The Carbon Benefit to Managed Grazing

(Carbon is a Proxy for Soil Health)

North Dakota Grazing Lands Coalition Mentor Guided Workshop

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With support by Jesse Beckers, ND Natural Resources Trust

OUTLINE

1. WHY MANAGE GRAZERS?
2. CARBON SEQUESTRATION MECHANICS
3. THE EXPERIMENT
4. PRELIMINARY RESULTS
5. FUTURE DIRECTIONS
6. QUESTION AND ANSWER SESSION

WHY MANAGE GRAZERS?

1. GREATER FORAGE PRODUCTION
2. GREATER BIODIVERSITY
3. HIGHER ORGANIC MATTER
4. MORE DROUGHT TOLERANCE
5. ECOSYSTEM HEALTH

Some say….

Well-Managed Cattle Sequester Carbon

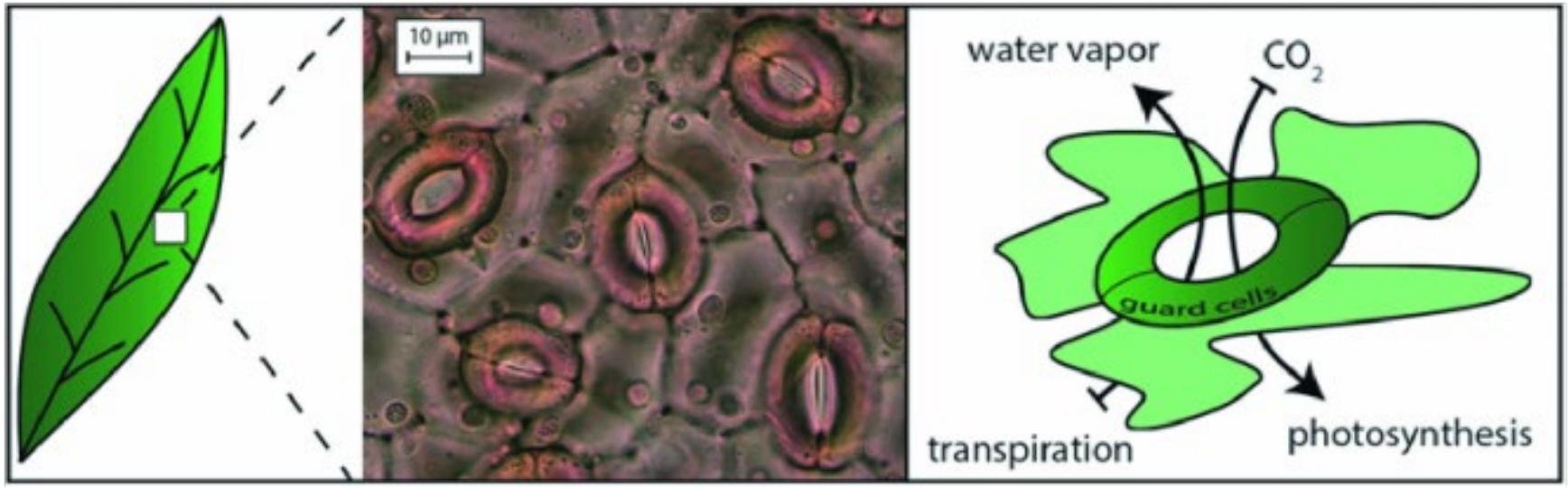
Regenerative practices, such as moving cattle frequently to fresh pasture, encourage transfer of carbon from atmosphere to plants to storage in soil organic matter. [1,2]

1. http://www.fao.org/3/x5304e/x5304e03.htm
2. https://www.drawdown.org/

So, how much carbon is sequestered?

