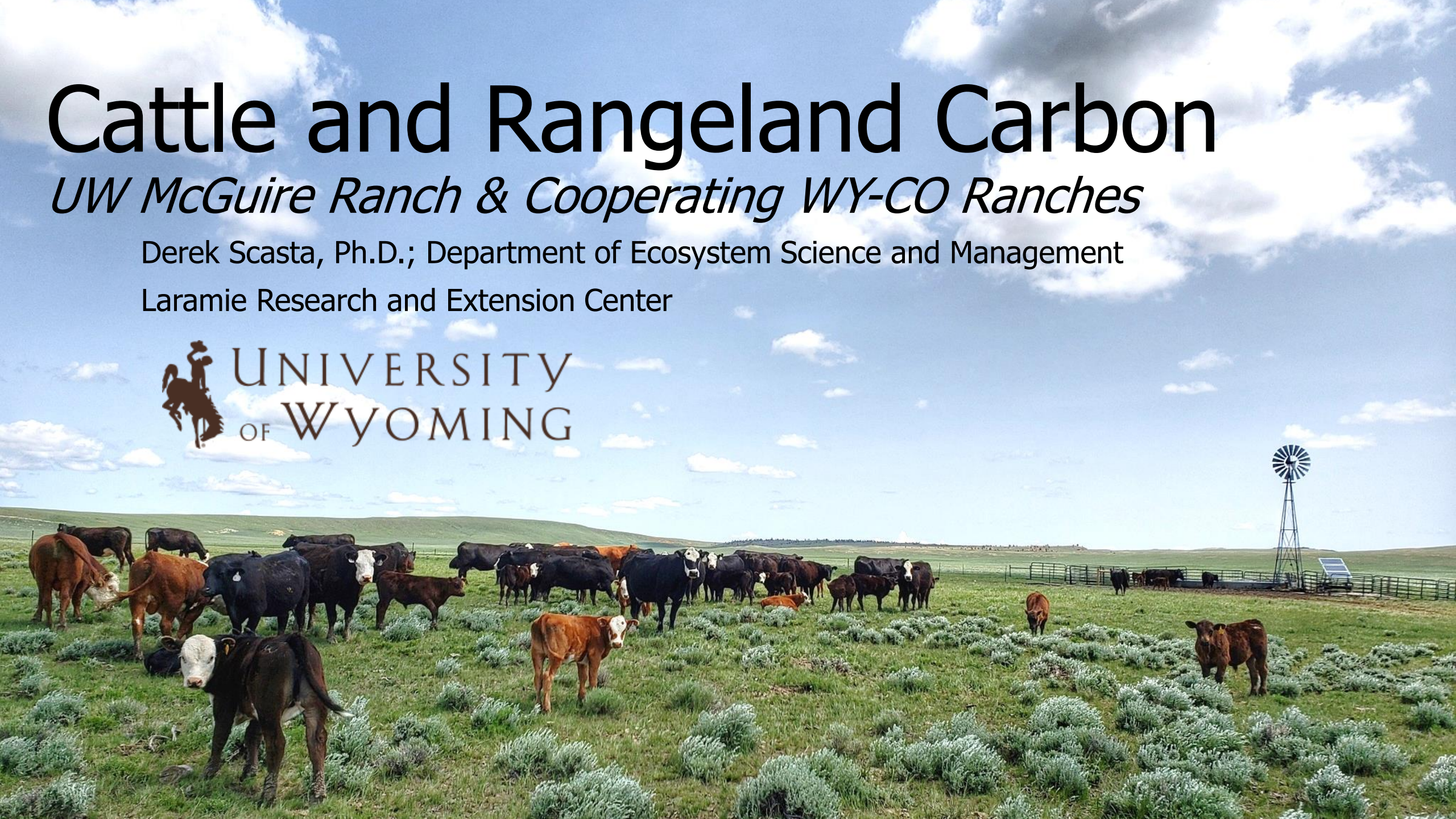


# Cattle and Rangeland Carbon

*UW McGuire Ranch & Cooperating WY-CO Ranches*

Derek Scasta, Ph.D.; Department of Ecosystem Science and Management

Laramie Research and Extension Center

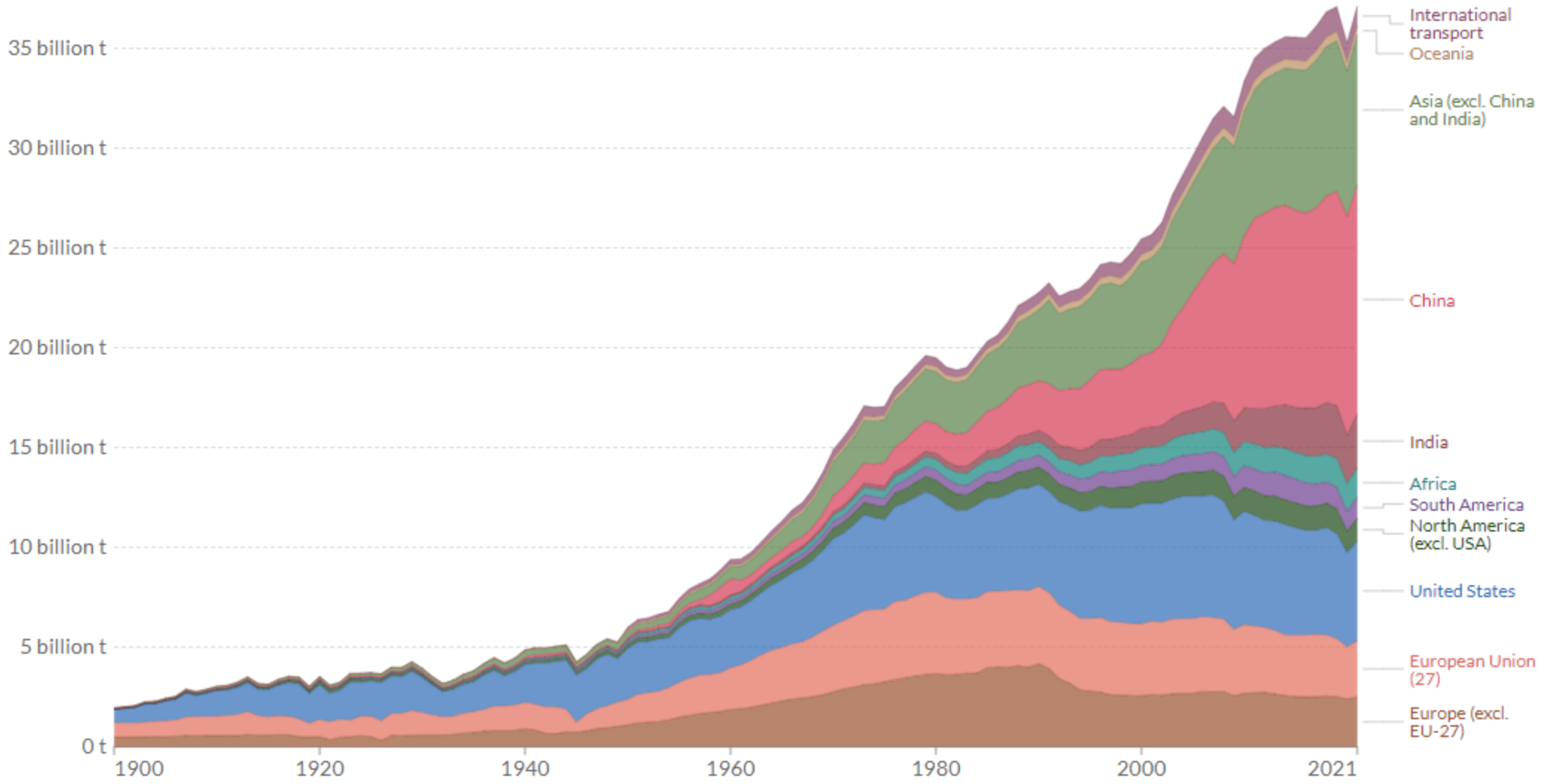




