

AGRICULTURAL CARBON CAPTURE IN NORTH DAKOTA RANGELANDS

Oil and Gas Research Program

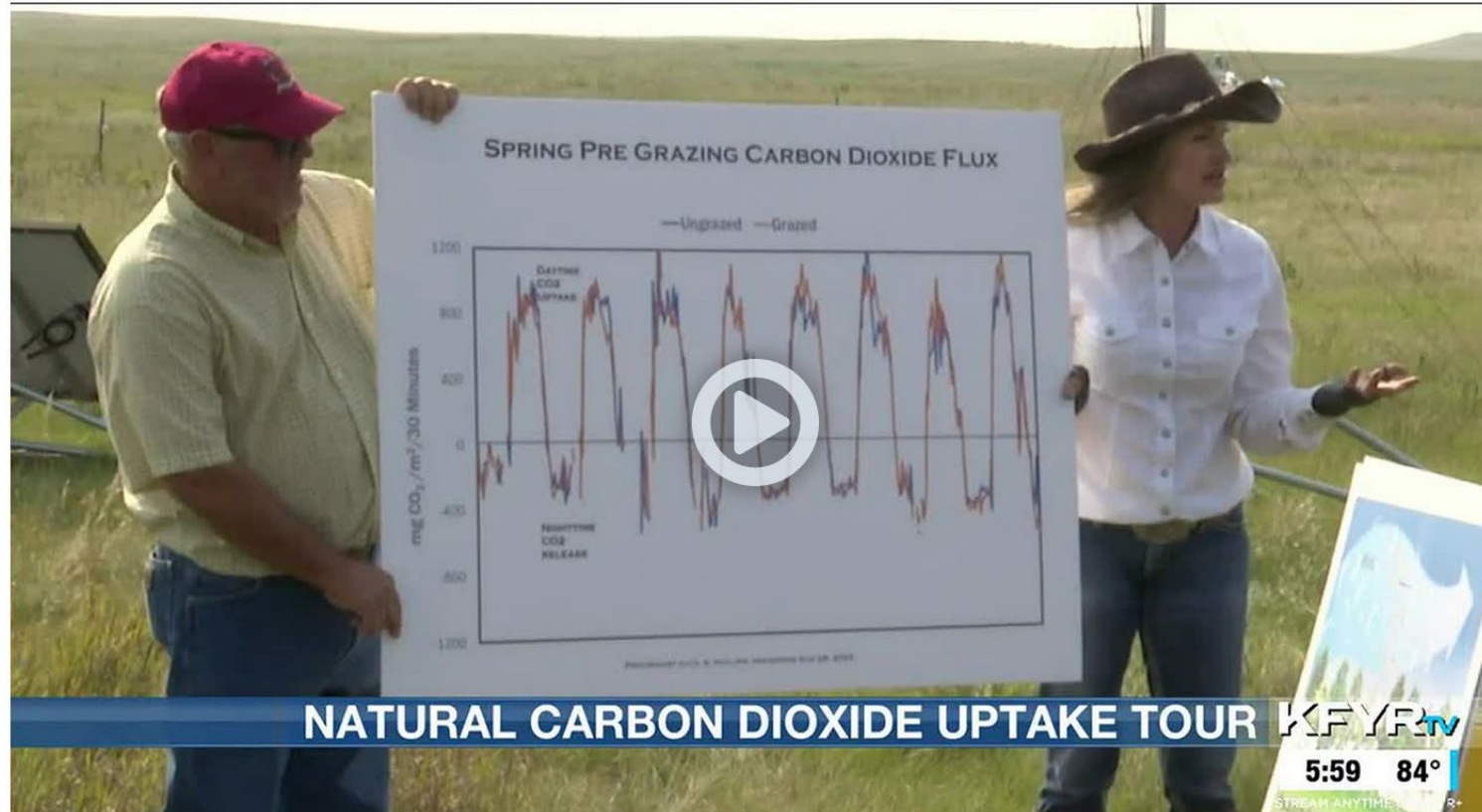
Bismarck, North Dakota, Dec 15, 2023

Jesse Beckers and Dr. Rebecca Phillips

North Dakota Natural Resources Trust, Ecological Insights