Answering this question is our fundamental objective

CARBON SEQUESTRATION MECHANICS

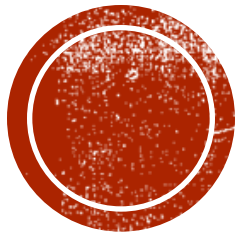


CARBON SEQUESTRATION MECHANICS

THE EXPERIMENT

- USE WORKING LANDS
- COW-CALF PAIR OPERATION, 150 PAIR
- SECTION OF REMOTE, HISTORIALLY NATIVE RANGELAND
- RANCHER PARTICIPATION, LEWIS HEATON

THE EXPERIMENT

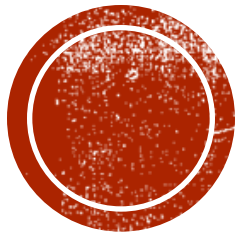


MEASURE CARBON DIOXIDE (CO2) EXCHANGE BETWEEN THE ATMOPSHERE AND THE RANGELAND ECOSYSTEM CONTINUOUSLY FOR A 50-ACRE PASTURE, AS COMPARED TO UNGRAZED CONTROL

THE EXPERIMENT

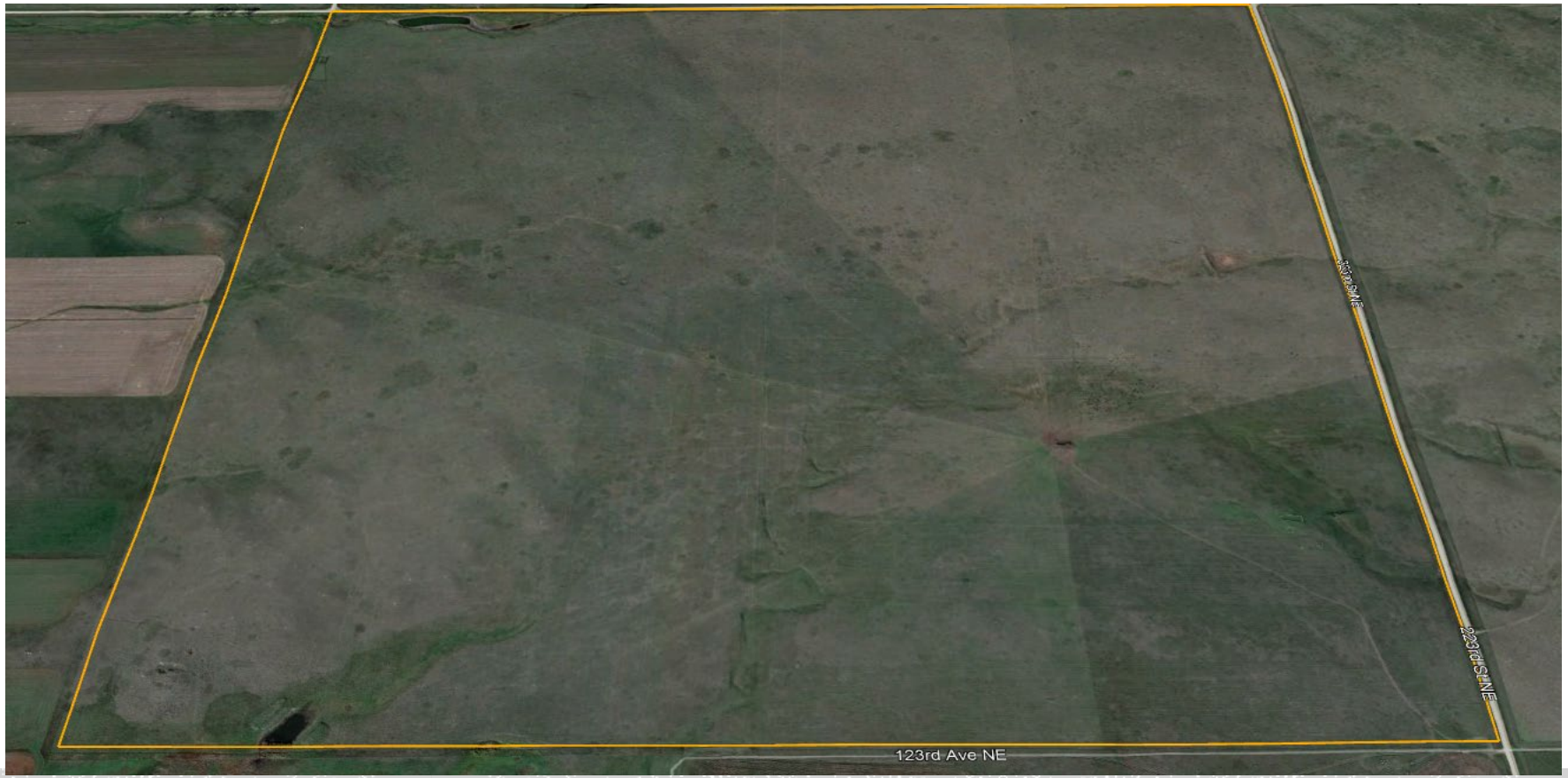
THE EXPERIMENT

