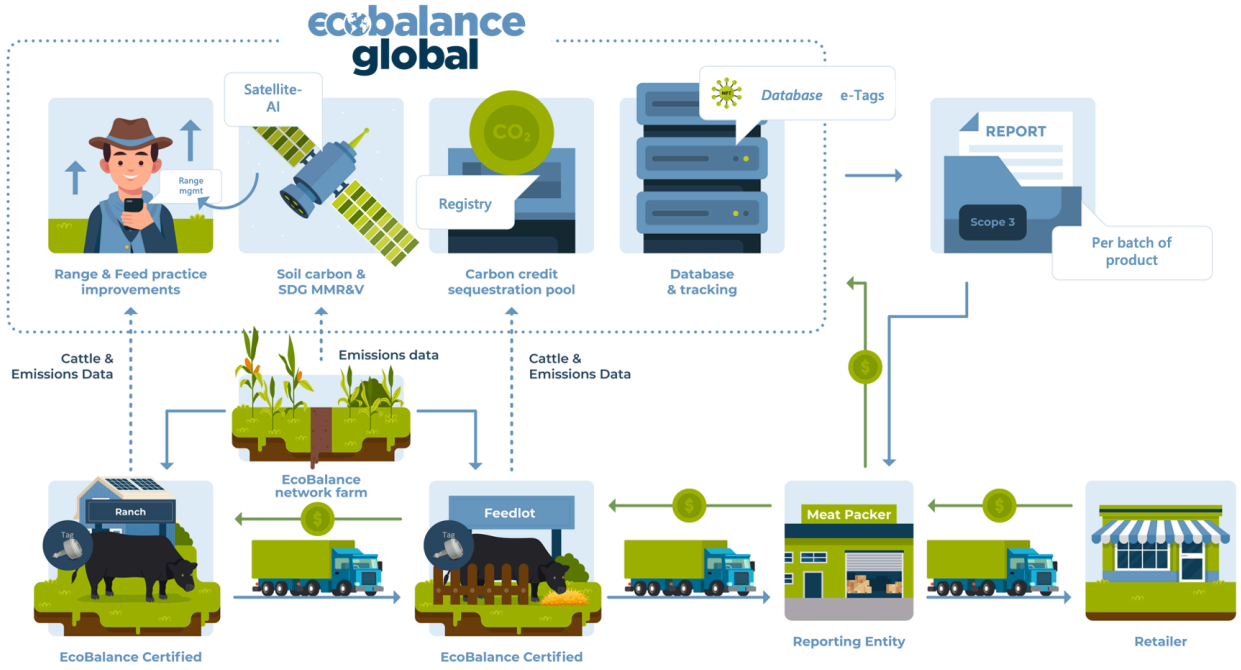


Figure 4: How EcoBalance executes carbon “insetting” to balance cattle emissions with soil carbon storage

Carbon Insetting vs Offsetting

Carbon offsetting is balancing emissions by purchasing carbon credits from outside of a product's supply chain. Carbon insetting occurs when carbon is sequestered inside of a product's supply chain in a way that is transparent and verifiable, typically through carbon credit registries and source verification.

For products which involve carbon sequestration, carbon credit retirement will occur within 90 days of product end-of-life.

Framework for soil carbon storage certification

1. Project Start:

The cycle begins with the project's initiation phase. This includes the creation of a grazing management plan, the design of the project, and the documentation of these processes. The first soil sampling (baseline #1) is conducted to establish the initial state of soil carbon stocks, which is necessary for future comparisons. Once these steps are completed, an application is made with a carbon credit registry to potentially generate carbon credits based on the anticipated improvements in soil carbon sequestration.

2. First Follow-Up:

Following the project start, the first follow-up phase involves a review of the grazing management practices. Documentation is updated to reflect any changes or results from the initial implementation, and a report is submitted to the carbon credit registry. This reporting is crucial to track the project's progress and validate the efficacy of the regenerative practices in enhancing soil carbon.

3. Second Follow-Up:

The cycle continues with another round of follow-up on grazing management. During this phase, the documentation is again updated with the latest practices, observations, and any adjustments made. The results are reported to the carbon credit registry for continued tracking and verification of soil carbon improvements.

4. Third Follow-Up:

This phase is similar to the previous follow-ups, where the ranch continues to monitor and document the grazing management practices and their outcomes. Updated information is once more reported to the carbon credit registry.

5. Re-sampling and Restart Cycle:

At the end of the 5-year cycle, a re-sampling of the soil is conducted. This step is vital to assess the changes in soil carbon stock and to compare it with the baseline established at the project's start. Based on this data, grazing management practices may be fine-tuned, and the documentation is updated accordingly. Results from the re-sampling are reported to the carbon credit registry, which may lead to the issuance of new or additional carbon credits based on verified increases in soil carbon.

The cycle then restarts, allowing for continuous improvement and adaptation of practices based on the data collected and lessons learned throughout the previous cycle.

Partners

BCarbon: Third party verified carbon credit registry

Best Beef: Beef supply chain and sales

EnvirometriX: Satellite soil modeling and monitoring

Food Water Wellness Foundation: Soil and range science advisory

Global Beef: International beef supply chain expertise

GPT: Developer of platform for the EcoBalance Framework

Hope Gourmet: UAE beef distribution

Missouri River Feeders: Feeding and finishing

Open A Angus Ranch: Primary cattle producer

Solutions Leisure Group: Restaurant group with global footprint

STE Solutions: Blockchain integration and tokenization

Results and Analysis

Grazing management continual improvement

At the heart of every EcoBalance Global land management project is implementation of improved practices. In this case, Grazing Land Solutions LLC provided the Open A Angus Ranch with a grazing management plan designed to improve soil health, cattle health, and profitability. From 2019-2021, the land was carefully inventoried to identify fencing, water, and cattle health. Infrastructure improvements were made to accommodate Adaptive Multipaddock Grazing using a subspecies called “Twice-over grazing” which is tailored to the Upper Great Plains climate in North Dakota.

In order to clearly communicate performance and record additionality, a grazing index scoring calculator was developed by EcoBalance’s range and soil scientists in 2022. Below is an example of one herd, “West Kramer”, which has 200 cow-calf pairs that rotate around 12 distinct pastures. Details on this herd are shown below, along with grazing scores for 2022 and 2023.

Ranch Name	Open A Angus		Herd Name	State Line Mature AI Cows		Average Weight of Livestock	1300	Animal Unit:	1.20	Number of Head:	200	Date:	1/26/23		
Type of Graz System:	2022 Actual 2X Over TTT		Number of times Pastures are Grazed each year:	2	Grazing Start Date:	7-May	Grazing End Date:	1-Dec	Total Herd Days:	208	Ave Annual Precipitation for your area/'t:		14		
Pasture Number or Name	Acres	Forage Type	Type of Livestock	Animal Unit Equivalent	Total Animal Units (AU)	Rating of Livestock Water Quantity & Quality (1 - 10) 1 =Poor, 10 Excellent (See Note on last two score boxes)	How Long do you Graze each pasture? (Total Days/year)	Total Grazing Days (GD)	Grazing Days per Acre (GD/Ac)	Animal Unit Months Per Acre (AUM/AC)	Average Stock Densities Ac/AU	Percent of Pasture grazed due to Densities	% Use on Key Species	Potential to Rebite Regrowth:	
5E SB/CW/Hu Rng	144	Cool Season Tame	Cow/Calf Pr	1.20	240.0	10.0	9	2160	15	0.49	0.60	75%	40%	0.3	
5W SB/CW/Hu Rng	210	Cool Season Tame	Cow/Calf Pr	1.20	240	10.0	17	4080	19	0.64	0.88	75%	40%	0.6	
2NW Range	141	Native Range	Cow/Calf Pr	1.20	240	10.0	8	1920	14	0.45	0.59	75%	40%	0.3	
2S Range	274	Native Range	Cow/Calf Pr	1.20	240	10.0	9	2160	8	0.26	1.14	65%	40%	0.3	
7N Range	459	Native Range	Cow/Calf Pr	1.20	240	10.0	23	5520	12	0.39	1.91	65%	40%	0.8	
8 Range	650	Native Range	Cow/Calf Pr	1.20	240	10.0	26	6240	10	0.31	2.71	60%	40%	0.9	
7S Range	406	Native Range	Cow/Calf Pr	1.20	240	10.0	19	4560	11	0.37	1.69	65%	40%	0.6	
15 Range/CW	706	Native/Tame Introduced	Cow/Calf Pr	1.20	240	10.0	27	6480	9	0.30	2.94	60%	40%	0.9	
Corrals at Justins Home	200	Cool Season Tame	Cow/Calf Pr	1.20	240	10.0	16	3840	19	0.63	0.83	75%	40%	0.5	
16 Range/CW	331	Native Range	Cow/Calf Pr	1.20	240	10.0	15	3600	11	0.36	1.38	65%	40%	0.5	
17 Rng/SB/CW	280	Native/Tame Introduced	Cow/Calf Pr	1.20	240	10.0	13	3120	11	0.37	1.17	65%	40%	0.4	
9 Range	526	Native Range	Cow/Calf Pr	1.20	240	10.0	26	6240	12	0.39	2.19	60%	40%	0.9	
	4327	Native Range		1.20	240.0	10.00	17	49920	12.6	5.96	1.50	0.67	40%	0.58	