# Annual CO<sub>2</sub> emissions by world region

This measures fossil fuel and industry emissions. Land use change is not included.

All together ▾ □ Relative



Source: Global Carbon Budget (2022)

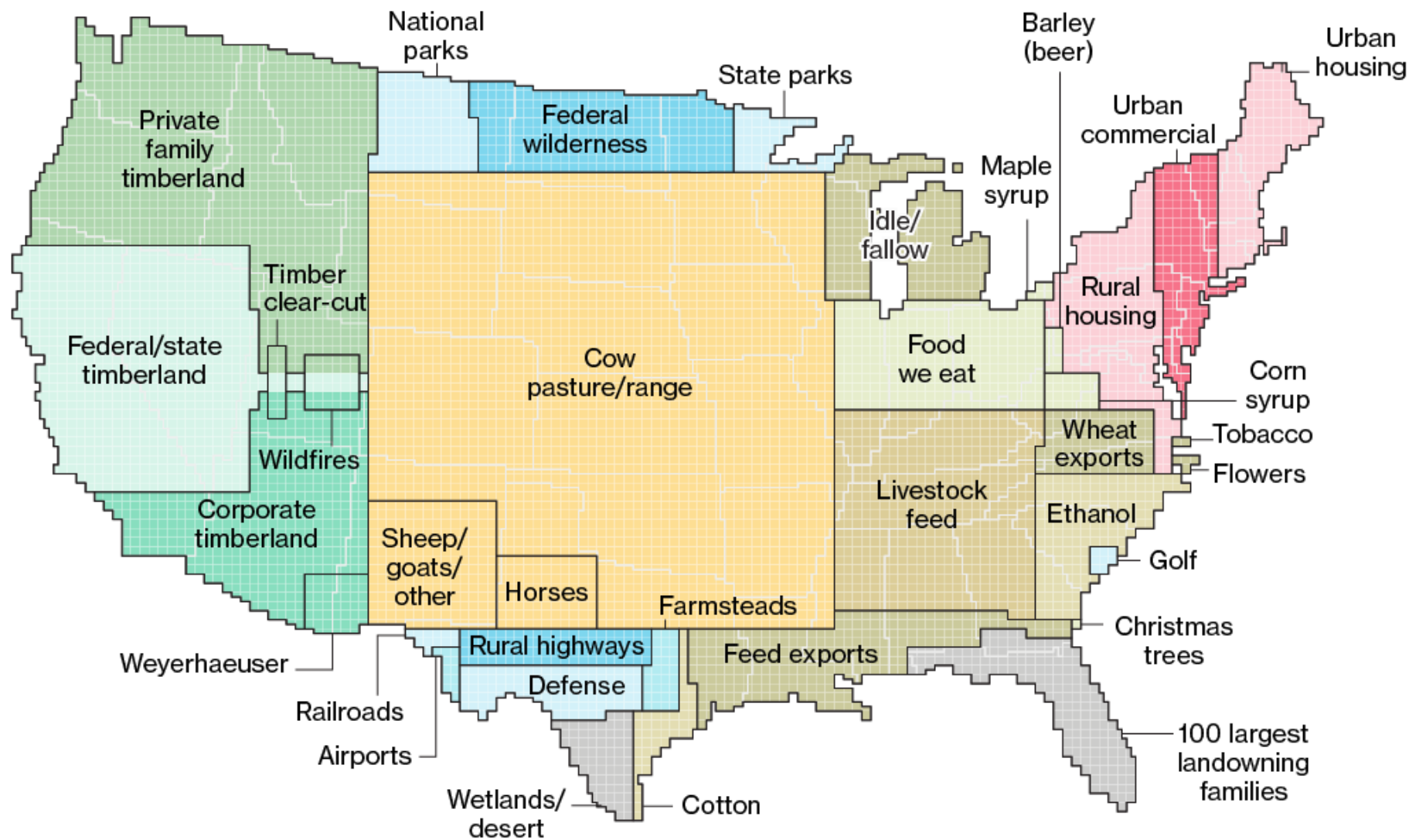
OurWorldInData.org/co2-and-greenhouse-gas-emissions • CC BY

# 655M

acres of  
pasture and  
rangeland in  
the U.S.