Natural carbon dioxide uptake grassland tour takes place in McKenzie



HYPOTHESIS

GRAZING MANAGEMENT WILL ENHANCE

-CARBON CAPTURE AND STORAGE

-WATER HOLDING CAPACITY

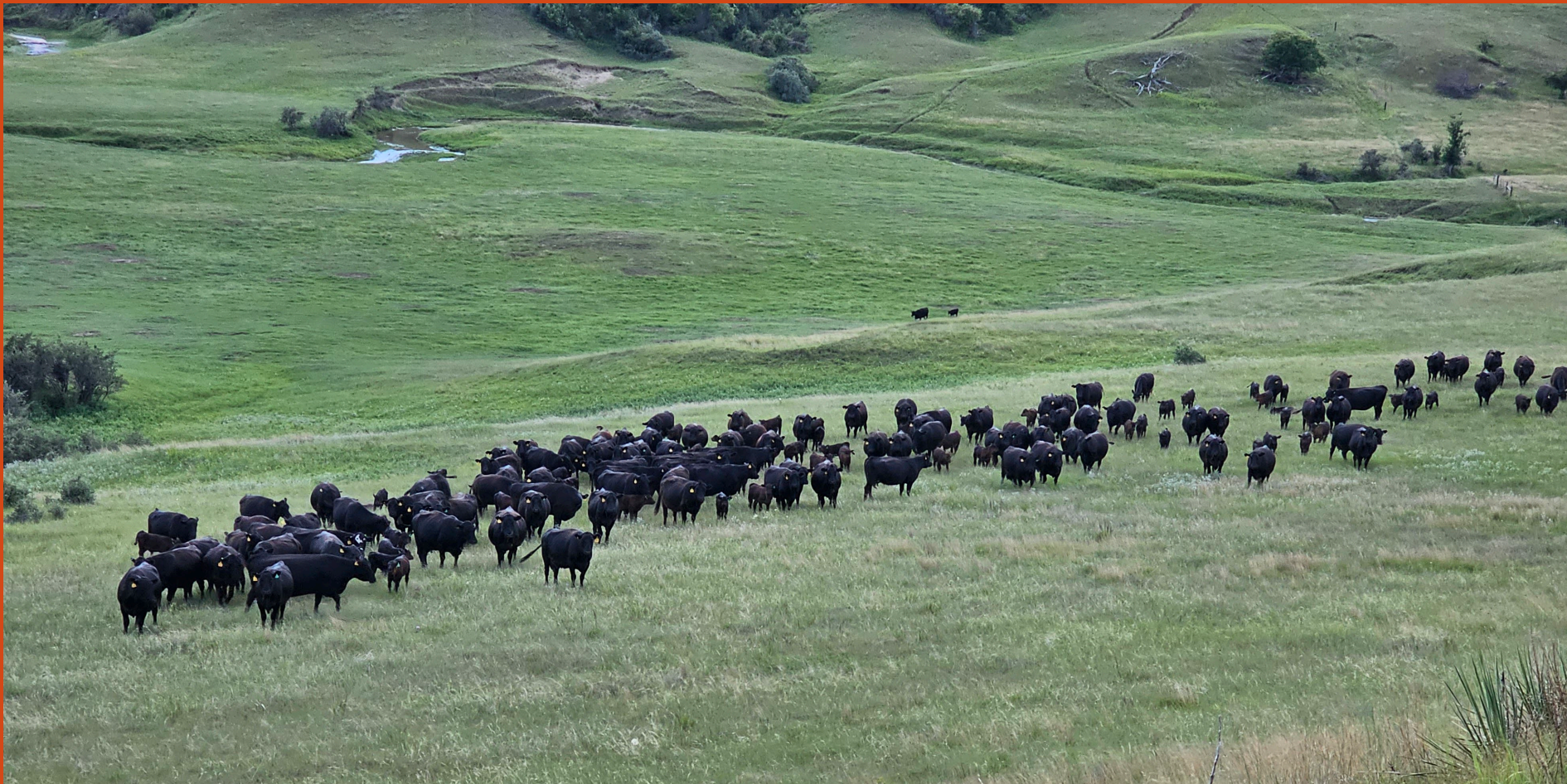