Figure 5: West Kramer herd and pasture details with “2X over TTT” (twice over grazing, or AMP)

The table is divided into several categories that are crucial for evaluating the biological enhancement of a grazing system. Each category has defined criteria with a scoring system that classifies practices as 'Good', 'Bad', or 'Ugly', each associated with a numerical score. The categories and their respective focus areas include:

- **Moisture Management**: Evaluates soil moisture retention capabilities influenced by grazing management, focusing on soil moisture retention and temperature moderation.
- **Solar Energy Absorption**: Measures how effectively the pastures utilize sunlight, which is critical for photosynthesis and biomass production.
- **Plant Diversity**: Assesses the variety of plant species present, which contributes to a robust and resilient ecosystem.
- **Soil Quality**: Looks at factors such as the presence of rhizosphere on roots, nutrient cycle, and organic matter depth, which are indicative of soil health.
- **Nutrition**: Concerns the quality of forage available to livestock, which affects both animal health and the quality of the beef produced.
- **Livestock Nutrition**: Focuses on the observed condition of the forage and livestock, which are direct indicators of the grazing system's effectiveness.

Each category's scores are totaled, reflecting the aggregate impact of the grazing practices on the ecosystem. The final 'Grazing Score' is a percentage derived from these totals, which represents the overall biological enhancement achieved through the grazing system.

For the AMP grazing project, a scoring rubric such as this is instrumental in objectively quantifying the performance of regenerative grazing practices. It provides a comprehensive overview of how well the grazing management aligns with the principles of soil health, biodiversity, moisture management, and livestock nutrition. A score of 70% suggests a strong adherence to AMP principles, indicating that the grazing practices at Open A Angus Ranch have made significant strides toward ecological enhancement and sustainability.

This rubric offers valuable insights into the environmental performance of the ranch's operations and serves as a benchmark for continuous improvement. It also provides a transparent framework that can be communicated to stakeholders and consumers who are increasingly interested in the sustainability credentials of their food sources.

In the broader context of the EcoBalance project, this grazing index score reflects a successful application of regenerative practices that align with the project's sustainability objectives, showcasing the environmental benefits achieved through conscientious land and livestock management.

Grazing System Biological Enhancement Scores					
Moisture Management:	Good (2)	Bad (1)	Ugly (0)	Score	Total H2O
Residue Management: Incontact with Soil=(ICS); Not Incontact with Soil=(NICS)	2000 lbs/ac (ICS)	2000 (NICS) or <1000(ICS)	>2000(NICS)<500(ICS)	1	
Soil Tempuratures (Departure from Ambient (F):	<10F	>10F	>20F	1	
Infiltration Rates (°/hr):	>5"/hr	2 to 5"/hr	<2"/hr	1	10.0
Rooting Depths: Inches	>12	>6<12	<6	1	
Percent of Utiliztion Observed: (% Removed from Key Species before regrowth)	30-40%	>50<60%	None and >=60%	1	
Solar Energy Absorption:	Good (2)	Bad (1)	Ugly (0)	Score	Total Solar
Areas of Non Use (NU)(<10% Use on all species): % of Pasture areas	<=35%	>35>55	>=55	2	
Percent Utilization on Key species:	30-40%	>50<60%	None and >=60%	1	
Areas of Heavy Use (HU)(<60% Use on Key species): % of Pasture areas	<=35%	>35>55	>=55	2	16.0
Rebite Potentials during Fast Growth May1 - July1: (Based on Days Grazed during this period)	<10	>10<15	>15	2	
Percent of Pastures Stimulated prior to July 15th:	>=65%	>50 - <65%	<=50%	1	
Native Plant Diversity % Departure from Climax (HCPC):	Good (2)	Bad (1)	Ugly (0)	Score	Plant Diversity
Cool Season Natives Grasses:	>35%<60	Anything other than	<20 or >75	2	
Warm Season Natives Grasses:	>25%<50	Anything other than	<10 or >60	2	20.0
Introduced Invasive Grasses:	<=35%	>35>55	>=55	2	
Invasive Forbs/Noxous weeds/Shrubs:	<10%	10-20%	>20	2	
Soil Quality:	Good (2)	Bad (1)	Ugly (0)	Score	Soil Quality
Rhizosphere Present on roots: (% Pastures Stimulated)	>=65%	>50 - <65%	<=50%	1	
Nutrient Cycle (Percent of Pastures Grazed prior to 7/15:	>=65%	>50 - <65%	<=50%	1	
Carbon Cycle (Number of Pastures Grazed prior to 7/15:	>=65%	>50 - <65%	<=50%	1	10.0
Organic Matter Depth (Inches):	>12	>6<12	<6	1	
Soil Structure:	Cottage Cheese	Blocky	Colapsed	1	
Livestock Nutition:	Good (2)	Bad (1)	Ugly (0)	Score	Nutrition
Forage Quality Extented (Number of Pastures Grazed prior to 7/15):	>=65%	>50 - <65%	<=50%	1	
Percent of Utiliztion Observed: (% Removed from Key Species before regrowth)	30-40%	>50<60%	None and >=60%	1	
Forage Quality Observed (Average Cow Pies Observed (thickness in Inches):	<2" (Runny-Pie Dished)	>2<3 True Pie Mounding	>3 Layered and stacking	1	14.0
Water Quality Observed (Good=Wash face/Swim, Fair=Wash Hands/not swim, Poor=Would have to wash after touch:	Wash Face/Swim	Would Wash Hands	Would have to wash after touching	2	
Water Quantity Observed (Good=Greater than 30 gal /day/AU; Fair=<30>20gal/day; Poor livestock searching/waiting for water.	>30Gal/AUD	<30>20Gal/AUD	<20Gal/AUD	2	
*Average Ranch Livestock Water Quality and Quantity Rating:(1 thru 10) Refer to Notes for references.					
Comments:				Grazing Score	
				70%	

Figure 6: Grazing index score for West Kramer herd on Open A Angus ranch, 2022 performance review

Grazing System Biological Enhancement Scores					
Moisture Management:	Good (2)	Bad (1)	Ugly (0)	Score	Total H2O
Residue Management: Incontact with Soil=(ICS); Not Incontact with Soil=(NICS)	2000 lbs/ac (ICS)	2000 (NICS) or <1000(ICS)	>2000(NICS)<500(ICS)	2	
Soil Tempuratures (Departure from Ambient (F):	<10F	>10F	>20F	2	
Infiltration Rates (°/hr):	>5"/hr	2 to 5"/hr	<2"/hr	2	20.0
Rooting Depths: Inches	>12	>6<12	<6	2	
Percent of Utiliztion Observed: (% Removed from Key Species before regrowth)	30-40%	>50<60%	None and >=60%	2	
Solar Energy Absorption:	Good (2)	Bad (1)	Ugly (0)	Score	Total Solar
Areas of Non Use (NU)(<10% Use on all species): % of Pasture areas	<=35%	>35>55	>=55	2	
Percent Utilization on Key species:	30-40%	>50<60%	None and >=60%	2	
Areas of Heavy Use (HU)(<60% Use on Key species): % of Pasture areas	<=35%	>35>55	>=55	2	20.0
Rebite Potentials during Fast Growth May1 - July1: (Based on Days Grazed during this period)	<10	>10<15	>15	2	
Percent of Pastures Stimulated prior to July 15th:	>=65%	>50 - <65%	<=50%	2	
Native Plant Diversity % Departure from Climax (HCPC):	Good (2)	Bad (1)	Ugly (0)	Score	Plant Diversity
Cool Season Natives Grasses:	>35%<60	Anything other than	<20 or >75	2	
Warm Season Natives Grasses:	>25%<50	Anything other than	<10 or >60	2	20.0
Introduced Invasive Grasses:	<=35%	>35>55	>=55	2	
Invasive Forbs/Noxious weeds/Shrubs:	<10%	10-20%	>20	2	
Soil Quality:	Good (2)	Bad (1)	Ugly (0)	Score	Soil Quality
Rhizosphere Present on roots: (% Pastures Stimulated)	>=65%	>50 - <65%	<=50%	2	
Nutrient Cycle (Percent of Pastures Grazed prior to 7/15:	>=65%	>50 - <65%	<=50%	2	
Carbon Cycle (Number of Pastures Grazed prior to 7/15:	>=65%	>50 - <65%	<=50%	2	20.0
Organic Matter Depth (Inches):	>12	>6<12	<6	2	
Soil Structure:	Cottage Cheese	Blocky	Colapsed	2	
Livestock Nutrition:	Good (2)	Bad (1)	Ugly (0)	Score	Nutrition
Forage Quality Extended (Number of Pastures Grazed prior to 7/15):	>=65%	>50 - <65%	<=50%	2	
Percent Utilization Observed: (% Removed from Key Species before regrowth)	30-40%	>50<60%	None and >=60%	2	
Forage Quality Observed (Average Cow Pies Observed (thickness in Inches):	<2" (Runny-Pie Dished)	>2<3 True Pie Mounding	>3 Layered and stacking	2	20.0
*Water Quality Observed (Good=Wash face/Swim, Fair=Wash Hands/not swim, Poor=Would have to wash after touch:	Wash Face/Swim	Would Wash Hands	Would have to wash after touching	2	
*Water Quantity Observed (Good=Greater than 30 gal /day/AU; Fair=<30>20gal/day; Poor livestock searching/waiting for water.	>30Gal/AUD	<30>20Gal/AUD	<20Gal/AUD	2	
*Average Ranch Livestock Water Quality and Quantity Rating:(1 thru 10) Refer to Notes stated for Water quality and quantity Observed above in score for each for more guidance.					
Comments:				Grazing Score	
OPEN A ANGUS BELFIELD, ND				100%	