# 20%

of the world's  
soil organic  
carbon stock is  
in pasture and  
rangeland



# Carbon: Challenge and Opportunity for Ag

1. Increased concern about carbon dioxide emissions
2. Opportunity to store and accumulate in range and pasture soils
3. May generate new income streams for ranches
4. Lack of information on effects of grazing and potential



The screenshot shows the top navigation bar of the AgWeb website. On the left is the logo for 'AGWEB FARM JOURNAL'. To its right is a search bar with the word 'Search' and a magnifying glass icon. Further right is a small image of a magazine cover titled 'FARM' with the subtitle 'Ducce'. Below the search bar is a horizontal menu with the following items: 'AgDay', 'AgriTalk', 'U.S. Farm Report', 'Pro Farmer', 'Markets Podcast', and 'Crop Comments'. Below this menu are four main categories: 'News' with a dropdown arrow, 'Markets' with a dropdown arrow, 'Cash Grain Bids', and 'Weather'. At the bottom of the screenshot, the title of an article is displayed: 'Ten Considerations Before Signing a Carbon Contract on Your Ranch'.



CLIMATE  
ACTION  
RESERVE

Kateri



agoro  
CARBON™ ALLIANCE





# Prior Work: Ranches

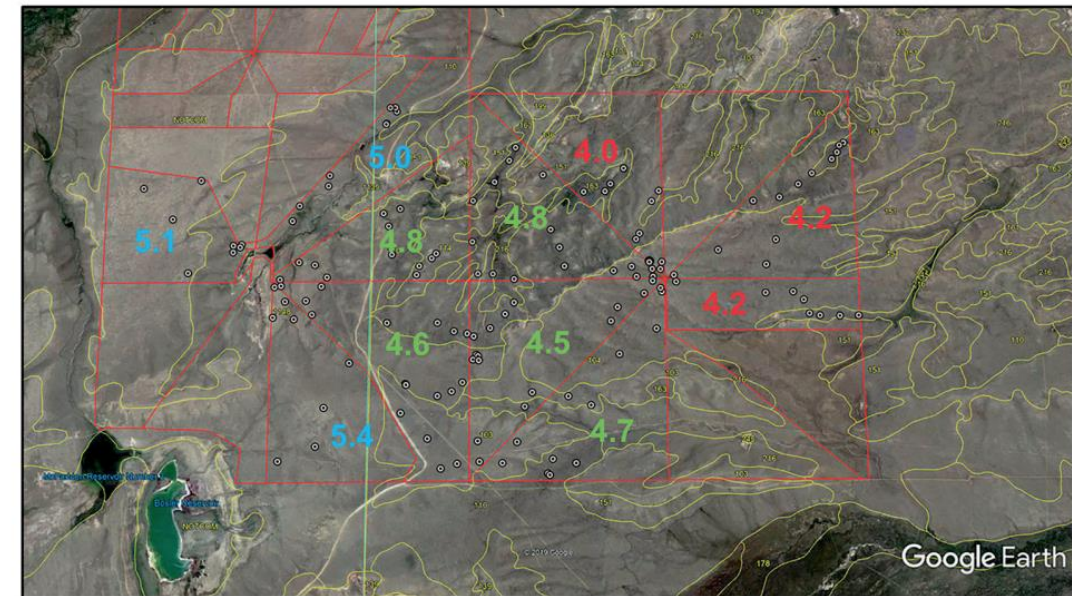
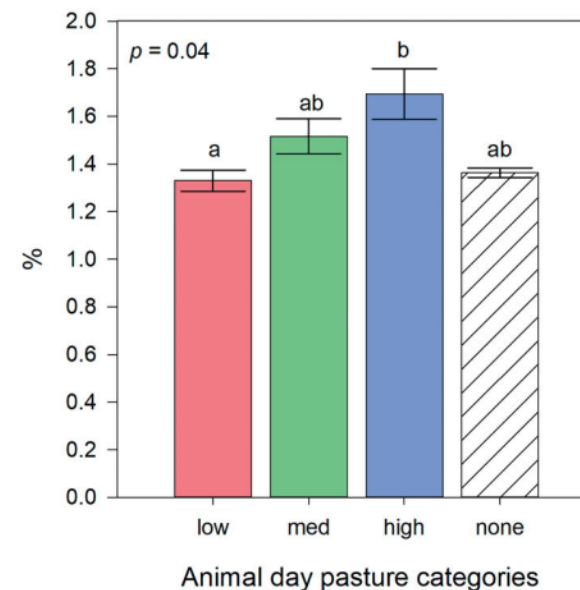
Soil organic carbon is an indicator of grazing capacity and may serve as a useful rangeland soil health indicator for producers

## Ranch-scale soil health, forage quality, and cattle grazing capacity linkages in a high-elevation steppe

Timm Gergeni<sup>a</sup>, John Derek Scasta<sup>a</sup>, Kristie Maczko<sup>a,b</sup>, and John Tanaka<sup>a</sup>