-FORAGE PRODUCTION

-ORGANIC MATTER

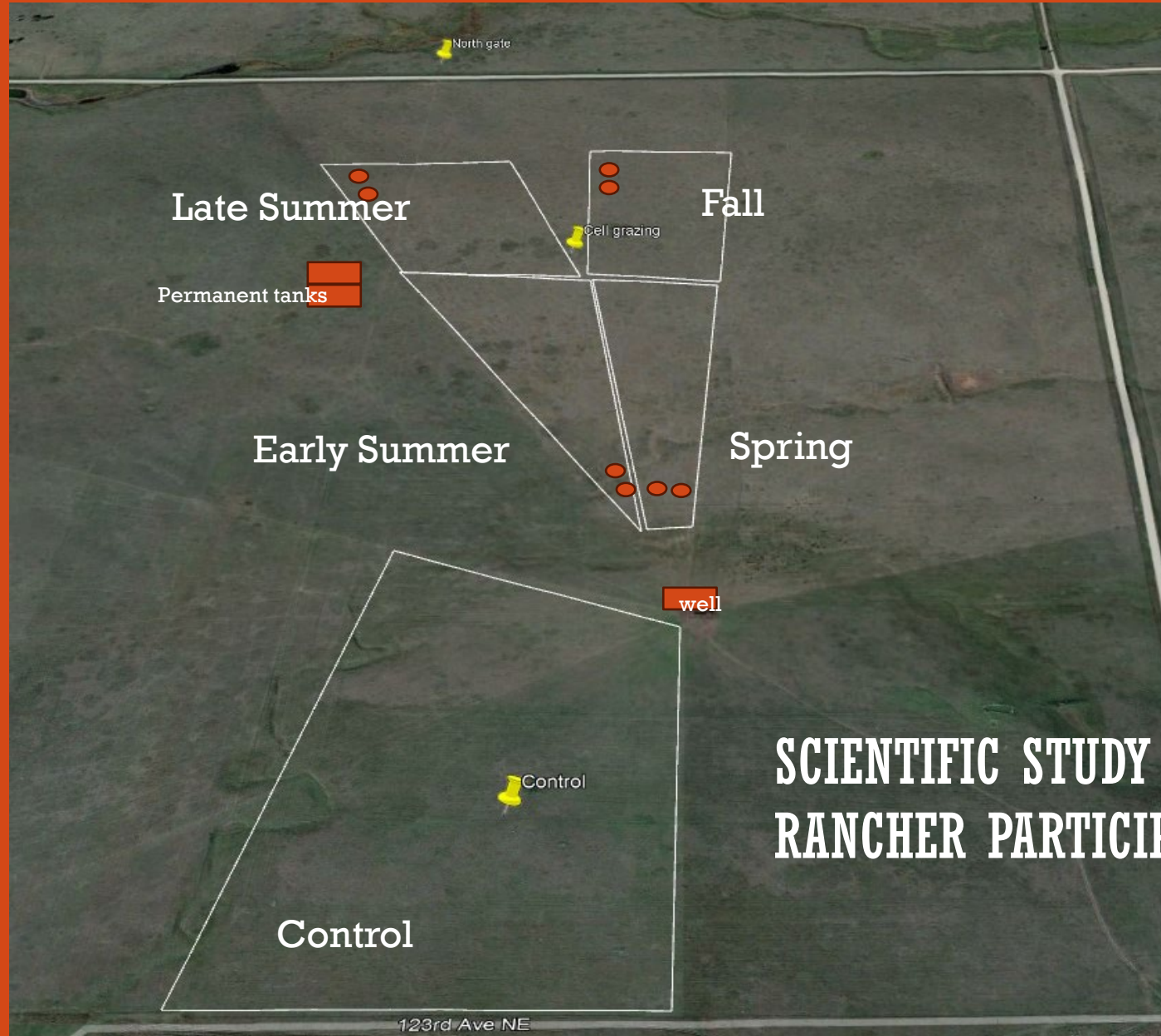
-BIODIVERSITY



WE ARE MEASURING MANAGEMENT EFFECTS ON WORKING LANDS IN REAL TIME



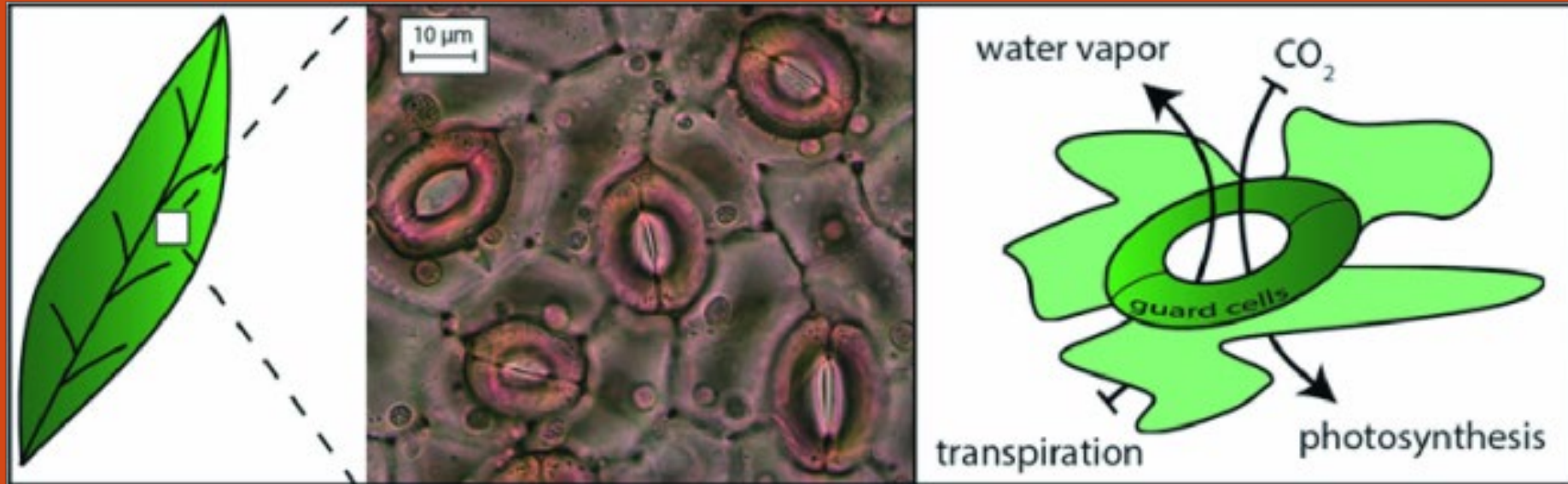
ON A WORKING RANCH WITH 150 COW-CALF PAIRS