Figure 7: Grazing index score for West Kramer herd on Open A Angus ranch, 2023 performance review

Physical soil sampling results

The purpose of physical soil sampling at the beginning of a soil carbon storage project is to establish a t0 soil organic carbon baseline. In this instance, the sampling plan had to meet the statistical requirements specified by the third party registry BCarbon in order to qualify for release of interim carbon credits. This was completed over the course of two years.

South portion of the ranch, sampled in 2022

EcoBalance contracted Earth Optics to design a sampling plan

The calculated values for soil organic carbon (in units of tons/acre) for the 0-30 cm layer for the project area are shown in Figure 2. The resulting estimate of the mean at the 90% confidence level is 32.04 +/- 0.75 tons/acre or 32.04 +/- 2.33% of the mean. The “Phase 1” project area is 8728.1 acres. The resulting baseline soil organic carbon in the 0-30 cm layer is 279687.6 +/- 6517.4 tons.

The calculated values for soil organic carbon (in units of tons/acre) for the 30-100 cm layer for the project area are shown in Figure 3. The resulting estimate of the mean at the 90% confidence level is 50.57 +/- 5.76 tons/acre or 50.57 +/- 11.3% of the mean. The “Phase 1” project area is 8728.1 acres. The resulting baseline soil organic carbon in the 30-100 cm layer is 441380.0 +/- 50273.9 tons.

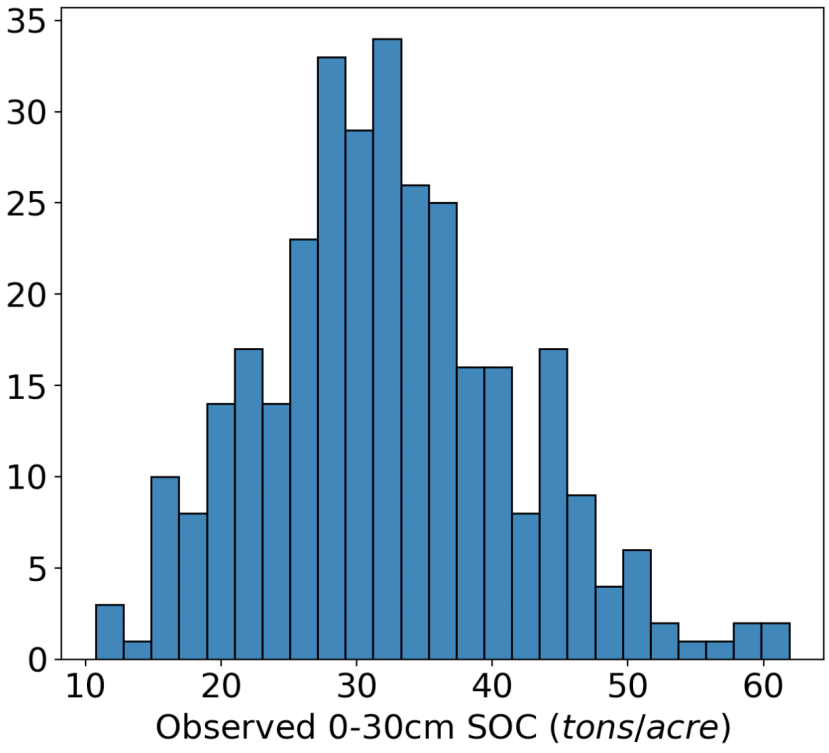


Figure 8: Observed distribution of SOC in 0-30 cm layer for project.

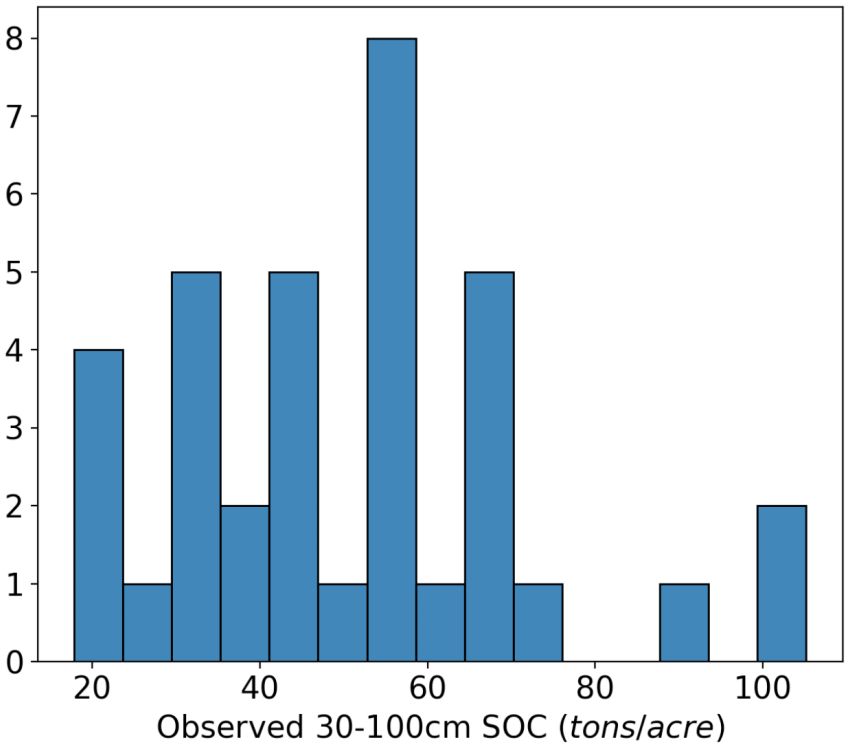


Figure 9: Observed distribution of SOC in 30-100 cm layer for project

North portion of the ranch, sampled in 2023

One hundred and twenty five samples were pulled on the northern 13634 acres of Open A Angus Ranch by GreenEdge using a soil sampling plan created using a satellite-AI platform (EnvirometriX) to optimize the location and number of samples.

The calculated values for soil organic carbon (in units of tons/acre) for the 0-30 cm layer for the project area are shown in Figure 1. The resulting estimate of the mean at the 90% confidence level is 36.3 +/- 1.4 tonnes C per acre. The “Phase 2” project area is 13633.7 acres. The resulting baseline soil organic carbon in the 0-30 cm layer is 4.95E+05 +/ 1.96E+04 tons, as shown in Table 4.

Table 1: Soil sampling data for the northern portion of the ranch

Project ID	Open A Angus Phase 2, North		
Dates of sampling	7/20/2023-8/24/2023		
Sampling contractor	GreenEdge		
Total acres	13633.7		
Number of cores	125		
EQN B.1.	0-30cm	30-60cm	0-60cm
Average SOC tonnes/ha	89.7	104.7	192.6
SD	23.5	30.0	37.22
90% margin of error	3.55	4.53	5.706
ni	121	121	117
EQN B.1.			0
CRITICAL RULE 0	8.97	10.47	19.26
t 90	1.66	1.66	1.658
LEFT SIDE T90	3.55	4.53	5.706
RULE OK T90?	TRUE	TRUE	TRUE
Average SOC tonnesC/acre	36.3	42.4	77.9

90% margin of error	1.44	1.83	2.31
Total carbon stock SOC tonnes C	4.95E+05	5.78E+05	1.06E+06
90% margin of error	1.96E+04	2.50E+04	3.15E+04

The calculated values for soil organic carbon (in units of tons/acre) for the 30-60 cm layer for the project area are shown in Figure 3. The resulting estimate of the mean at the 90% confidence level is 42.4 +/- 1.8 tons/acre. The resulting baseline soil organic carbon in the 30-60 cm layer is 5.78E+05 +/- 2.50E+04 tons.