158 T. GERGENI ET AL.

(a) Soil Organic Carbon (OC)



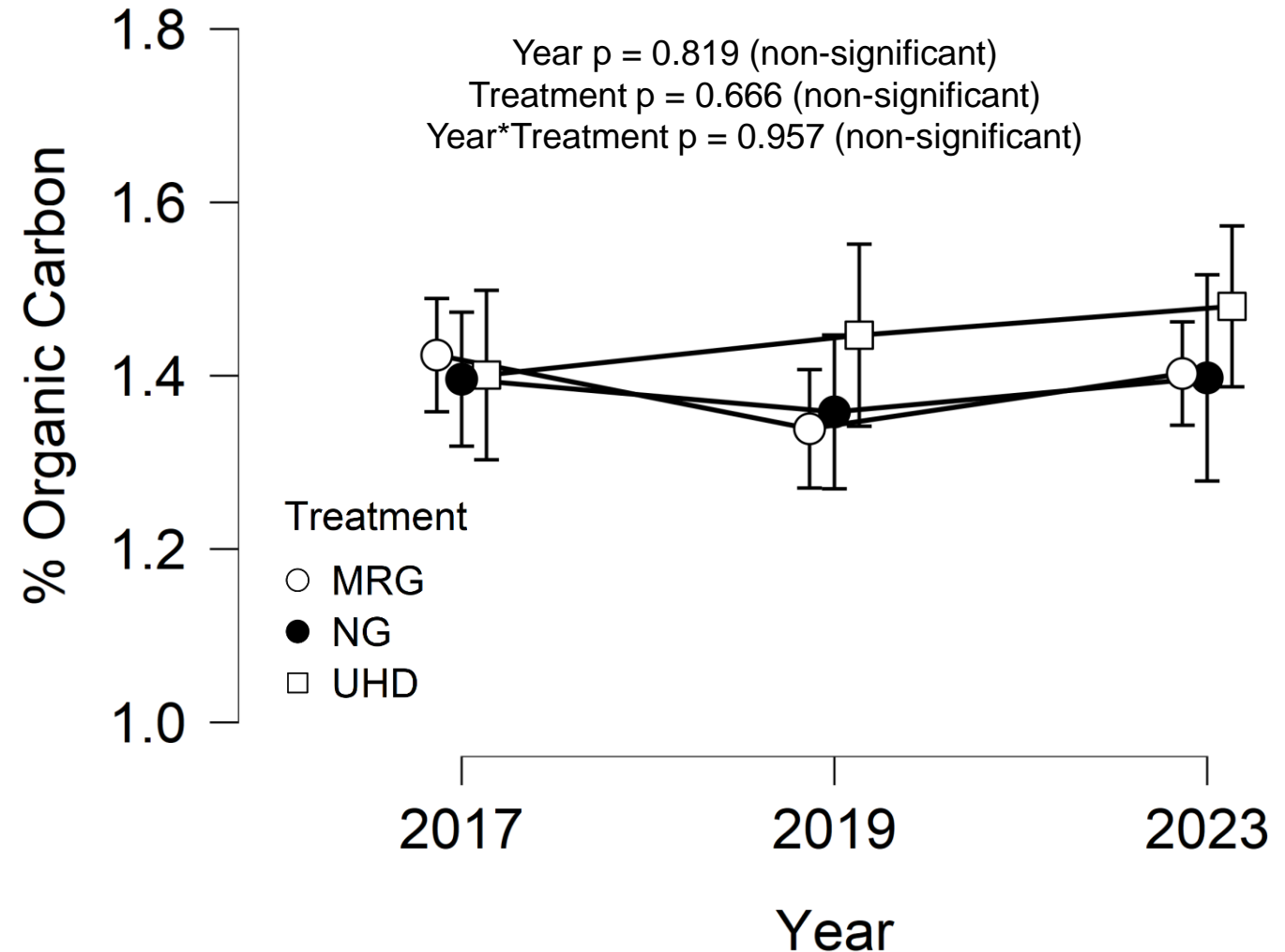
**Figure 1.** Soil sampling points at Sims Ranch in McFadden, Wyoming, USA overlain on pasture and U.S. federal Soil Survey Geographic Database (SSURGO) soil maps for evaluating the relationship between soil health, forage quality, and grazing capacity at the ranch-scale in a high elevation steppe. Red lines denote pasture boundaries, yellow lines denote mapped soils, and circle symbols denote a soil sampling location. Red, green, and blue numbers indicate animal days per hectare for low, medium, and high categories, respectively.

# Prior work: SAREC

Soil organic carbon in eastern WY did not change relative to grazing from 2017-2023

**Temporal variability drives soil chemical and biological dynamics more than grazing in a northern mixed-grass prairie**

TIMM GERGENI<sup>1</sup>, JOHN DEREK SCASTA<sup>1\*</sup>, KRISTIE MACZKO<sup>1,2</sup>, STEVE PAISLEY<sup>3</sup>, JOHN TANAKA<sup>1,2</sup>