USING STATE-OF-THE-ART TECHNOLOGY



TRACKS ECOSYSTEM “BREATHING” CONTINUOUSLY FOR 50 ACRE PASTURES

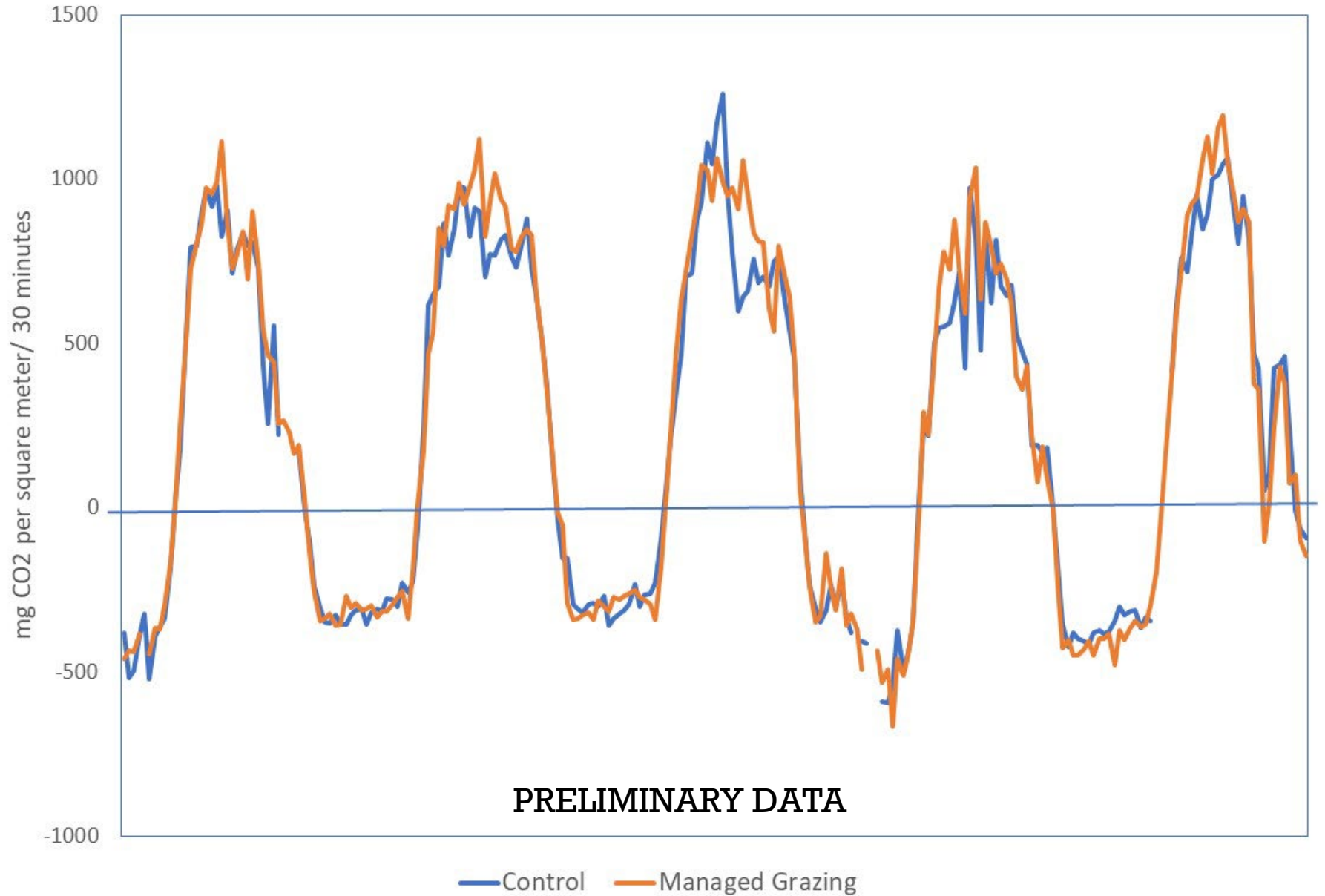


CO₂ moves in during the day and out at night



Net Ecosystem Exchange of CO₂

Prior to Grazing, May 24-28, Net Ecosystem Exchange of CO₂



CO₂ uptake daytime

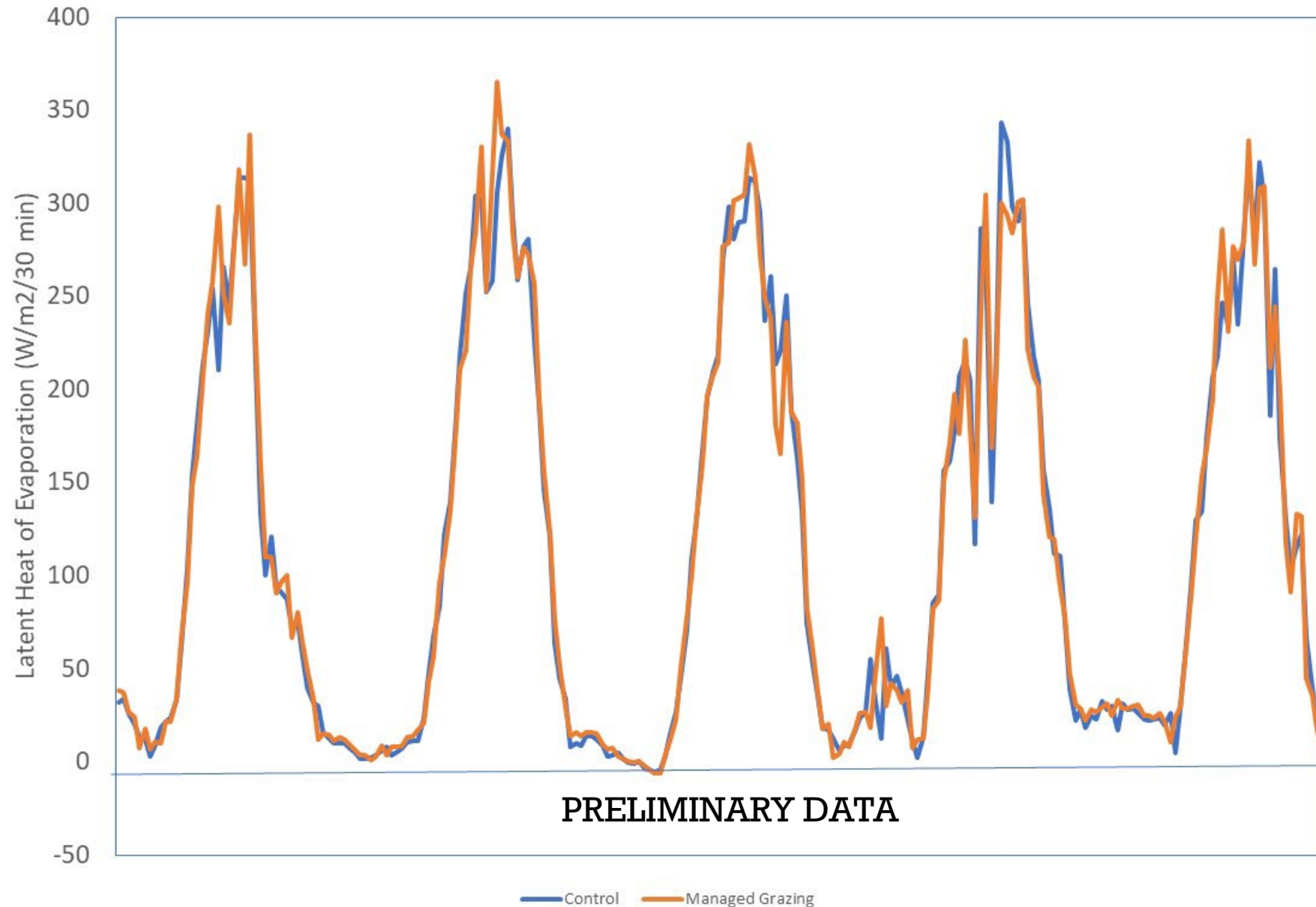


CO₂ release nighttime



Daytime CO2 uptake coincides with water vapor losses

Prior to Grazing, Energy Losses as Water Vapor, May 24-28