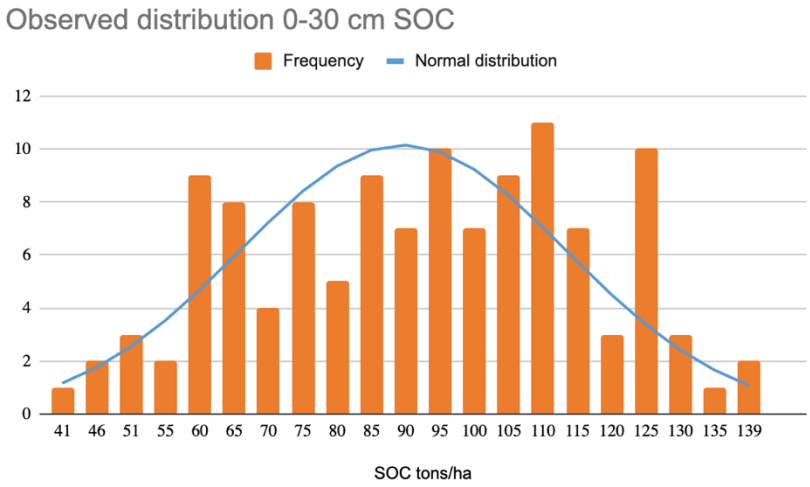


Figure 10: Observed distribution of SOC in 0-30 cm layer for project.

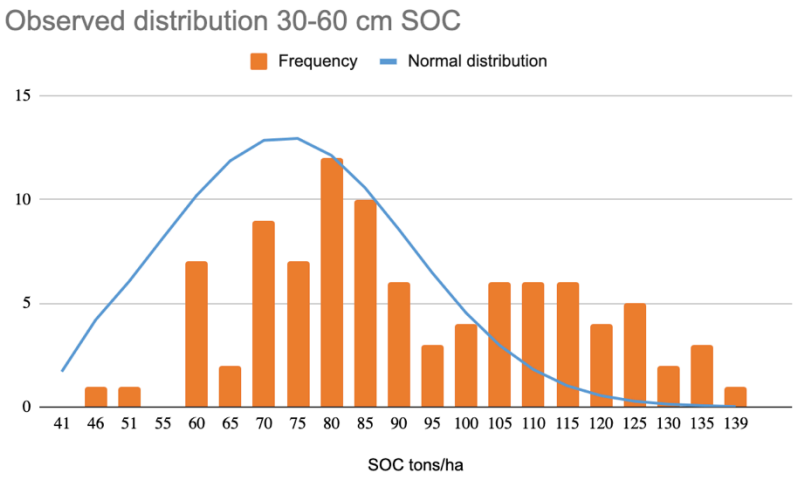


Figure 11: Observed distribution of SOC in 30-60 cm layer for project.

The calculated values for soil organic carbon (in units of tons/acre) for the 0-60 cm layer for the project area resulting estimate of the mean at the 90% confidence level is 77.9 +/- 2.3 tons/acre. The resulting baseline soil organic carbon in the 0-60 cm layer is 1.063E+06+/- 3.15E+04 tons.

The soil sampling met the rule of T90 wherein the 90% CI is < 10% of the mean for this section of land.

Remote sensing to monitor management improvements

Table 2: Soil type analysis on Open A Angus Ranch

Soil type	Area ac	EcoSTAC annual soil carbon stocks t/ac	EcoSTAC annual soil pH in H2O pH	USGS National Elevation Dataset (NED) elevation ft (US)	CropScape annual land cover	Glance30 annual land cover
typic argiustolls	7893	34.5	7.7	2621.9	Grass/Pasture (51.0%)	Herbaceous (99.0%)
aridic haplustolls	4182.8	33	7.7	2516.2	Grass/Pasture (76.0%)	Herbaceous (100.0%)
calcic haplustepts	3468.9	34.1	7.7	2515	Grass/Pasture (51.0%)	Herbaceous (99.0%)
typic ustorthents	3300.8	35.5	7.7	2526.3	Grass/Pasture (48.0%)	Herbaceous (99.0%)
aridic ustorthents	3193.8	34.8	7.7	2477.3	Grass/Pasture (46.0%)	Herbaceous (99.0%)

NDVI ANALYSIS

Management practices entailed “twice over grazing”, a subspecies of Adaptive Management of Pastures (AMP) tailored to the upper great plains climate. Documentation of continued management is attached and the developer concludes that the ranch achieved a high grazing index score. This indicates that AMP grazing practices were continued throughout 2023. The grazing management specialists provided further guidance leading into 2024 in order to continue this program.

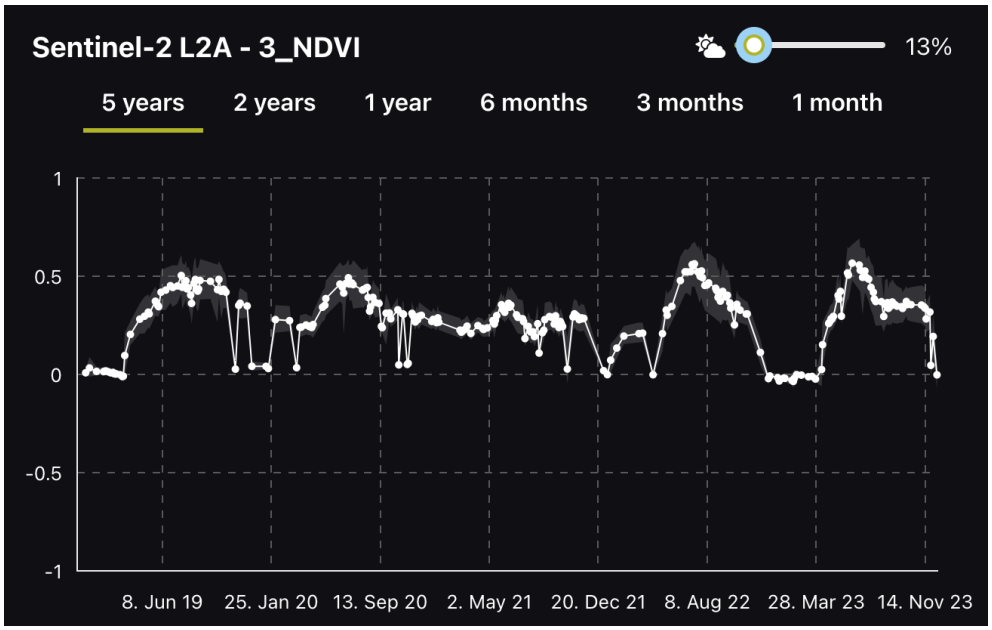


Figure 12: Normalized density of vegetation index (NDVI) from 2019-2023 on the Open A Angus ranch reveals marked improvement in groundcover in the first two years under AMP grazing management in 2022 and 2023.

We can use NDVI and rainfall as a proxy for remote monitoring of the ranch’s performance. Climate data (precipitation and rainfall) was collected from NOAA’s National Center for Environmental Information at the closest weather station in Dickinson, ND. NDVI data was taken from Sentinel Hub using Sentinel-2 L2A with less than 10% cloud cover in June 2023.

Table 3: Average NDVI from Sentinel-2 L2A (annual and June averages) for Open A Angus ranch south; annual precipitation and average temperature in Dickinson, ND

	3_NDVI-C0/median, annual average	*3_NDVI-C0/median, June average*	*annual precipitation, in*	*Average temperature, degF*
2019	0.28	0.40	n/a	39.6
2020	0.30	0.44	10.82	44.5

2021	0.25	0.33	13.63	45.7
2022	0.34	0.51	16.62	41.7
2023	0.27	0.54	16.44	43.6

Results from this NDVI and climate analysis show that with the first implementation of grazing practices in 2022, NDVI increased dramatically. In part this could be due to increased rainfall, but 2020-2021 had a reversal in NDVI despite increase rainfall. It can be reasonably concluded that enhanced grazing management practices are increasing groundcover and therefore are also enhancing soil carbon storage rates.