# Funding & Partnerships

Total Cost

Funding

More than  
**\$19M**



Additional funding Provided by

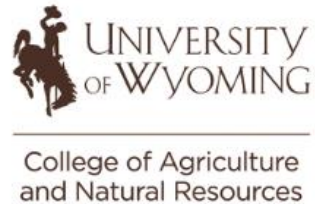
GREENACRES



BUTCHERBOX



MICHIGAN STATE  
UNIVERSITY



QUANTERRA



~60 Cooperating Ranches

# UW McGuire Ranch

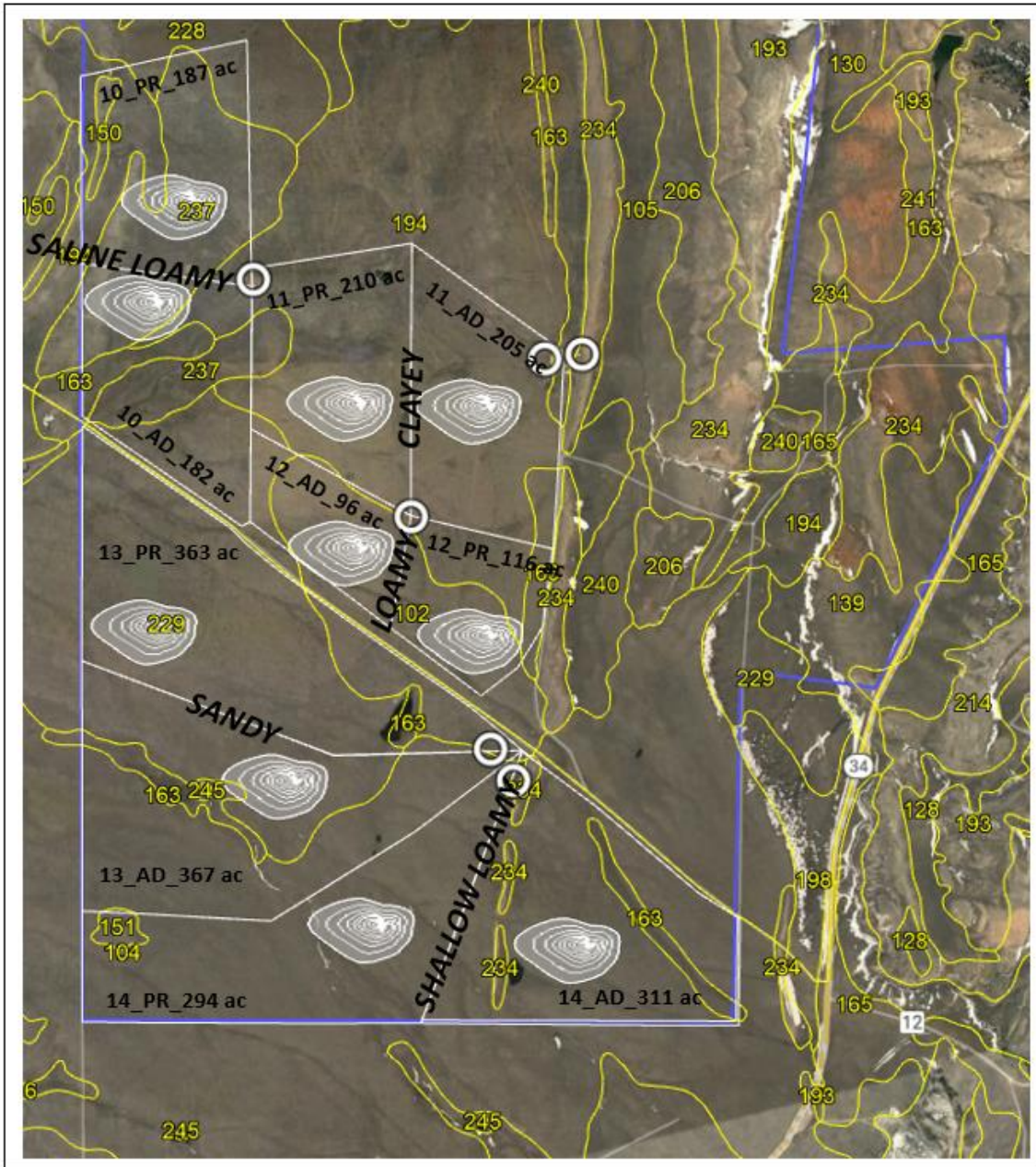
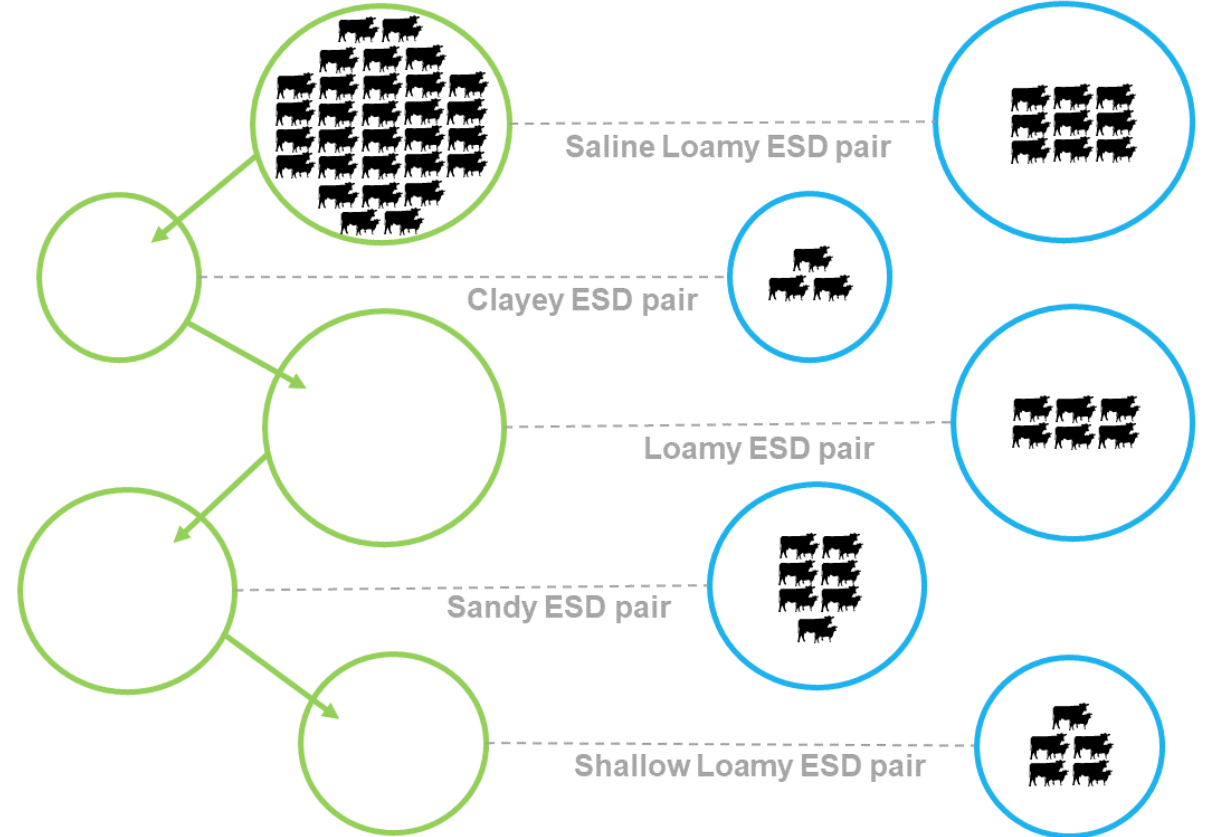
- ~5,500 acre ranch between Laramie and Wheatland
- Sagebrush steppe on west slope of the Laramie Range
- Owned by UW for over 30 years
- New Infrastructure
  - ~12 miles of new fence to build 10 new study pastures (~2,300 acres)
  - New well drilled and a  $\frac{3}{4}$  mile pipeline off existing well
  - 3 new livestock tanks
- Assessing how grazing management can influence soil carbon