Graze each paddock until 50% of the leaf area is removed

Track forage recovery over time

Determine actual amount of forage and leaf area removed by grazers



LEAF AREA MEASUREMENTS-GREEN BIOMASS





NET ECOSYSTEM EXCHANGE OF CARBON DIOXIDE

Collects data at a pasture scale (~ 50 acres)

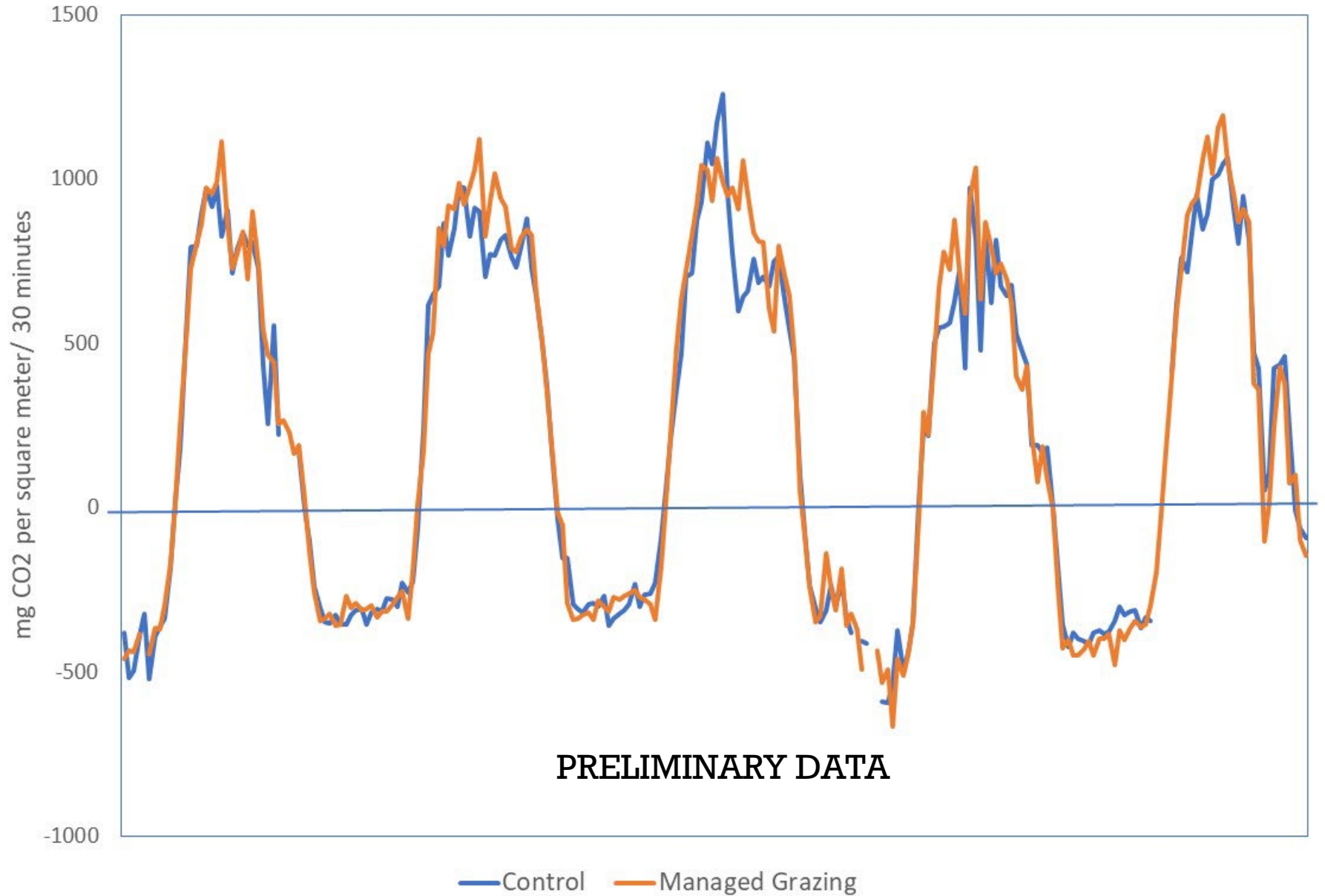
The most direct way to measure vertical fluxes of water vapor, trace gases, heat, and momentum between the surface and the atmosphere.

