

# MANAGING RANGELANDS FOR NATURAL CARBON CAPTURE

Visions West Natural Resources Meeting

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# OUTLINE

- Why carbon is important in North Dakota
- How we measure carbon
- Managed grazing experiment
- Preliminary data
- Future directions in spatial modeling







## **THIS PROJECT**

Determine how managed grazing can improve production and therefore carbon uptake.

The data will help rangelands have a higher value







# NATURAL CARBON CAPTURE IN RANGELANDS

1. Low \$\$, low risk
2. Could more carbon be captured under managed grazing?
3. This project is needed to address this question





# THE PROJECT IS MORE THAN JUST CARBON

- Economic
- Soil Health
- Habitat
- Legacy
- Voluntary Markets



# WAYS WE MEASURE CARBON

1. Soil samples, as percent carbon and/or percent organic matter (parts per hundred)

2. CO<sub>2</sub> Fluxes, Net Ecosystem Exchange (NEE)  
Real-time measurements of CO<sub>2</sub> in air (parts per million). Annual amount of CO<sub>2</sub> that was transferred from the air to plant biomass.

3. Annual Ecosystem C Sequestration

= NEE (net uptake) – HARVEST + DEPOSITS

This takes a full year of data to determine





# 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 CO<sub>2</sub>
- 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