# Stratified by soils

Adaptive Management [AD]

Prescriptive Management [PR]



UW AES – McGuire Ranch  
 FFAR-Noble 3 M's Pasture Infrastructure  
 PR = Prescriptive Grazing; AD = Adaptive Grazing



Water Tank



CO<sub>2</sub> Tower Footprint





# Soils

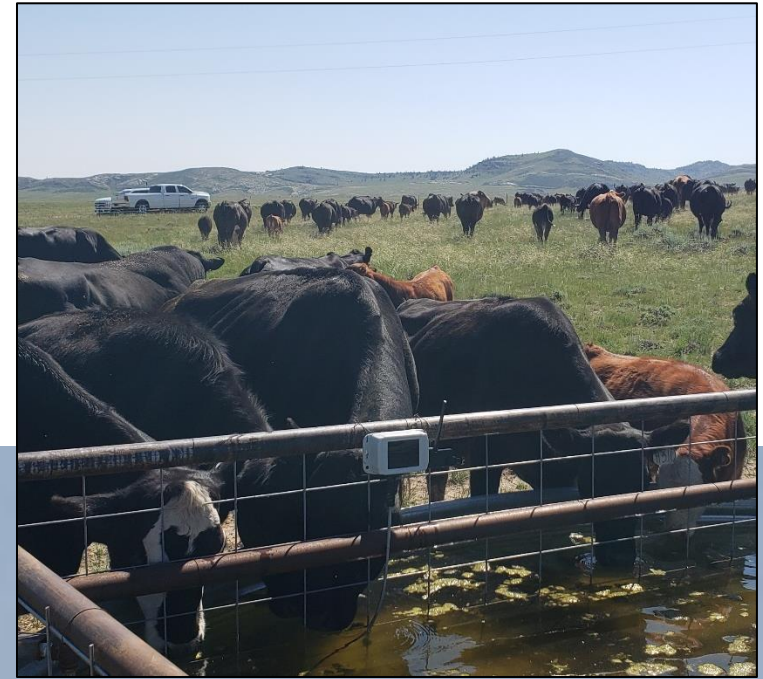
- Down to 1 meter





# Water

- Soil and livestock water



**MICHIGAN STATE**  
**UNIVERSITY**





# Vegetation



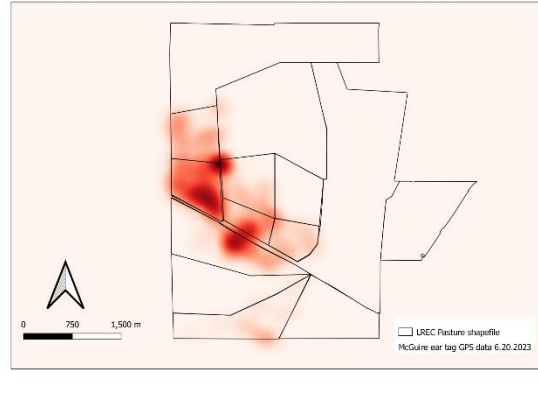
- Forage quantity & quality; Plant composition; Response to grazing