- Sonic anemometer and infrared gas analyser
- Measures concentrations of CO₂
- Measures 3-D wind speed and direction, 10 times per second
- Weather data, soil moisture, soil temp, air temp, rainfall, humidity, radiation, energy
- Continuous, every ½ hour



Pre-Grazing Net Ecosystem Exchange of CO₂

Prior to Grazing, May 24-28, Net Ecosystem Exchange of CO₂



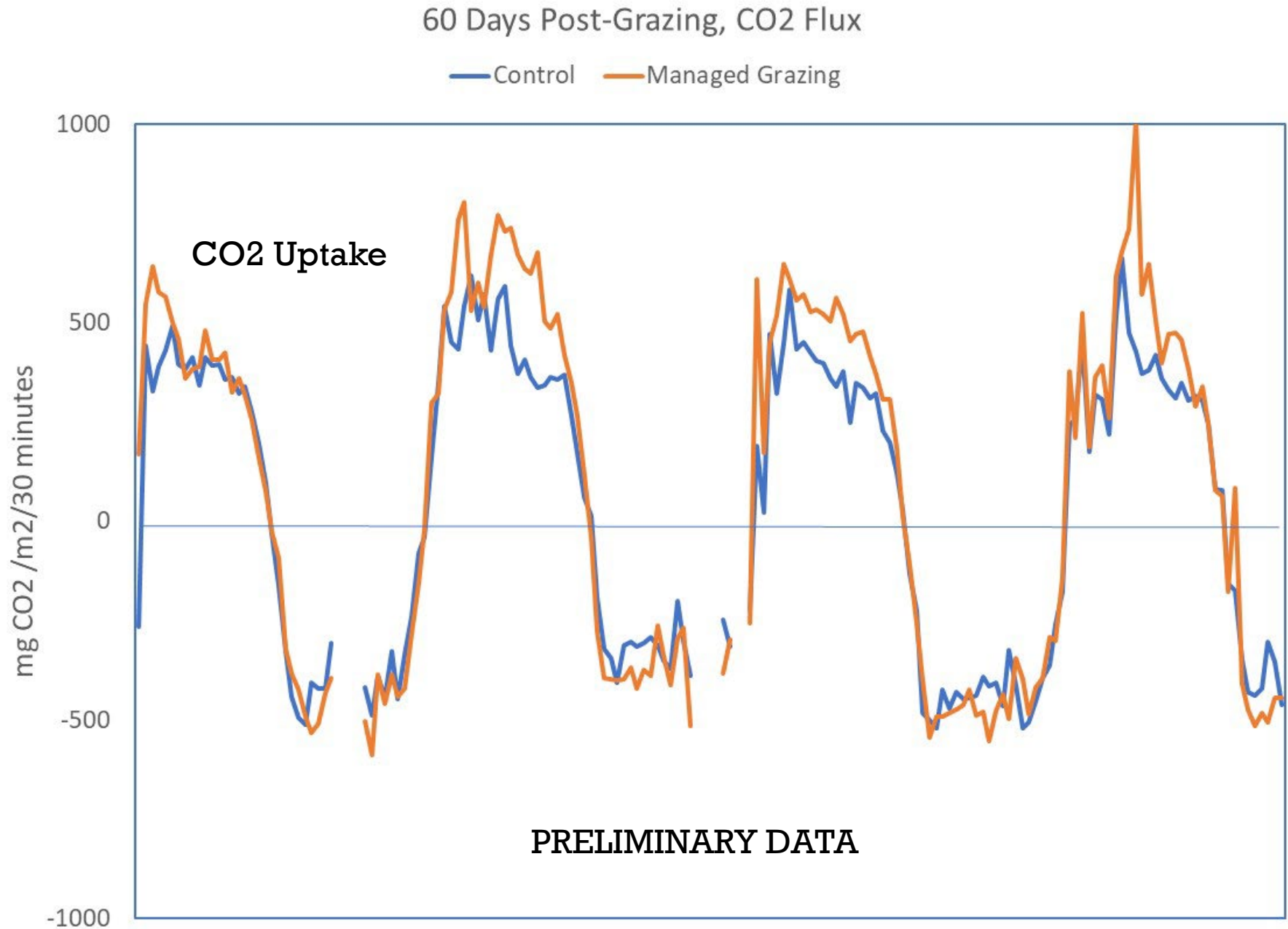
CO₂ uptake daytime



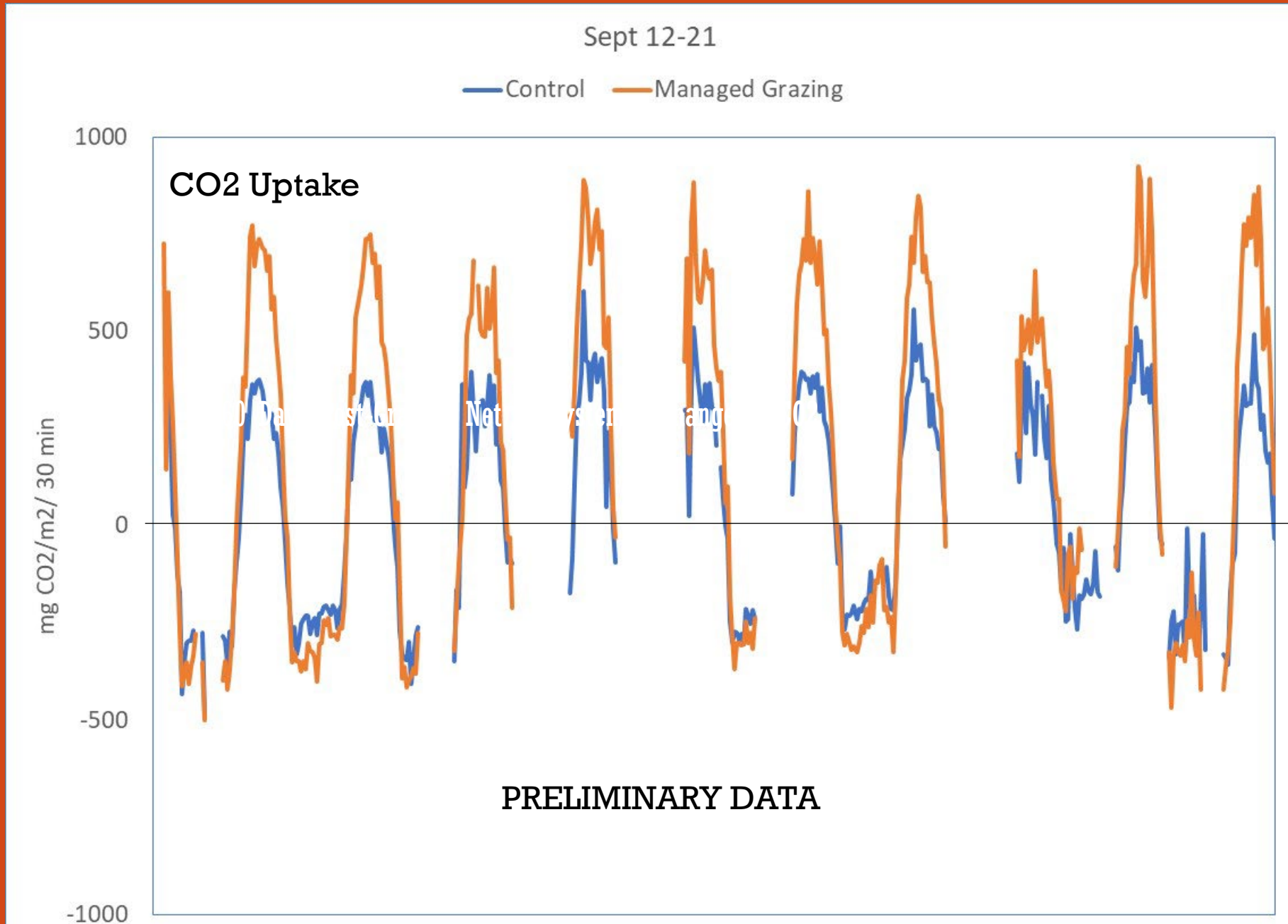
CO₂ release nighttime



60 Days Post-Grazing Net Ecosystem Exchange of CO2

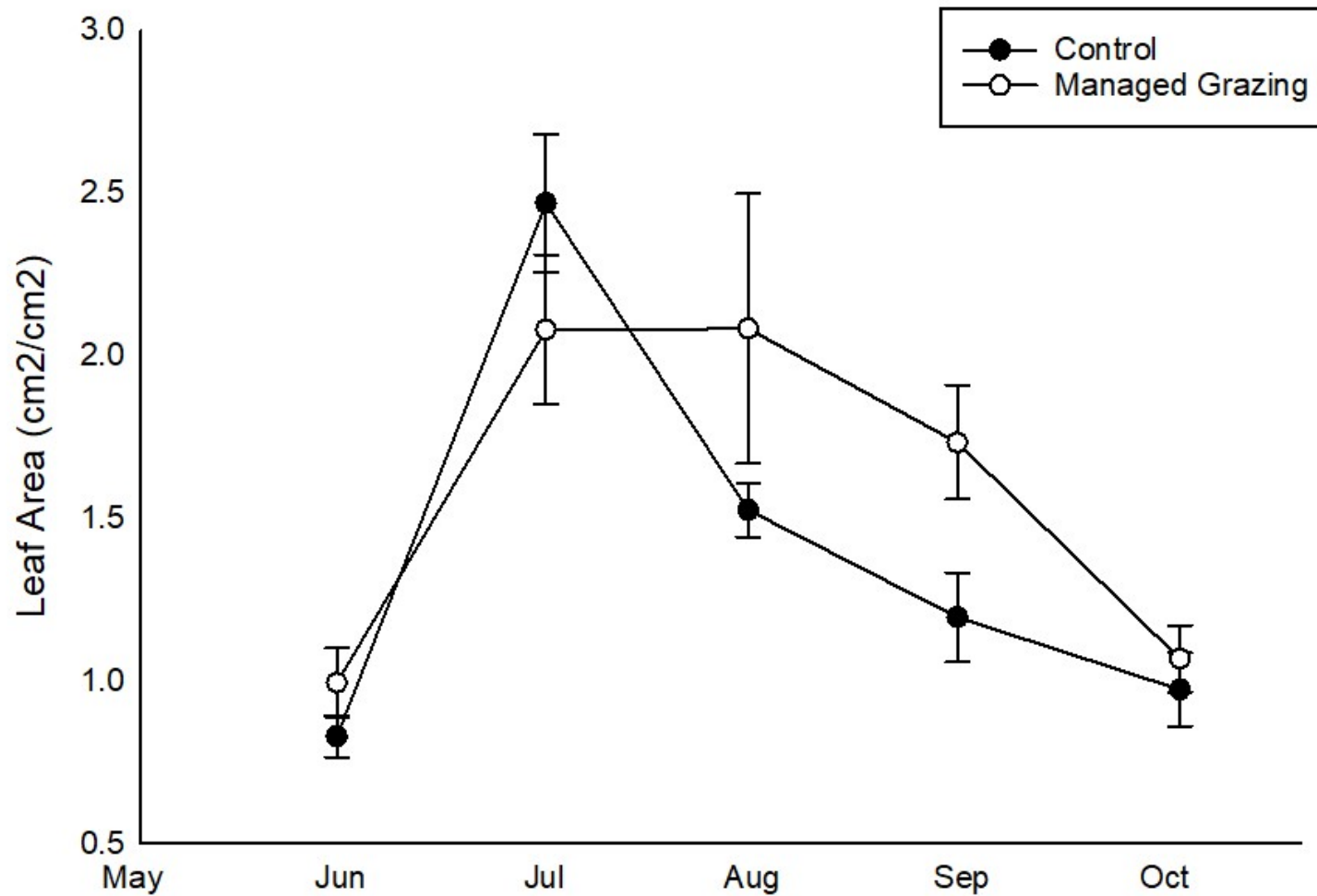


100 Days Post-Grazing Net Ecosystem Exchange of CO₂