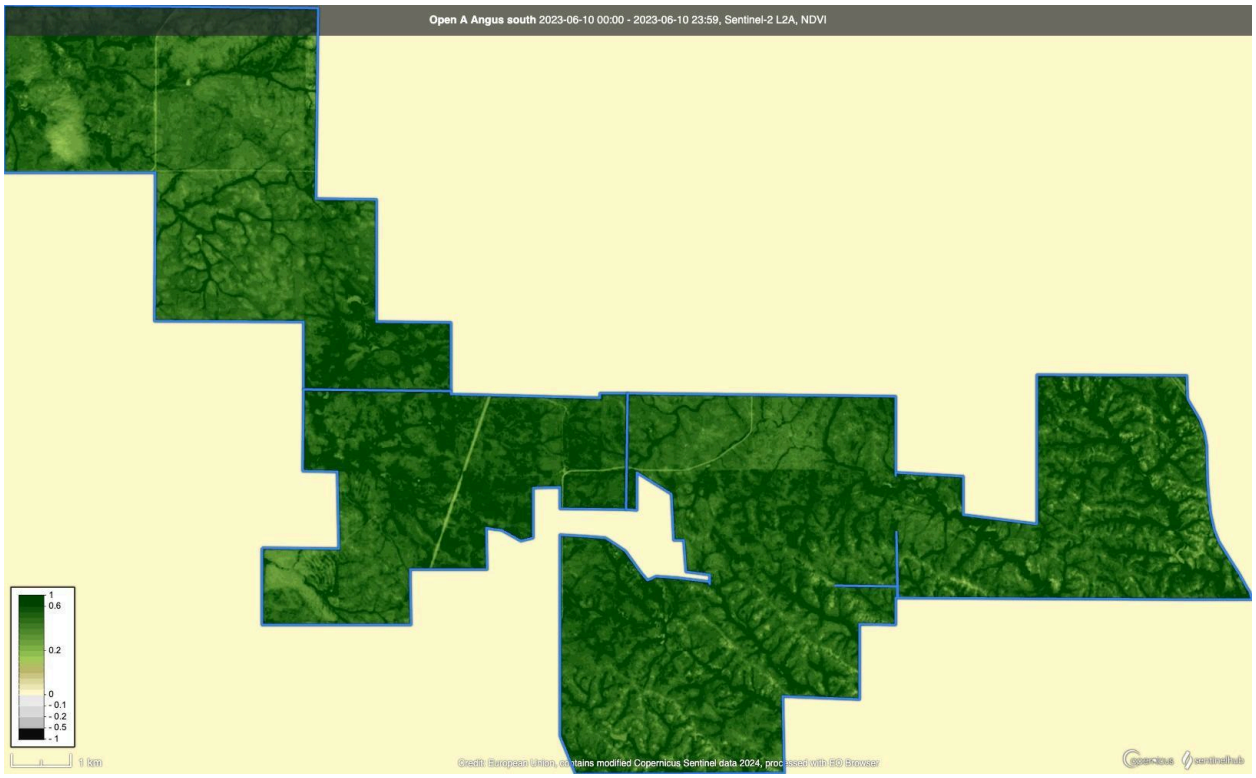
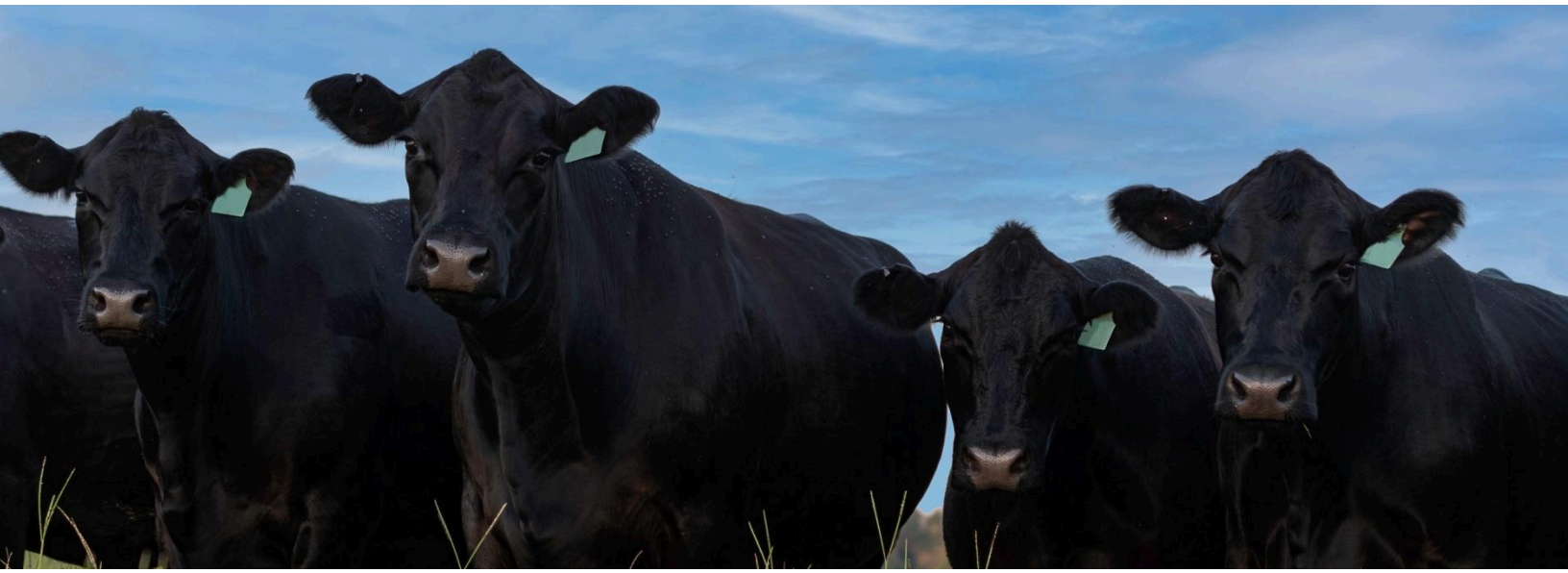


Figure 13: NDVI from June 2023 of the south portion of the ranch reveals high ground cover with minimal reflectance except for hill peaks and roads.



HISTORICAL CARBON STORAGE RATES

Soil Carbon Mapper predictions of soil carbon stocks based on 3D machine learning and publicly available training data KSSL and NRCS. These data were assembled by EnvirometriX and are currently being retrained for accuracy using physical soil carbon coring data taken in 2022 and 2023. It is interesting to note that the soil organic carbon trends upwards

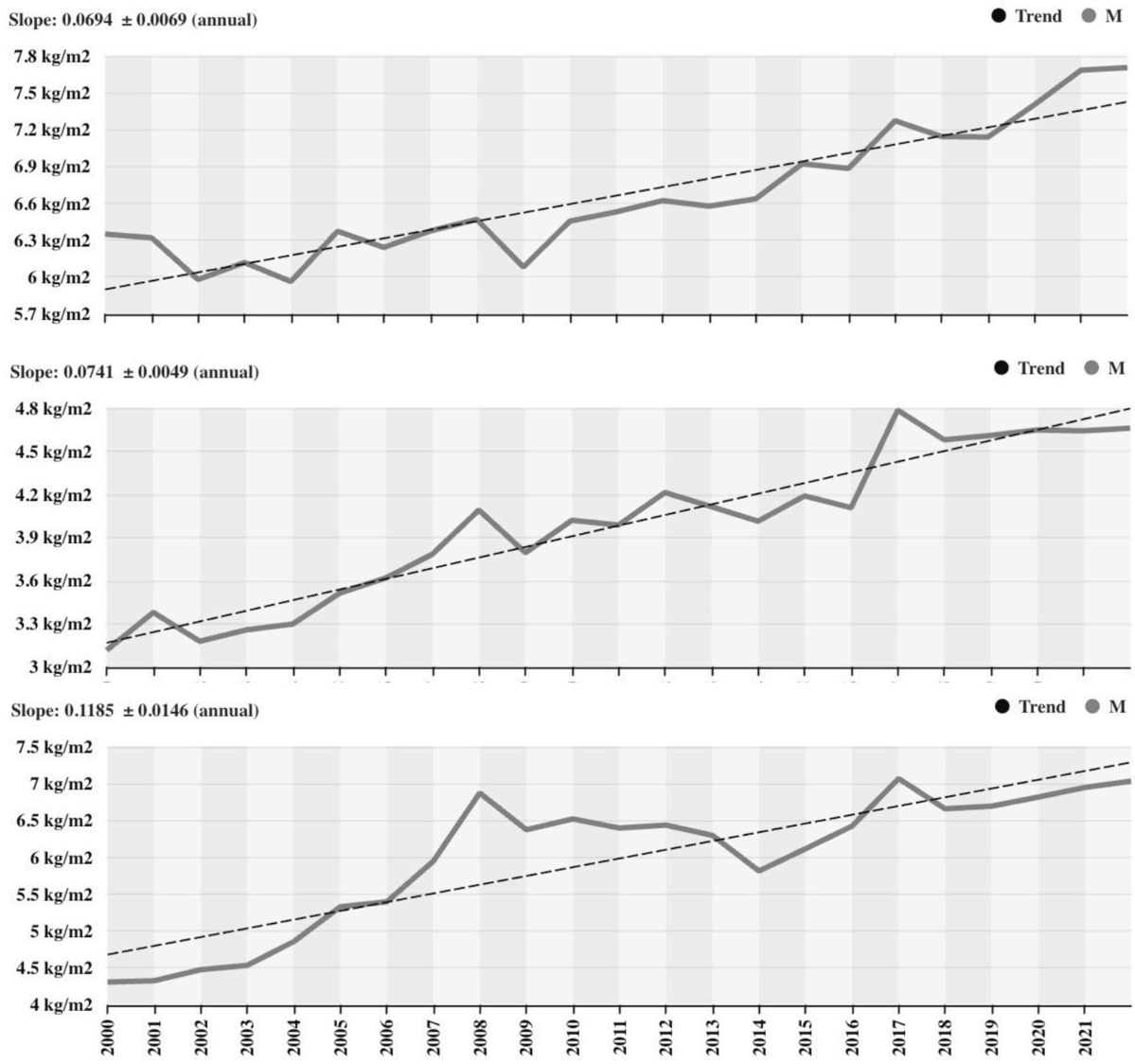


Figure 14: Historical soil organic carbon stock from 2020-2021 on Open A Angus Ranch