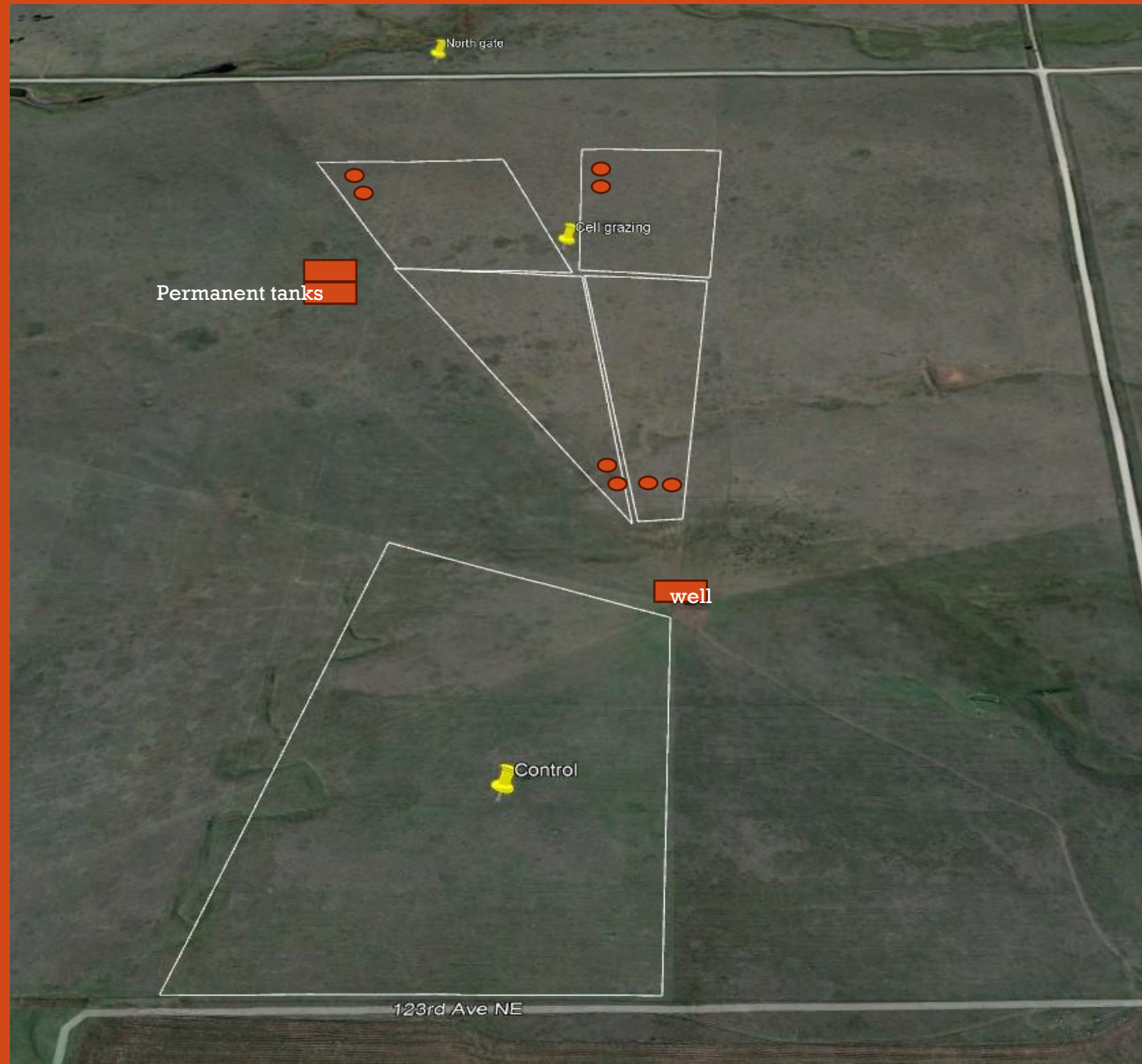


Business as usual, prior to 2023



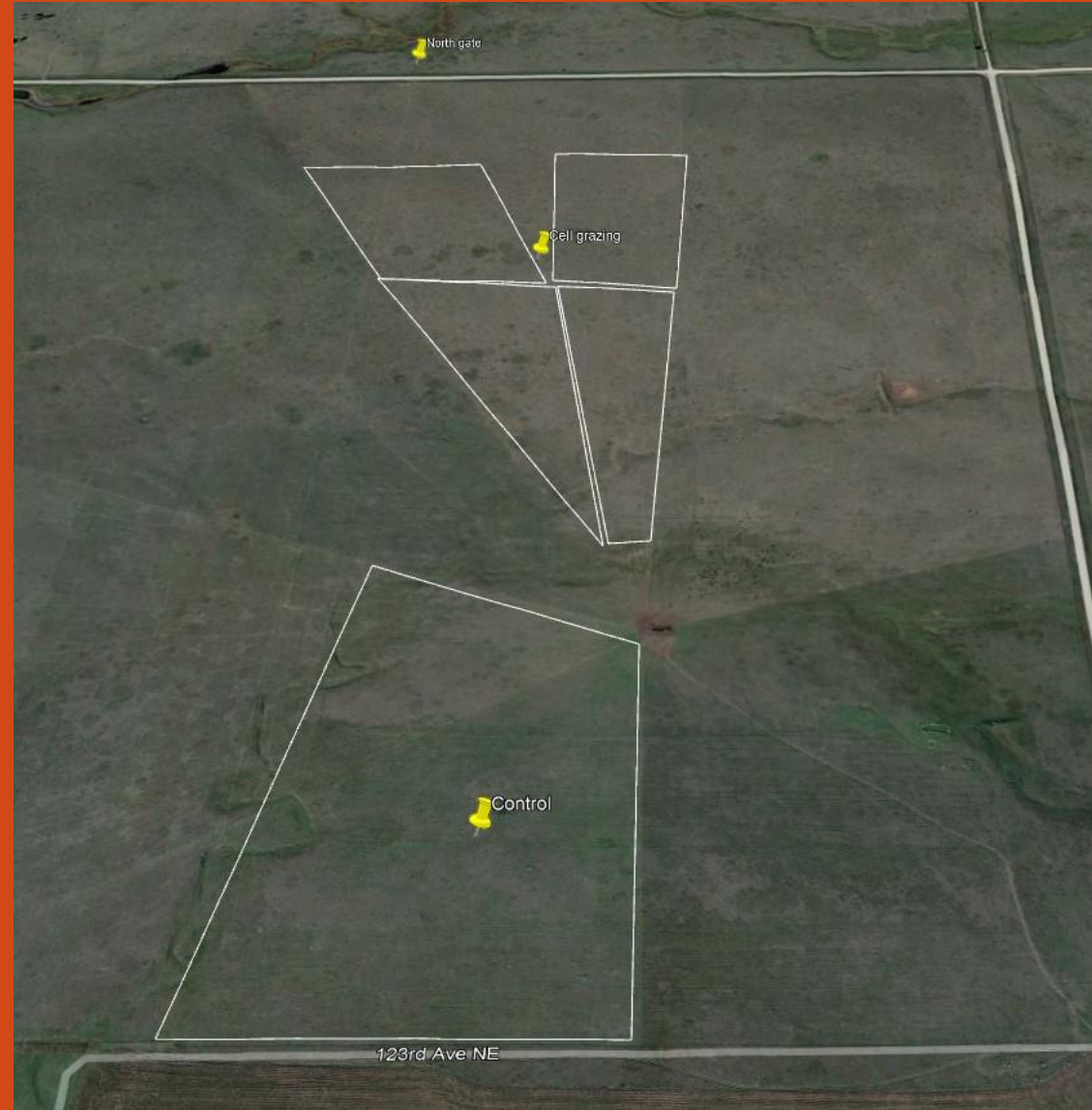


# Set up needed to accommodate eddy covariance measurement



# WORKING LANDS RESEARCH

- 4 paddocks grazed at different times of the year, ~11 acres each.
- First year of 2-year project
- Target 50% leaf area removal.
- Measure leaf area and biomass before and after each grazing event.
- Alter season of use.
- Track species cover each year
- Instrumented, ungrazed control