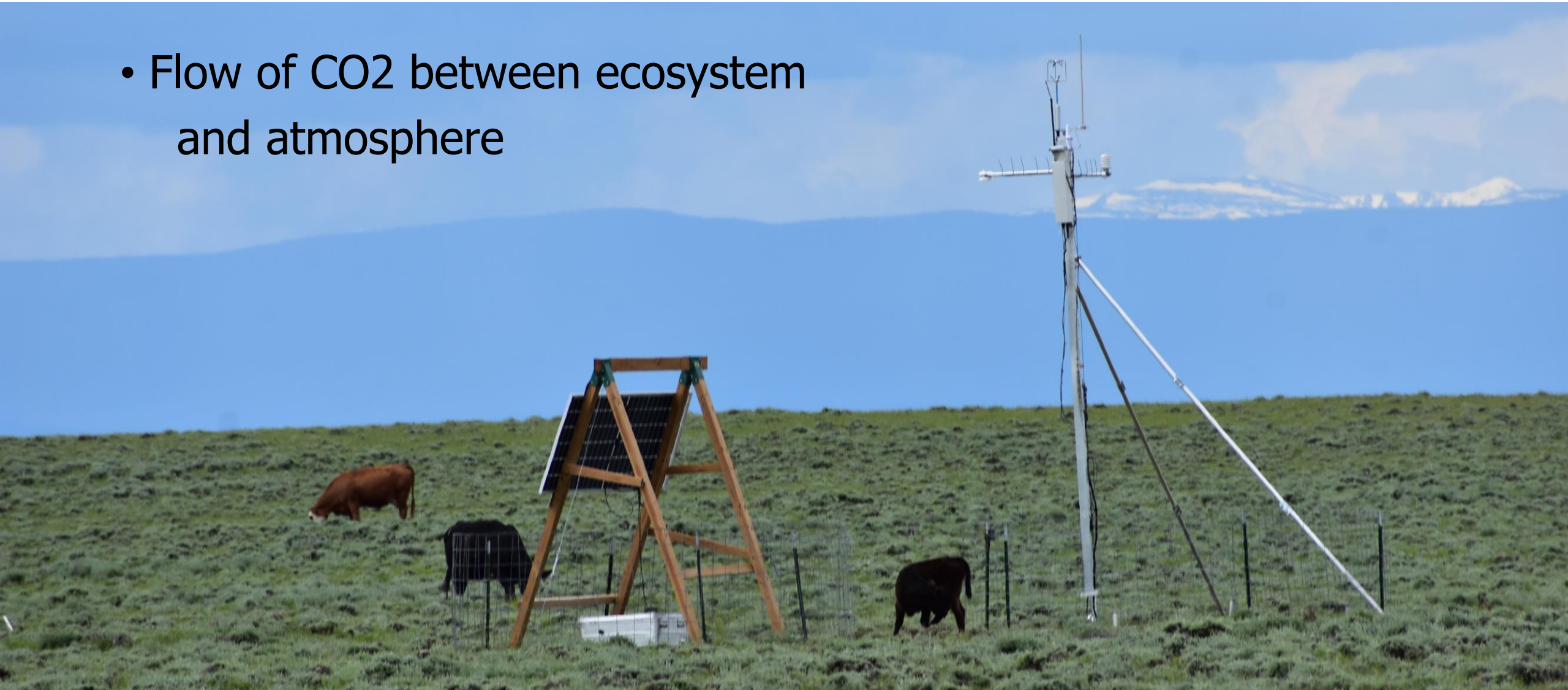
# Animals

- Cattle and wildlife



## Carbon Dioxide

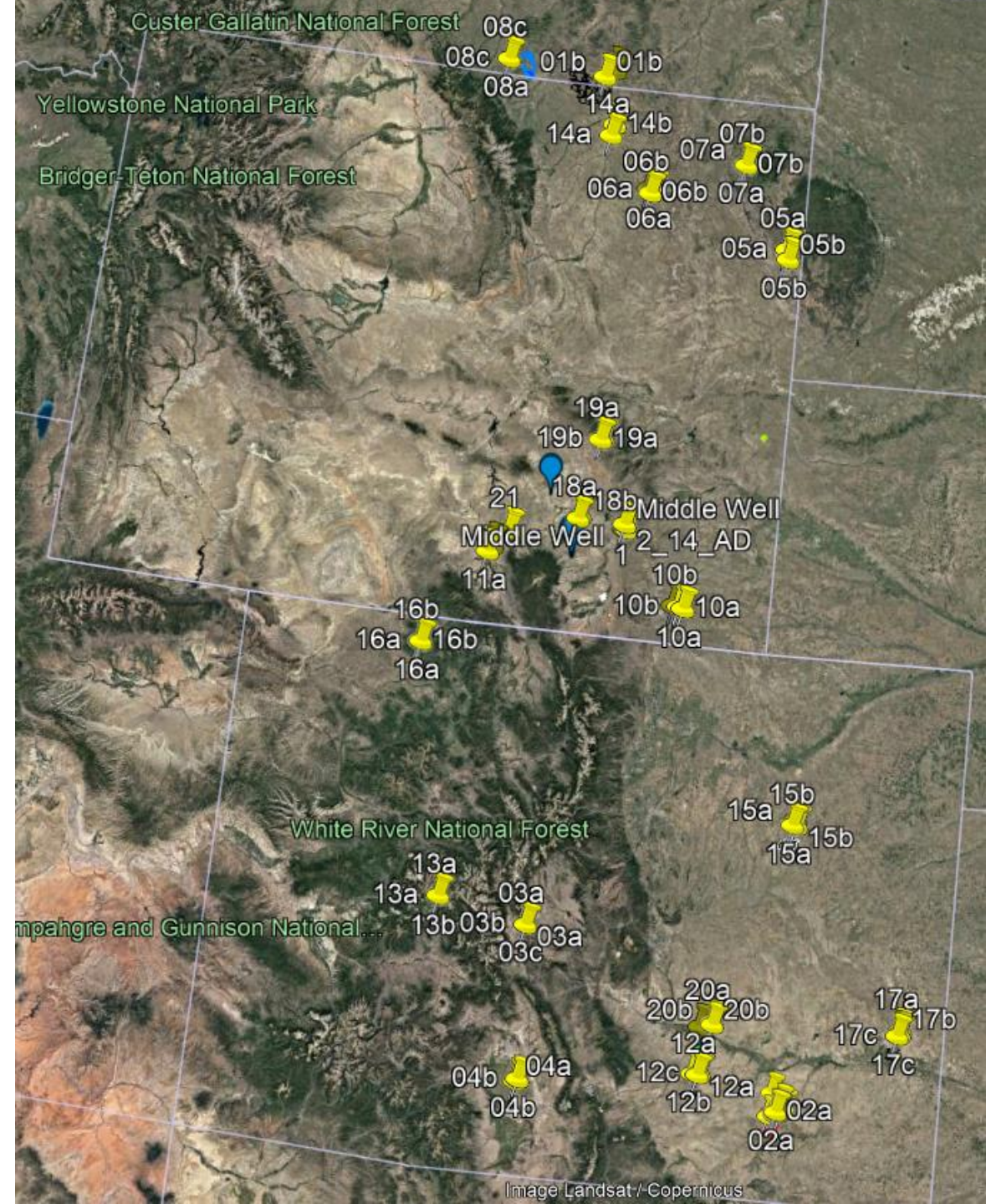
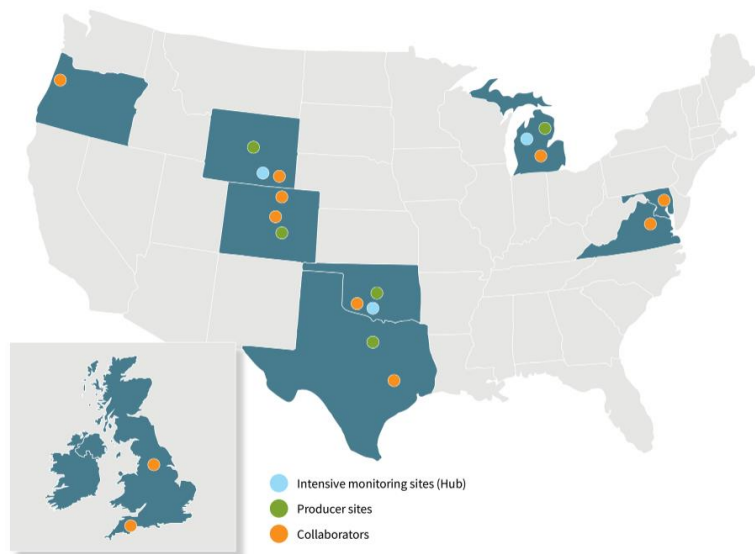
- Flow of CO<sub>2</sub> between ecosystem and atmosphere