Table 4: Average soil carbon storage rates on Open A Angus Ranch, 2000-2021

	Soc, kg/m2.y	Soc, tCO2e/acre.y	Average soc storage, tCO2e/y	Soc stored from 2000-2021, tCO2e
0-30 cm	6.94E-02	1.03E+00	2.44E+04	5.12E+05
30-60 cm	7.41E-02	1.10E+00	2.61E+04	5.47E+05
60-100 cm	1.19E-01	1.76E+00	4.17E+04	8.75E+05
0-100 cm	2.62E-01	3.89E+00	9.21E+04	1.93E+06

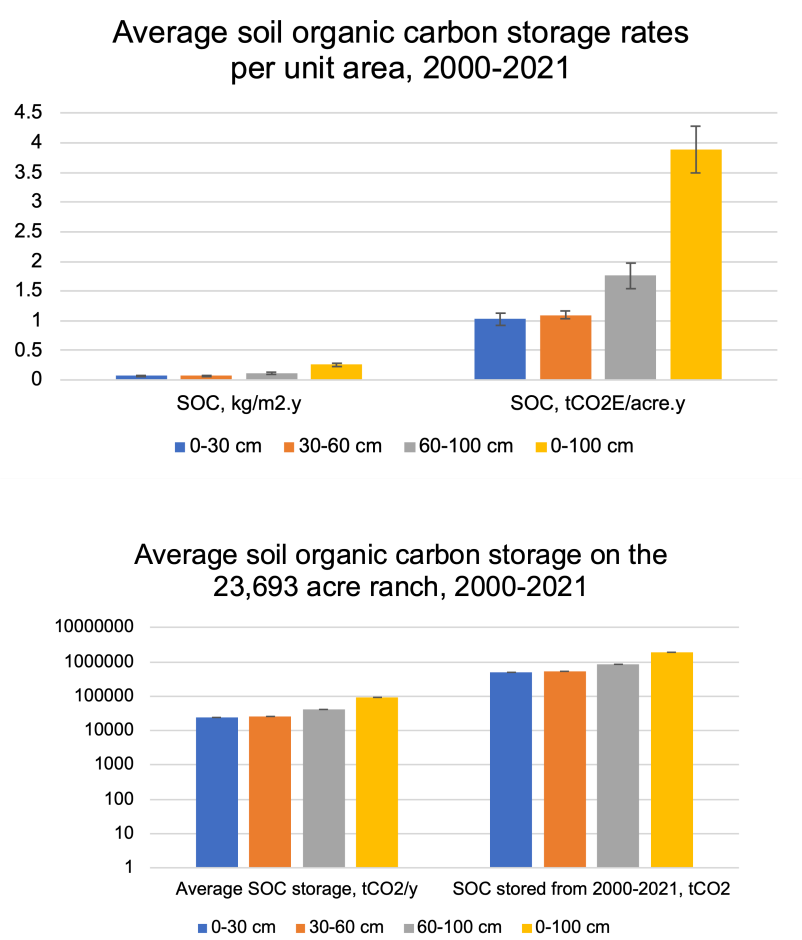


Figure 15: Average soil carbon storage rates on Open A Angus Ranch, 2000-2021

SUPPLY CHAIN TRACING AND INSETTING OF CARBON CREDITS

EcoSmart Enterprise platform

At EcoBalance, our EcoSmart Enterprise platform stands at the core of our operations, enabling us to implement our Framework and offer a suite of comprehensive services. This innovative platform is designed to streamline and enhance the management of carbon credits and risks, track supply chains, and support our clients with their billing and accounting needs.

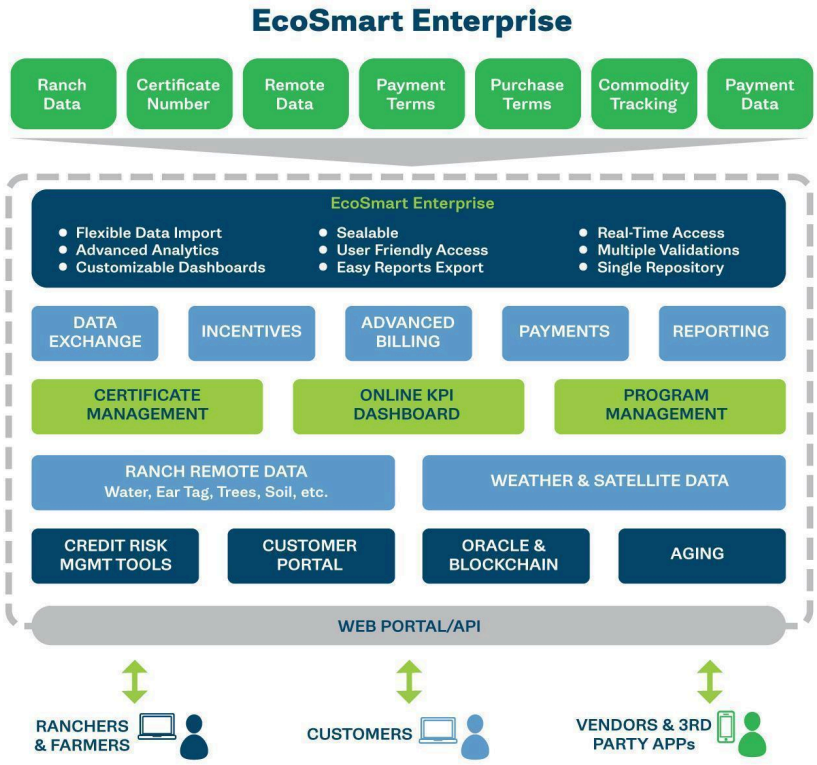


Figure 16: Overview of EcoSmart Enterprise

This system was used to trace cattle transfers by importing cattle tag EIDs, bill of laden records, shipping logs, customer information, carbon credits (on-chain), and satellite data via API. This blockchain integrated data system has been tied to both web3 and web2 environments to allow customers to personally verify the authenticity of claims made on their products. EcoX.world is your live portal to view these projects and purchase blockchain certificates.

Emissions calculations and associated insetting: Taste of Vail example

A snapshot summary of our EcoSmart beef project was is shown below, illustrating the final shipment weight of beef, carbon credit retirements, and steps in the supply chain with links to polygon scan for blockchain verification. This example was for 1,090 lbs of edible beef sold to the Taste of Vail event in April 2024.

The average emissions associated with the lifecycle for edible beef for cradle-to-grave are shown below. This encompasses production at the cow-calf operation, feeding and finishing, processing, transportation, and even waste-associated emissions using best available data in the USA market.[21] A summary of the data from this paper can be found in the table below.

Table 5: Average emissions for beef in the USA translated to carcass weight, live weight, and edible beef functional units.[21]

kg CO2 per kg *carcass* weight to processor	21
kg CO2 per kg live weight to processor	13
Carcass yield	0.618
Reported Average weight live cattle at finishing, Lbs	1500
Carcass Yield from live weight, %	61.8%
Consumed beef per live cow	32.6%
kg CO2, eq per kg CONSUMED beef, farm to grave	42.7
kg CO2 per kg live cow, farm to grave	13.9
tonnes CO2 per kg edible beef, farm to processor	0.02797
tonnes CO2 per lb edible beef, farm to processor	0.01269
tonnes CO2 per kg carcass weight, farm to processor	0.021

[21] Putman, Ben, C. Alan Rotz, and Greg Thoma. 2023. "A Comprehensive Environmental Assessment of Beef Production and Consumption in the United States." Journal of Cleaner Production 402 (May): 136766. https://doi.org/10.1016/j.jclepro.2023.136766.

tonnes CO2 per lb carcass weight, farm to processor	0.0095255
tonnes CO2 per kg live weight, farm to processor	0.012978
tonnes CO2 per lb live weight, farm to processor	0.00589

In this project we aimed to balance the emissions up to the point of delivery to the processor. This calculation is shown in the table below, and equates to 13.8 tCO_{2e} which we rounded up to 14 carbon storage units (carbon credits). These carbon credits were the same credits created on the land from which the cattle were sourced.

Table 6: Calculation for cradle to processor emissions for 1090 lbs of beef delivered to Taste of Vail.