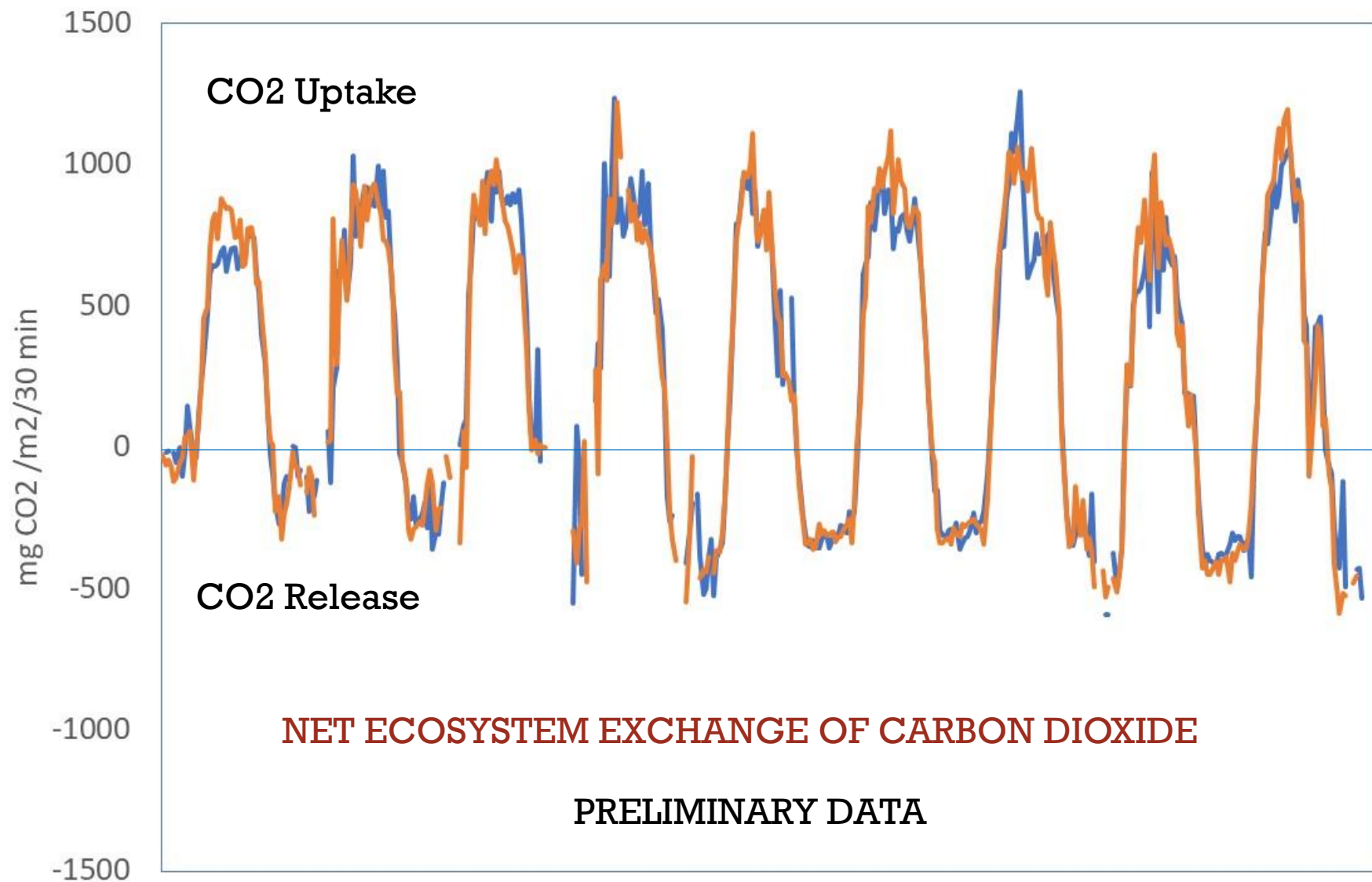






# Pre-Grazing, May 20-28 CO2 Flux (mg/m2/30 min)

Control Managed Grazing



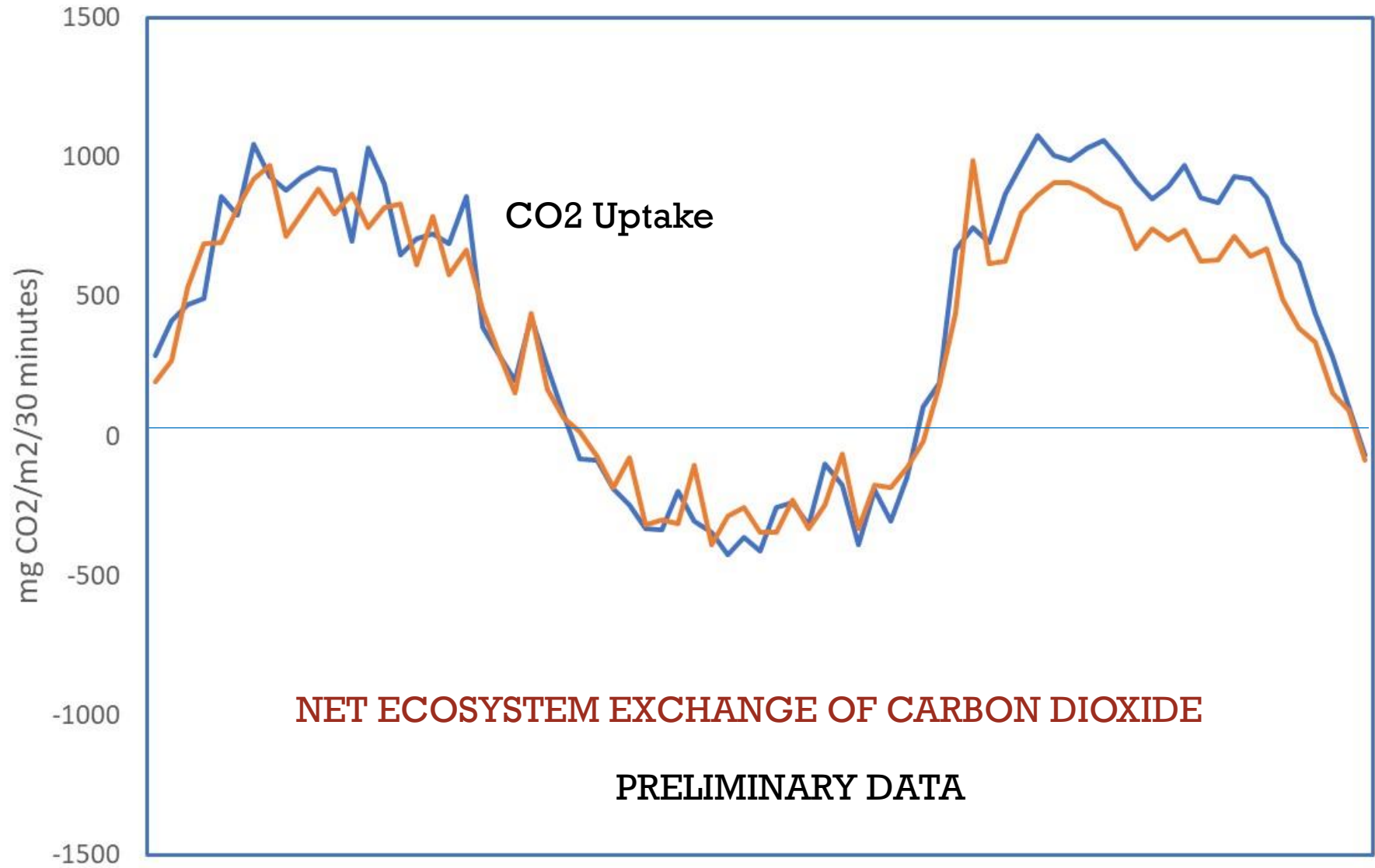






# 10 Days Post-Grazing CO2 Flux

— Control — Managed Grazing