# Cooperating Ranches

- Started work with 20 ranches in WY and CO this summer





# Cooperating Ranches

- Encompass environmental and managerial variation

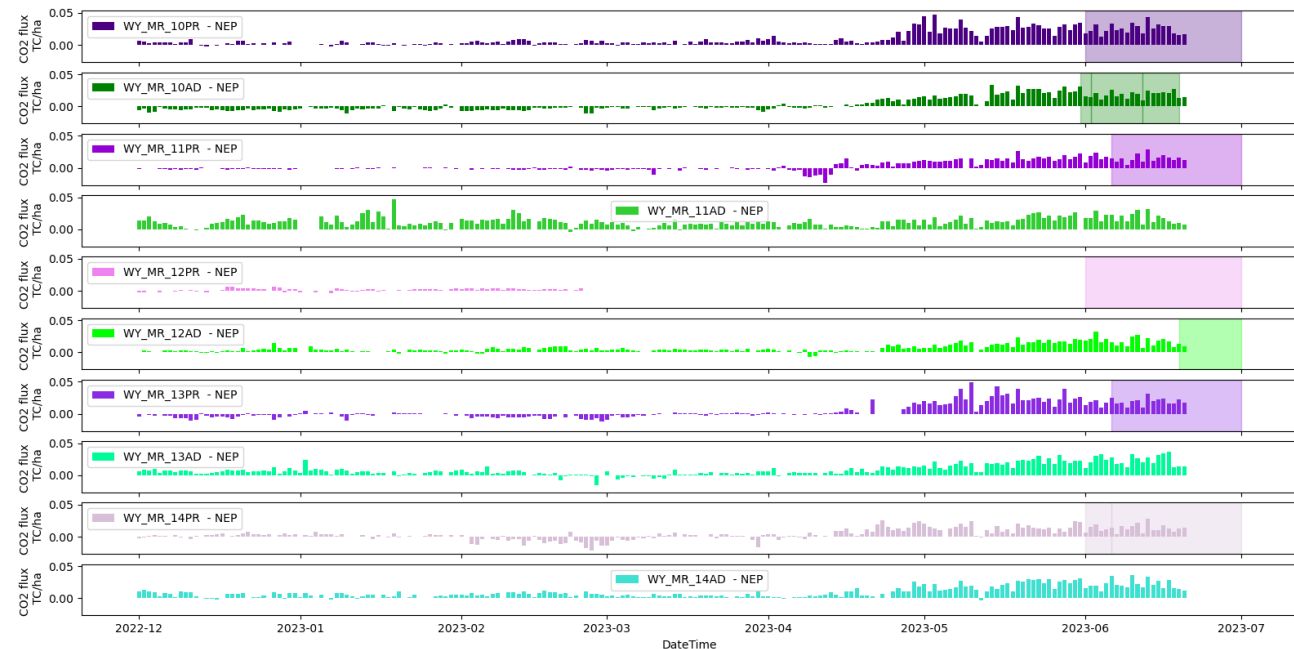




# Data Streams (in progress)

- Soil Carbon
- Evapotranspiration and Soil Moisture
- Net Radiation
- Net Ecosystem Productivity
  - ***Difference between gross primary productivity (GPP) and ecosystem respiration (ER), is the carbon sink basis***

- Grazing Management
- Vegetation productivity
- Economics
- Weather and Climate







# Teamwork





Questions?  
[jscasta@uwyo.edu](mailto:jscasta@uwyo.edu)