Input		**Output**	
Description	*Value*	*Description*	*Value*
Edible meat, lb:	1090	Emissions, tCO2e	13.8

PRODUCTS

Type	Transport Date	Quantity	Order	Blockchain
EcoSmart Beef	March 25, 2024	1,090lbs		polygonscan

RETIREMENTS

Vintage	Retirement Date	Quantity	Serial Number	Blockchain
2023	March 25, 2024	14 VCC	BCR101	polygonscan

TRACEABILITY

Location	Transport Date	Quantity	Tracking ID	Blockchain
ND, US	June 18, 2023	3Cows	BCR101	polygonscan
ND, US	March18, 2024	3Cows	BCR101	polygonscan
IA, US	March 18, 2024	3Cows	BCR101	polygonscan
CO, US	March 25, 2024	1,090 lbs	BCR101	polygonscan

Figure 17: Tracing of products and carbon credit retirements for insetting of beef

Key learnings

One of the most obvious key learnings is that the agriculture industry is very fragmented, and the supply chain process is complicated. Whether purposely obscured or the industry is resistant to new technology, there is a very evident opportunity for EBG to achieve its mission and make a global impact. With new technologies we were able to analyze existing processes and conduct third party verification for traceability. This level of transparency in the supply chain is unprecedented and brings clarity and the product information that climate conscious consumers are demanding.

The experienced gained during the 18 month PoC was vital for EBG to understanding the selection criteria for the carbon credit methodology, EBG Framework development, critical data collection experience, soil sampling experience, BCarbon registration experience, supply chain process knowledge and experience, and understanding of international demand for the EBG service offering. The ability to scale and provide a meaningful economic incentive is paramount. EBG has the foundation and the experience to build a solution that the world desperately needs.

Summary of Results

Key results from this project are as follows:

Grazing Management Plan Implementation: The introduction of “Twice-over grazing” tailored to the climatic conditions of the Upper Great Plains has shown promising improvements in soil health and cattle well-being.

Grazing Index Score Development: A grazing index score, established by EcoBalance’s range and soil scientists, has been applied to assess the biological enhancement of the grazing system, which achieved a high score suggesting a substantial ecological benefit.

Soil Carbon Baseline Establishment: Through rigorous soil sampling conducted by Earth Optics and GreenEdge, significant increases in soil organic carbon levels have been documented, fulfilling the statistical requirements of the BCarbon third-party registry.

Remote Sensing and NDVI Analysis: Satellite-derived NDVI data has demonstrated marked improvements in vegetative cover, indicating successful management changes. The data suggests a positive correlation between AMP grazing practices and enhanced soil carbon storage rates.

Historical Carbon Storage Rates: Predictions made by EnvirometriX using 3D machine learning models suggest an upward trend in soil organic carbon stocks, supporting the potential for long-term carbon sequestration.

Supply Chain Tracing and Carbon Insetting: The EcoSmart Enterprise platform has allowed for robust tracing of cattle and carbon credits through the supply chain, enabling the insetting of emissions for products, such as the beef provided to the Taste of Vail event and customers in the UAE.

The proof of concept has provided valuable insights into the benefits of regenerative grazing practices, demonstrating their potential for enhancing ecosystem services and contributing to carbon neutrality goals. The project’s success establishes a scalable model for sustainable agriculture,

offering a benchmark for similar initiatives globally.

Benefits and Implications

Direct benefits

The EcoBalance Global proof of concept at Open A Angus Ranch has yielded several direct benefits with tangible outcomes:

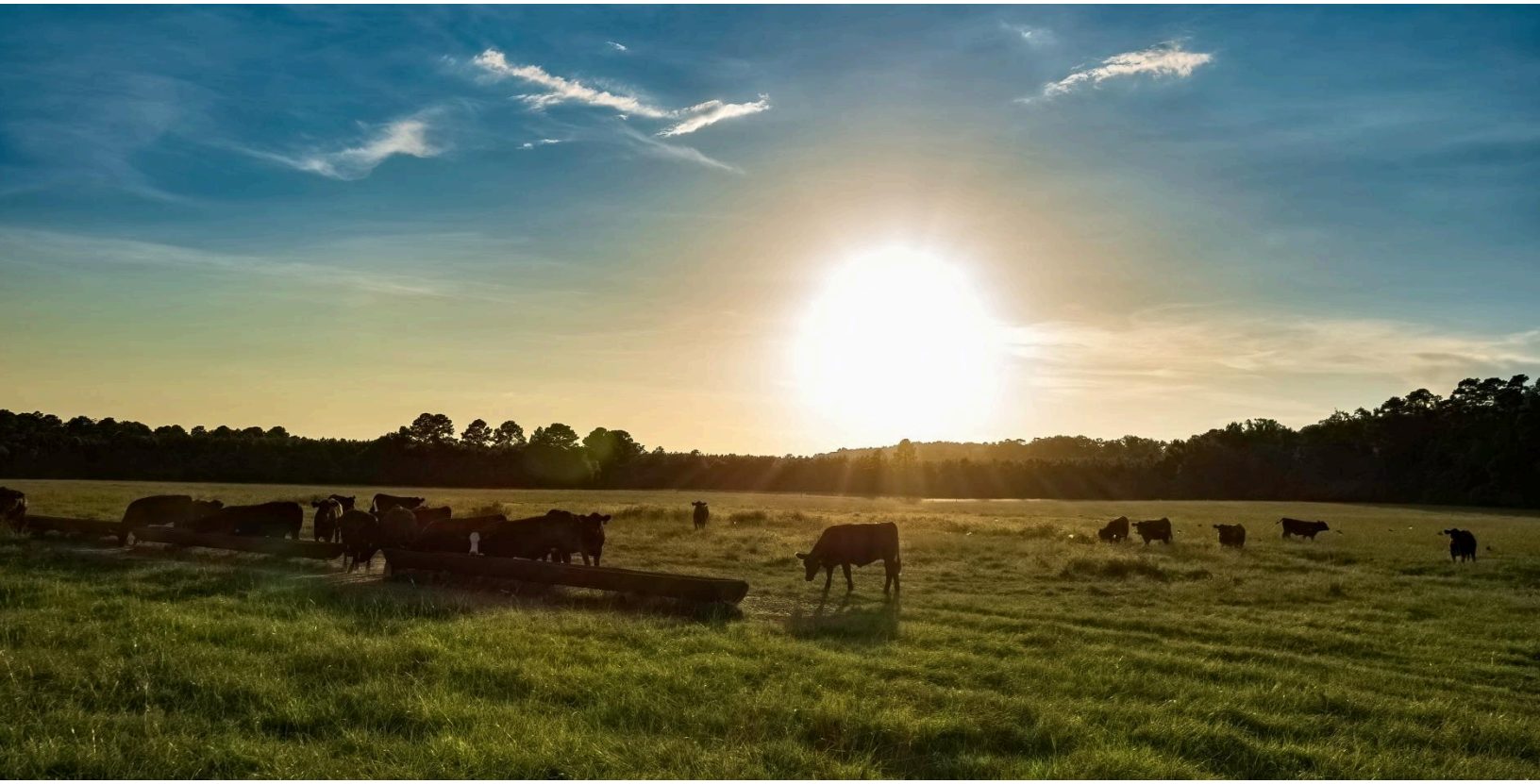
- **Soil Health Enhancement**: The application of Adaptive Multi-Paddock grazing led to improved soil health, as evidenced by increased soil organic carbon levels, fostering long-term land viability.
- **Carbon Credits**: The project effectively transformed land management practices into verifiable carbon sequestration, generating carbon credits and creating a new revenue stream.
- **Operational Efficiency**: The implementation of the EcoSmart Enterprise platform streamlined the supply chain management, making the tracing of cattle and carbon credits more efficient and transparent.
- **Product Quality Improvement**: Healthier cattle and improved pasture conditions likely resulted in higher quality beef, which may command premium prices in the market.
- **Cost Savings**: Reduction in input costs such as fertilizers and feed, as a result of more efficient land and animal management, directly impacted the bottom line favorably.

Strategic Implications

- **Market Differentiation**: The successful integration of sustainable practices allows the company to differentiate its products in a competitive market that increasingly values sustainability.
- **Policy Influence**: Demonstrable success in sustainable practices positions the company as a leader in influencing agricultural policy towards more eco-friendly practices.
- **Investor Attraction**: The project showcases a model for sustainable investment, attracting investors interested in ESG (Environmental, Social, Governance) criteria.
- **Industry Benchmarking**: The grazing index score and remote sensing methodologies provide a benchmark for other ranches and stakeholders in the industry to evaluate and improve their own practices.