**NET ECOSYSTEM EXCHANGE OF CARBON DIOXIDE**

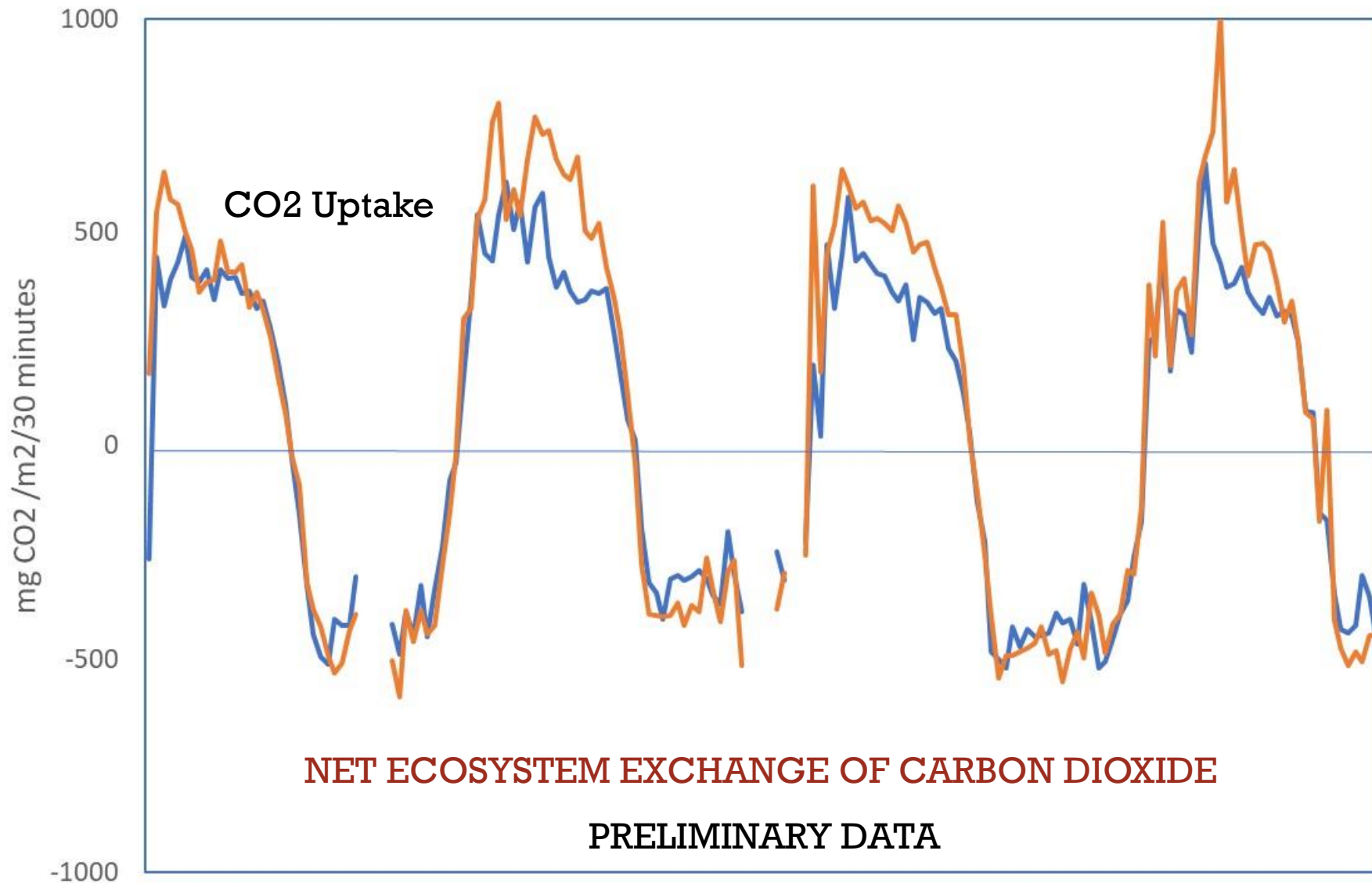
**PRELIMINARY DATA**





# 60 Days Post-Grazing, CO2 Flux

— Control — Managed Grazing



NET ECOSYSTEM EXCHANGE OF CARBON DIOXIDE