Biomass Data for Leaf Area

Average Leaf Area from June through October 2023



OUTCOMES FOLLOWING COMPLETION OF FIRST YEAR OF DATA IN 2024

1. Annual carbon captured & stored for rangelands
= net production – harvest + deposits – dissolved
2. Grazing management impacts on rangeland carbon capture
and the water budget.
3. Estimate % change in carbon capture for managed
rangelands relative to control.



POTENTIAL OUTCOMES FOLLOWING COMPLETION OF TWO YEARS OF DATA

1. Determine if effects of managed on grazing capture changes from year to year under variable environmental conditions.
2. Model rangeland carbon capture under variable climatic conditions and leaf areas.
3. Apply imagery to spatially model carbon capture for rangelands in western North Dakota



Cattle grazing near the instruments in spring



were friendlier by autumn



Toughing it out under all kinds of conditions



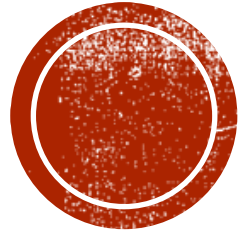
SPONSORS AND PARTNERS

- ND Natural Resources Trust
- National Fish and Wildlife Federation
- ND Game and Fish
- Hess Oil (now Chevron)
- ND Industrial Commission
- ND Grazing Lands Coalition
- Soil Conservation Districts
- ND Oil and Gas Research
- Nature Conservancy
- Ducks Unlimited
- Pheasants Forever, Audubon
- Badlands Alliance Group



Rancher Lewis Heaton





THANK YOU