Potential for Scaling

- **Replicability**: The framework established through this proof of concept is designed to be replicable, allowing for adaptation and implementation in diverse geographic and climatic conditions.
- **Technology Adoption**: The success of the EcoSmart Enterprise platform paves the way for wider adoption of blockchain and remote sensing technologies in agriculture.
- **Expansion of Carbon Markets**: As carbon credit generation becomes more standardized and accepted, there is potential for scaling the production and trading of carbon credits within the agricultural sector.
- **Collaborative Partnerships**: Scaling the project offers the opportunity to form strategic partnerships with other stakeholders in the supply chain, from ranchers to retailers, creating a coalition for change towards regenerative practices.



Challenges and Lessons Learned

Encountered Challenges:

The challenges faced by EcoBalance Global (EBG) during the proof of concept were multifaceted, rooted in the inherent complexities of the agricultural sector:

- **Industry Fragmentation**: EBG grappled with the fragmented nature of the agriculture industry, characterized by a convoluted supply chain process that lacked coherence and transparency.
- **Resistance to Technology**: There was a discernible hesitation within the industry to embrace new technology, posing a barrier to modernization efforts.
- **High Cost of Soil Sampling**: The financial burden of extensive and regular soil sampling emerged as a significant hurdle, given its necessity for validating soil carbon sequestration claims.
- **Lack of Unified Data:** The absence of a standardized data framework led to challenges in aggregating and analyzing information across different stages of the supply chain.
- **Deficiency of Robust Frameworks**: EBG faced the absence of an established, robust framework for making and verifying sustainable claims, which is essential for industry-wide credibility and consumer trust.

Solutions and Adaptations

In response to the encountered challenges, EcoBalance Global (EBG) implemented a multi-faceted approach to streamline the agricultural supply chain and integrate new technologies.

- Supply Chain Integration: EBG developed a more integrated supply chain model, using the EcoSmart Enterprise platform to connect different stages of the supply chain, thereby reducing fragmentation.
- Technology Implementation: Innovative technologies such as blockchain for traceability and remote sensing for land management were harnessed to bring a new level of transparency and efficiency to the process.
- Third-Party Verification: By partnering with credible third-party verifiers, EBG ensured that its processes and outcomes were trustworthy and met industry standards, which helped to overcome resistance to new technologies.
- Stakeholder Engagement: EBG engaged with stakeholders across the supply chain to educate and demonstrate the benefits of the new system, thereby fostering acceptance and collaboration.
- Flexible Framework Development: The EBG Framework was designed to be adaptable, allowing for the integration of various carbon credit methodologies and to accommodate the diverse needs of the agricultural industry.

Lessons Learned:

The 18-month proof of concept phase yielded several key insights:

- **Critical Role of Data**: Accurate and timely data collection is essential. The project highlighted the importance of robust data in every facet of the supply chain, from soil sampling to product delivery.
- **Demand for Transparency**: There is a strong and growing consumer demand for transparency. Consumers are increasingly climate-conscious and demand detailed product information, a need that EBG is well-positioned to meet.
- **Importance of Methodology Selection**: Selecting the appropriate carbon credit methodology is crucial. This choice impacts not only the environmental outcomes but also the economic viability of the projects.
- **Value of Practical Experience**: Hands-on experience in soil sampling, carbon credit registration, and supply chain management is invaluable. The insights gained from direct involvement have informed the development of more effective processes and frameworks.
- **Scalability and Economic Incentives**: The ability to scale solutions and provide economic incentives is essential for widespread adoption. The project demonstrated that economic benefits are key drivers for the adoption of sustainable practices.
- **Global Service Demand**: There is a significant international demand for services like those offered by EBG. Understanding this demand is crucial for tailoring the service offerings to meet global needs.

Conclusion

Summary of Findings

EcoBalance Global's proof of concept at Open A Angus Ranch has culminated in a series of impactful findings, showcasing the potential of Adaptive Multi-Paddock (AMP) grazing to revolutionize sustainable land management:

- The **implementation of AMP grazing** resulted in enhanced soil health and increased soil organic carbon levels, demonstrating that regenerative practices can positively influence the carbon cycle.
- A **novel grazing index scoring system** was developed to objectively evaluate the efficacy of grazing management, with the project achieving a commendable score of 70% for ecological enhancement.
- **Soil sampling** indicated substantial carbon sequestration potential, providing a foundation for the issuance of carbon credits and offering a new revenue model within the agricultural sector.
- The **EcoSmart Enterprise platform** revolutionized supply chain transparency, marrying technological innovation with the demand for product traceability.

Next Steps

Building on the success of this project, the next phases are designed to amplify the reach and impact of these sustainable practices:

- **Scaling the Framework**: Expansion of the EBG Framework to include more ranches and regions, adapting the model to various climatic and soil conditions.
- **Enhancing Technology Integration**: Continued development of the EcoSmart Enterprise platform to lower costs, increase efficiency, and streamline data management across the supply chain.
- **Broadening Stakeholder Engagement**: To foster wider adoption, engaging with more stakeholders - including ranchers, industry partners, and policymakers - to showcase the benefits of sustainable practices.

Call to Action

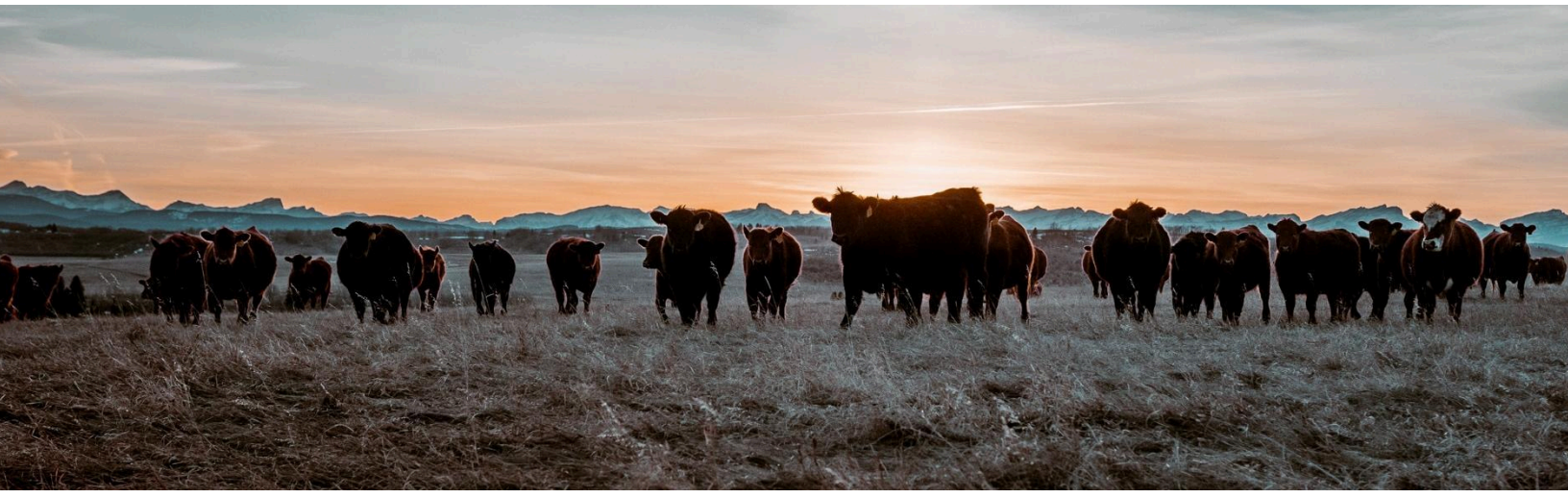
As we stand at the forefront of agricultural innovation, the success of the EcoBalance Global proof of concept at Open A Angus Ranch underscores the potential and urgency of expanding sustainable practices within the industry. We invite stakeholders from all sectors—agricultural professionals, investors, policymakers, and industry leaders—to join us in scaling these transformative solutions.

- **Invest in Sustainability**: We encourage investors to seize the opportunity to fund a pioneering approach that combines profitability with environmental stewardship. Your investment can propel the expansion of EcoSmart beef and similar sustainable initiatives globally.
- **Adopt Our Technologies and Practices**: We call on ranchers and agricultural businesses to adopt the EcoBalance Framework and technologies. Implementing these practices can lead to enhanced soil health, improved cattle welfare, and verified sustainable products in your operations.
- **Collaborate with Us**: There is immense value in partnership. We are open to collaborations that leverage collective expertise to refine and spread sustainable practices. Whether through joint ventures, research initiatives, or commercial partnerships, there is a wealth of opportunity for collective impact.
- **Stay Informed and Engage**: Follow EcoBalance Global's continued progress through our website and subscribe to our updates. Engage with us at conferences, workshops, and through online platforms to stay at the cutting edge of sustainable agriculture.

By taking action today, you can contribute to a sustainable future that benefits not only the environment but also the economic viability of the agriculture sector. Join us in transforming agriculture into a force for good.

For more information or to discuss potential partnerships and investment opportunities, please contact us at info@ecobalanceglobal.com or visit our website at www.ecobalanceglobal.com.

Together, let's cultivate a sustainable future.



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