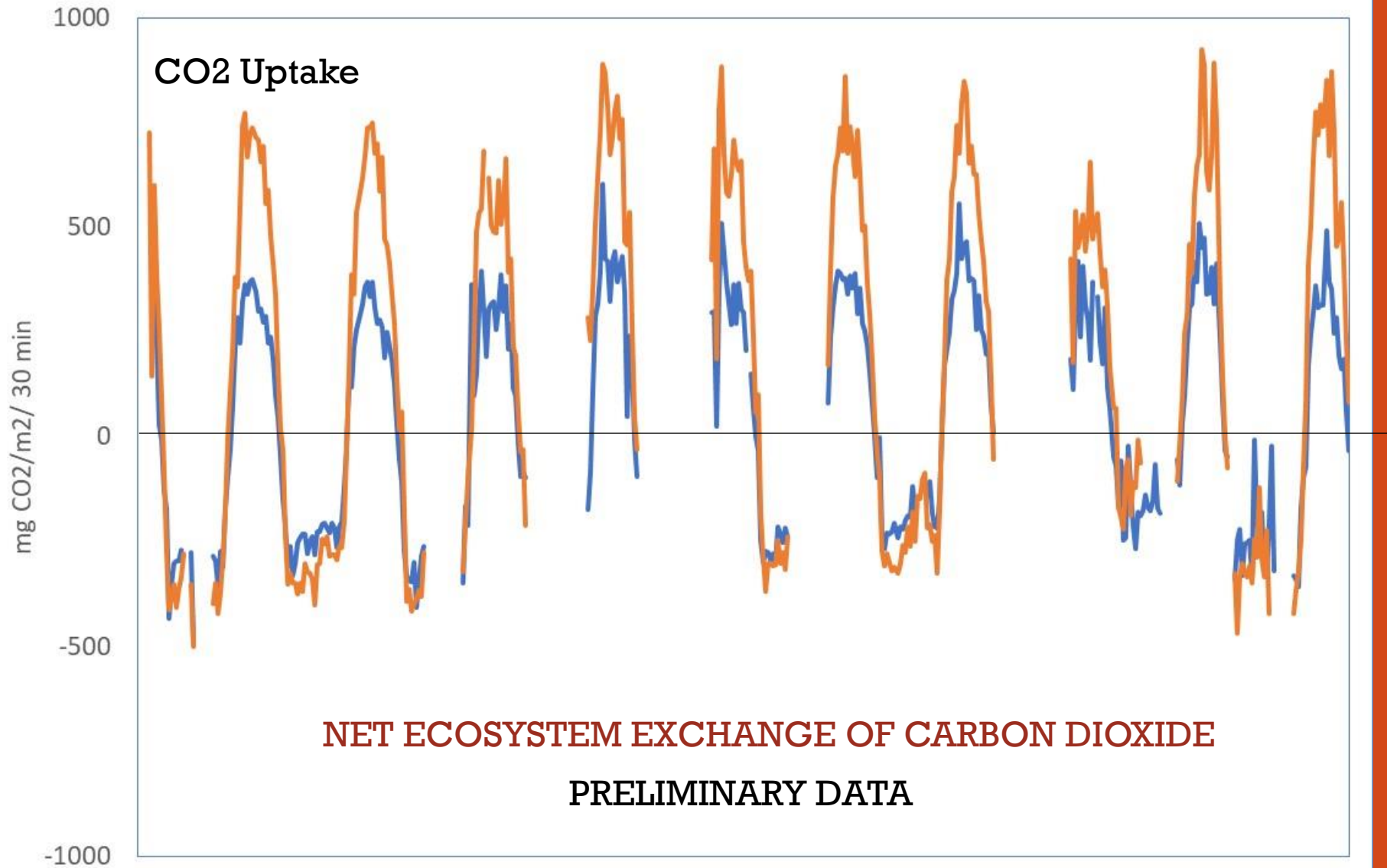
PRELIMINARY DATA





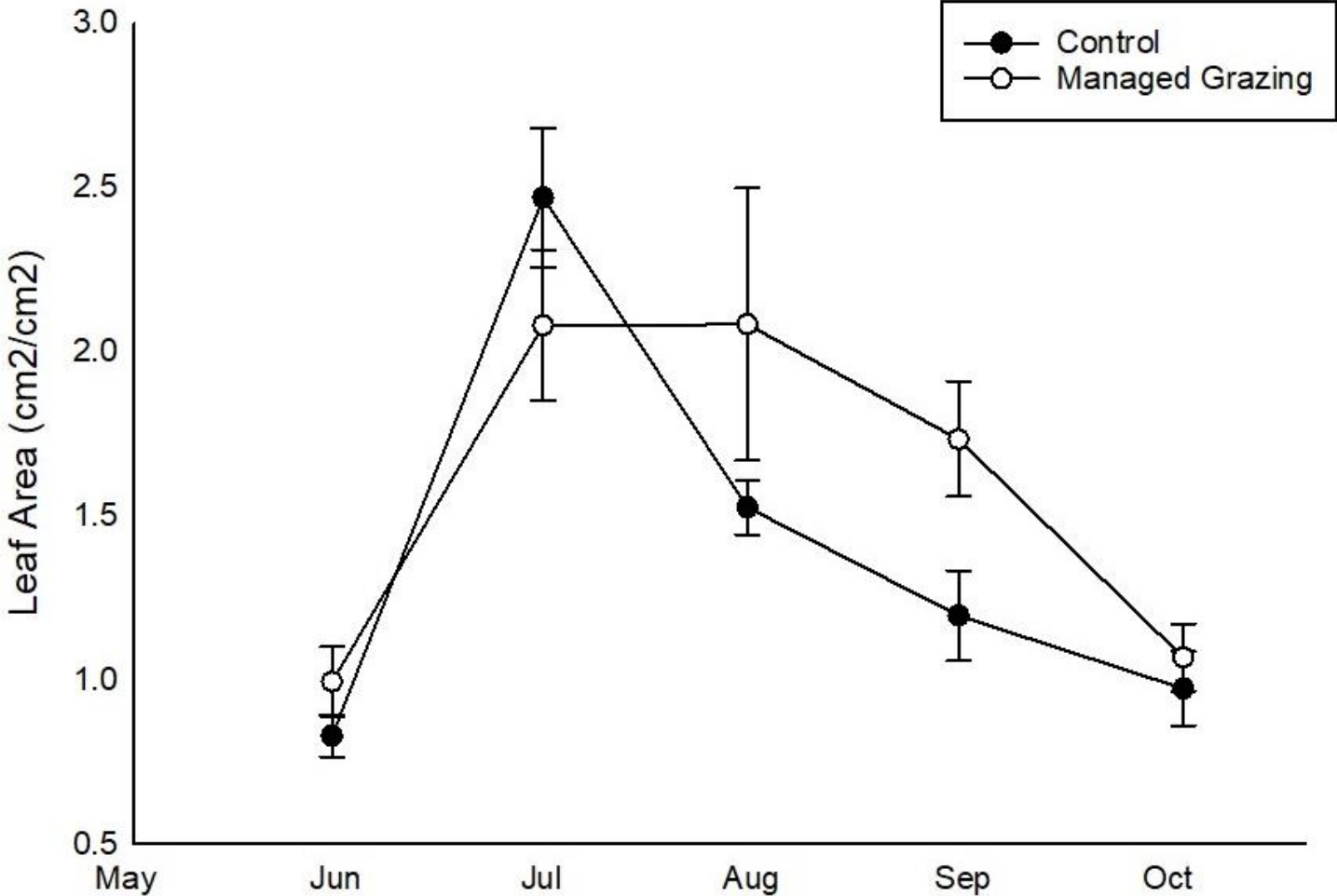
Sept 12-21

Control Managed Grazing





Average Leaf Area from June through October 2023





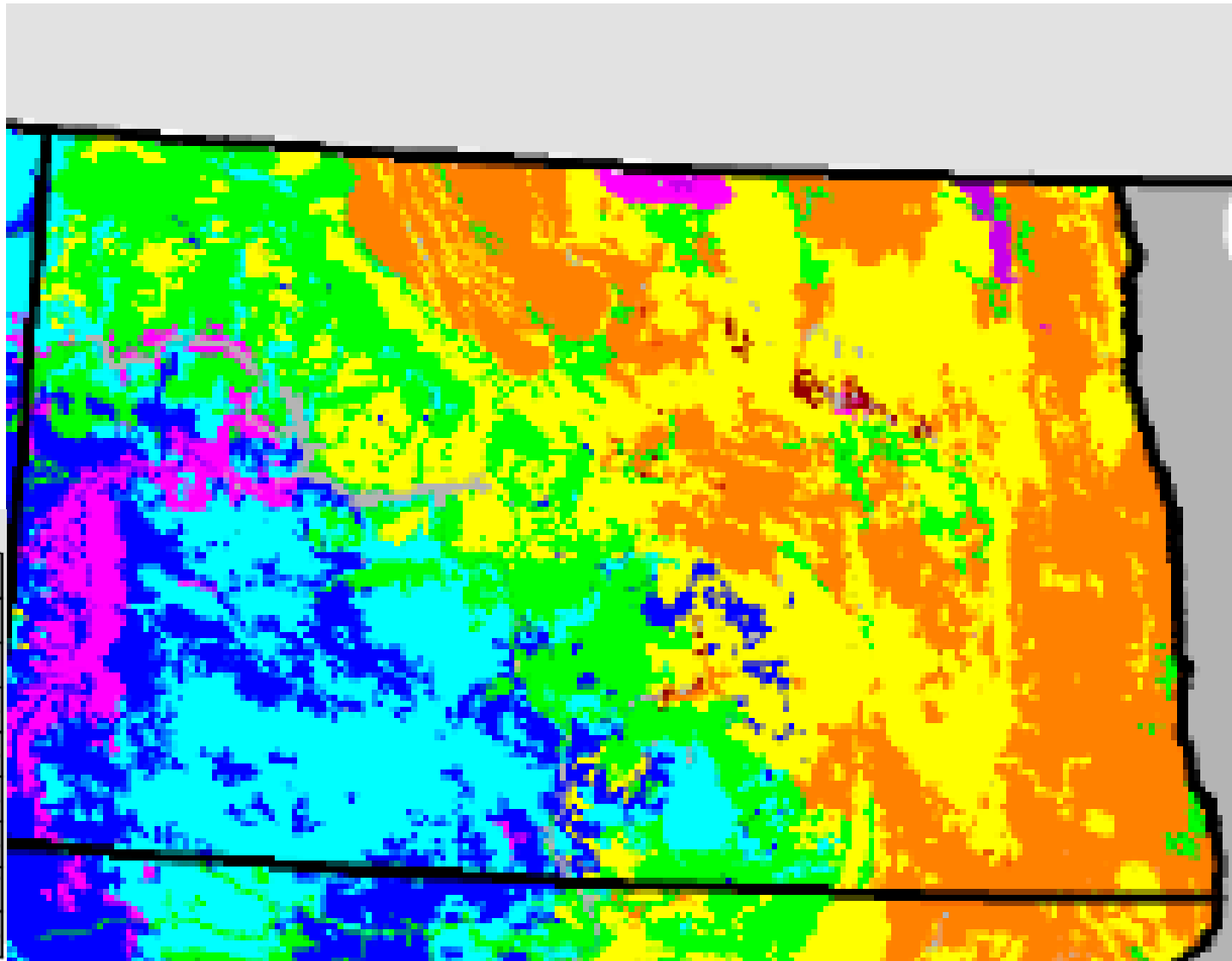
# WHAT SETS THIS PROJECT APART FROM CLASSICAL ACADEMIC RESEARCH

## Working lands research









- First managed grazing field experiment
- Expedited time-line
- Incorporates values of multiple stakeholders and partners
- Testing a rancher's idea







Unit: kg ha<sup>-1</sup>

	Class	Mean	Max	Min
	1	506	860	11
	2	1,197	1,483	863
	3	1,741	2,014	1,484
	4	2,256	2,517	2,016
	5	2,780	3,117	2,524
	6	3,537	3,969	3,134
	7	4,601	5,511	3,977
	8	6,726	13,381	5,516

