Understanding multi-use land management systems with regenerative grazing and solar PV

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1. Motivation: Agrivoltaic Grazing that Benefits the Land, the Animals, and the Solar Asset

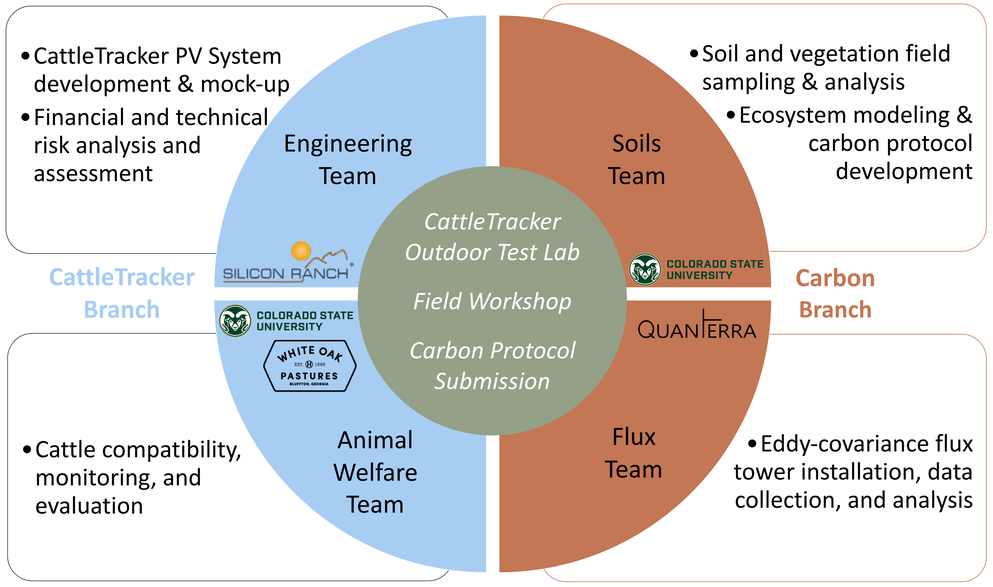
- Concerns about amount of land required by solar energy and displacement of agriculture
- Research suggests potential to co-locate agriculture and solar energy
- Co-location of regenerative grazing & PV offers many potential animal welfare, economic, social, and environmental benefits – however questions need to be answered!

2. Research Questions: Understanding Layered Land Use

1. Can a PV system be designed to allow for cattle grazing, effectively **eliminating the risk at the PV-cattle interface**? What is the **proper design** for the solar asset to maximize the joint objectives of energy generation and grazing while **minimizing the capital costs**?
2. Can properly managed livestock grazing in a solar array produce **quantifiable ecosystem outcomes** such as improved water resource, net carbon sequestration, and improved soil and grass nutrient status, including accounting for net GHG emissions from livestock?

3. Tackling Complex Questions with a Multidisciplinary Team

White Oak Pastures, Bluffton, Georgia, USA



4. 1st Field Season – Spring 2023

Objectives

- Establish soil baselines & quantify characteristics
- Track vegetation patterns over the growing season under different management schemes
- Install microclimate sensors & flux towers to collect continuous data on key environmental parameters
- Observe cattle interaction with different panel designs

Taking soil cores

Installing soil moisture & temp sensors

Dividing soil core by depth

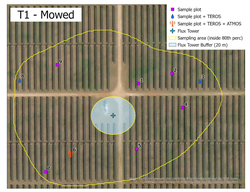
Outcomes

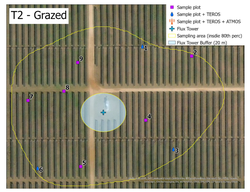
- Installed 3 **flux towers**, 81 **soil moisture & temperature sensors**, and 7 **weather stations**
- Collected 194 **soil samples** at two depths
- Collected 194 baseline **vegetation samples** and trained field site staff to continue sampling through growing season

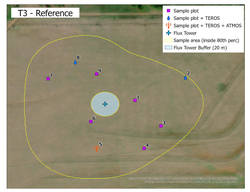
Implementation

Characterizing Ecosystem Impacts

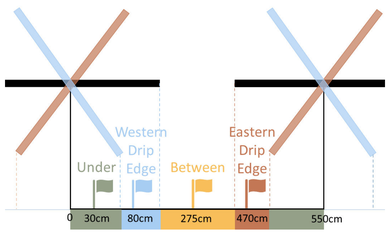
- Three treatments of ~30 acres:







- Select 9 plots and define 4 distinct zones within a plot for sampling, to capture heterogeneity created by panels



Observing Cattle Interaction with Infrastructure

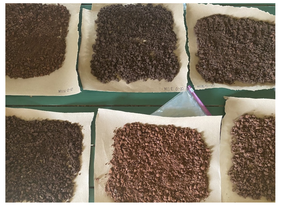
- Test cattle interactions with module mock-ups at 3 different heights

5. Take Aways & Next Steps

- Inherently **heterogeneous systems**, but with larger patterns – learning how to balance feasibility of capturing that heterogeneity at necessary resolution
- Crucial to improve understanding of the **social & economic dimensions** for large-scale deployment
- Importance of **interdisciplinary collaboration** & systems-level perspective

Moving forward…

- Analyze samples collected this season
- Use data to parameterize biogeochemical model incorporating a solar panel layer
- Stakeholder workshop Spring 2024
- Building toward CattleTracker Outdoor Test Lab



6. Acknowledgements

Project Team: Nick **DeVries**, PI (Silicon Ranch); Dr. Anna Clare **Monlezun,** Research Lead (Graze L.L.C)**;** Will **Harris**, Bridget **Hogan** & Scott **Cleveland** (White Oak Pastures); Dr. Keith **Paustian**, Dr. Lily **Edwards-Callaway** & Dr. Mu **Hong** (Colorado State University); Dr. Robert **Clement** & Dr. Rebecca **Mitchell** (Quanterra Systems)

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