Forage Production, Normal Year, Modeled by Wylie et al. 2016



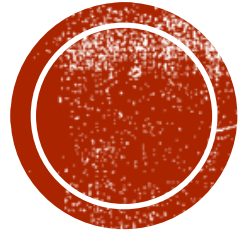
# SPONSORS AND PARTNERS

- 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







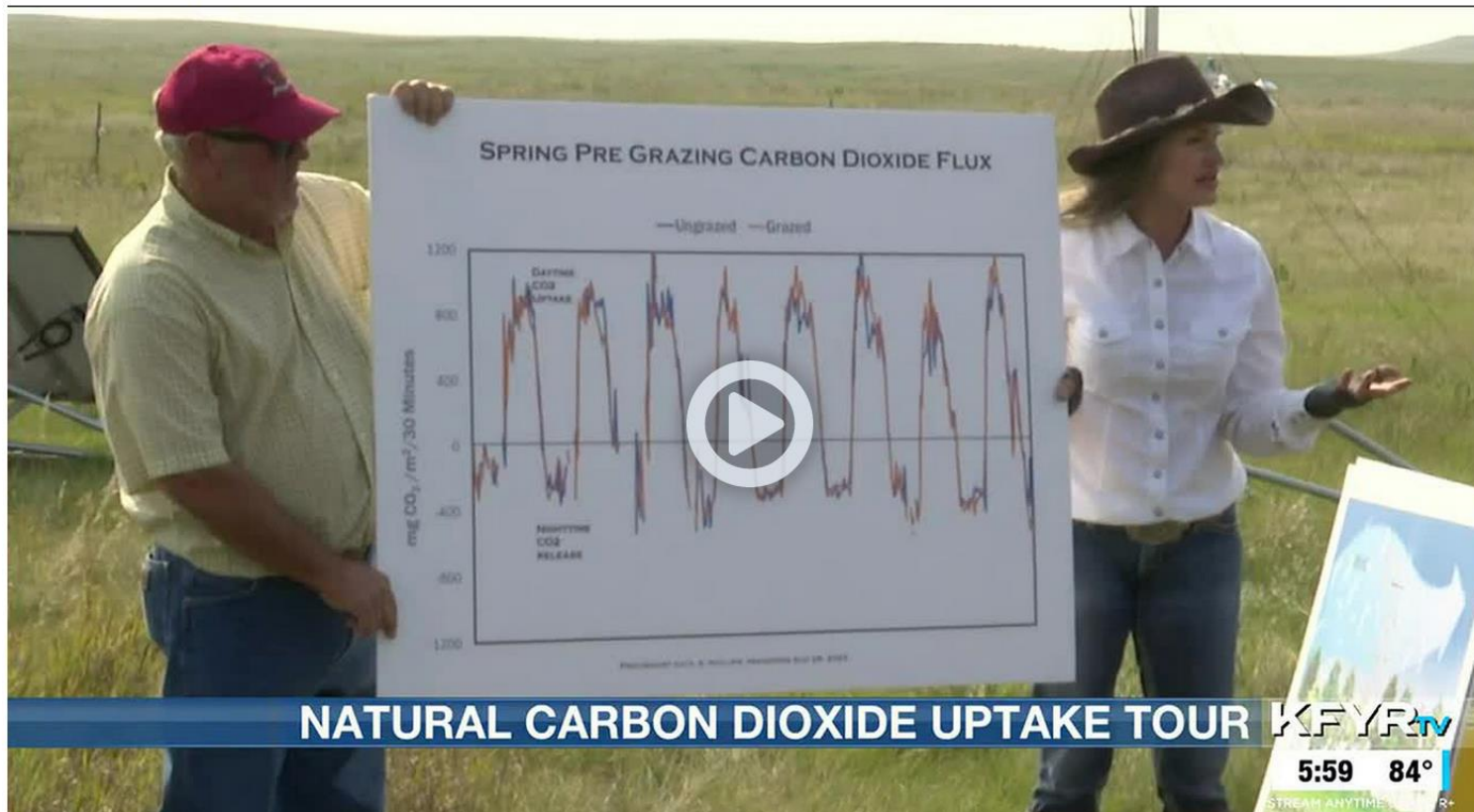


# THANK YOU





## Natural carbon dioxide uptake grassland tour takes place in McKenzie



# SCENARIO

**NET C SEQUESTRATION = NEE - C REMOVAL + C DEPOSITION**

**NEE - 300 lbs/acre/yr removed + 120 lbs/acr/yr deposited**  
**(\*1700 lbs C/acre) - 300 + 120 = 1520 lbs/acre/yr**

We will know NEE for the Heaton site in 6 months

\*(Gilmanov et al. 2010)