MANAGEMENT FOR THIS EXPERIMENT

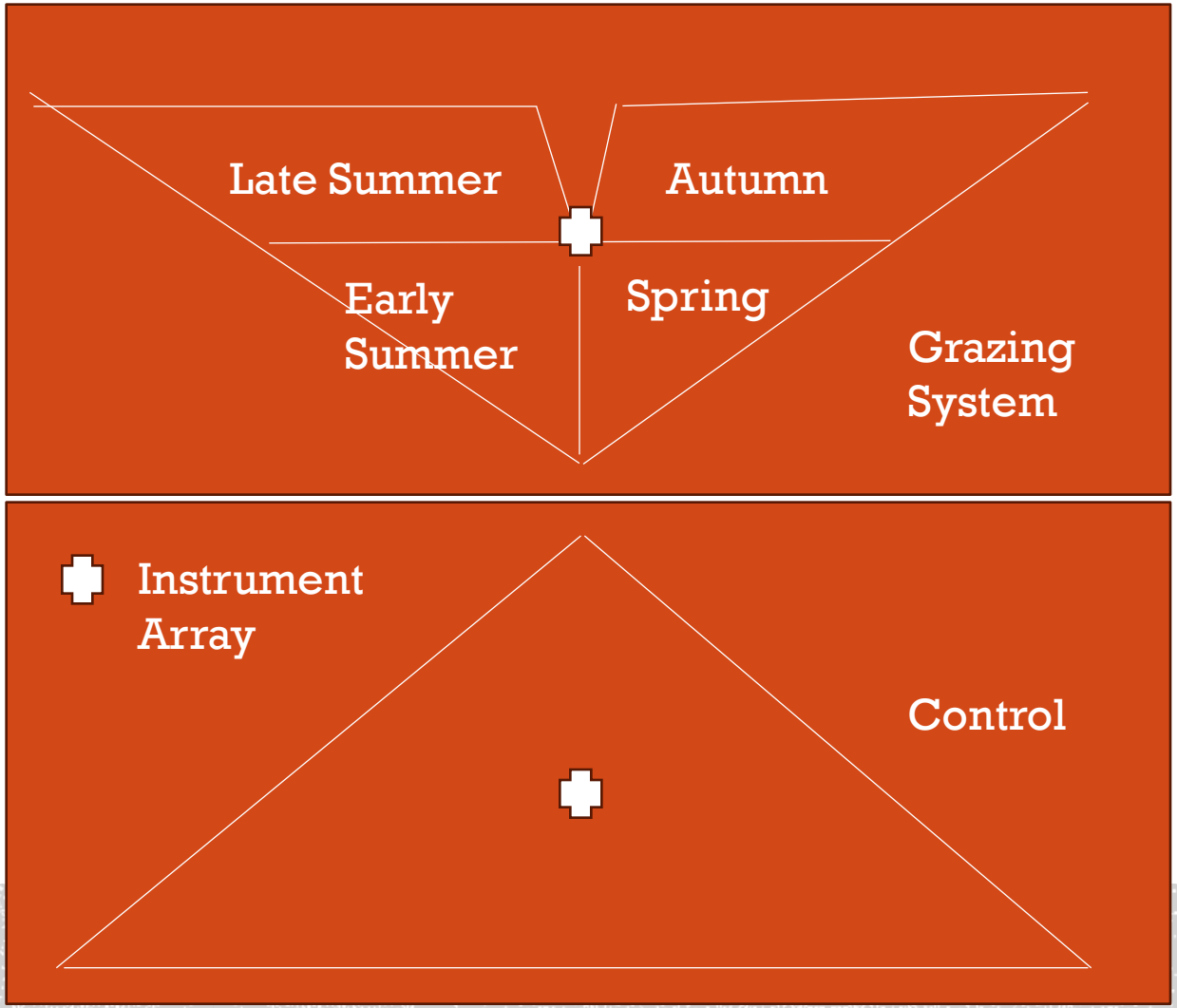


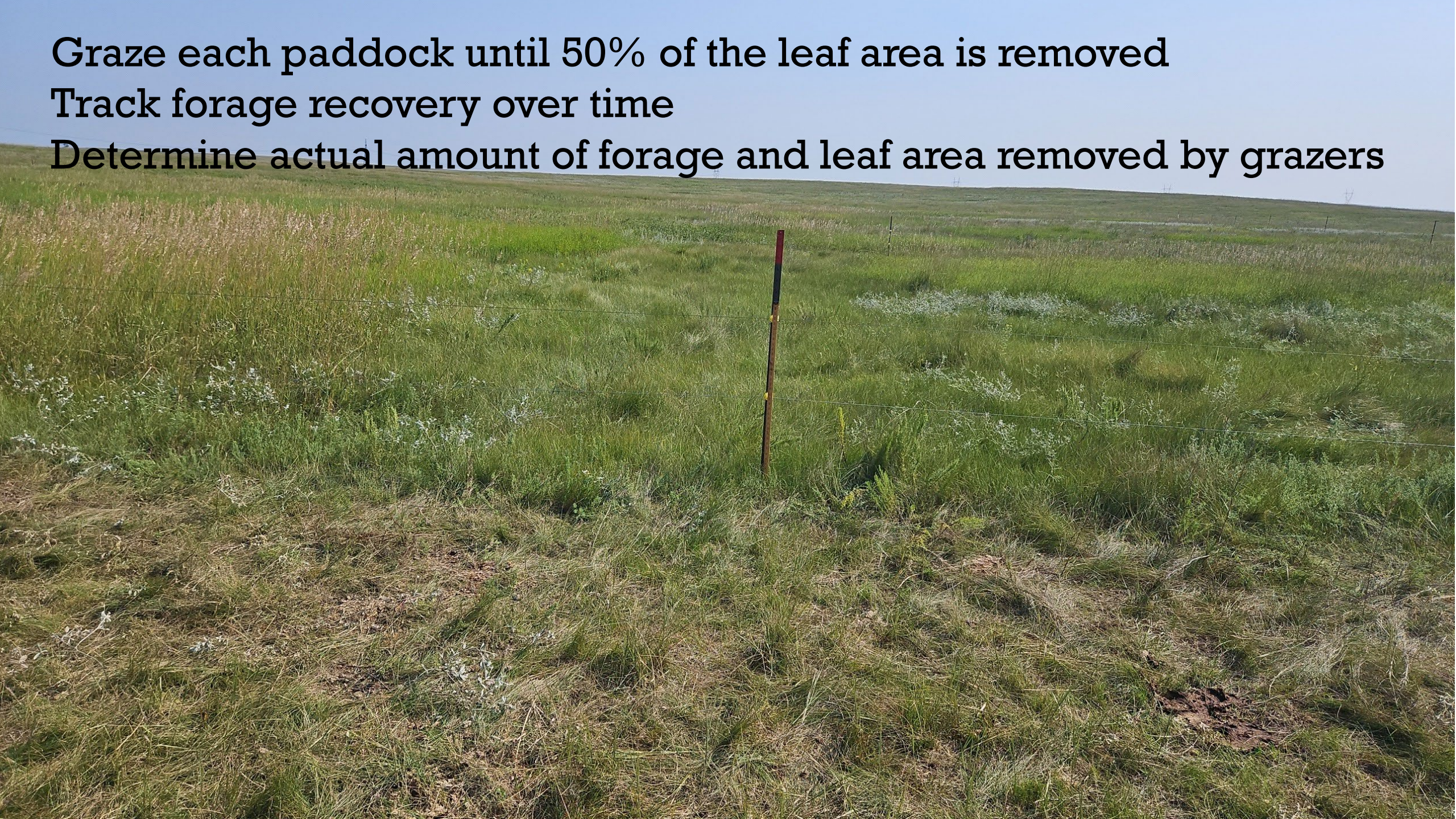
1. ALTER SEASON OF USE
2. MONITOR SPECIES COVER
2. TARGET 50% LEAF AREA REMOVAL
3. HIGH-INTENSITY, SHORT DURATION GRAZING
4. TRACK FORAGE RECOVERY WITH CO2 AND BIOMASS DATA

THE EXPERIMENT



THE EXPERIMENT

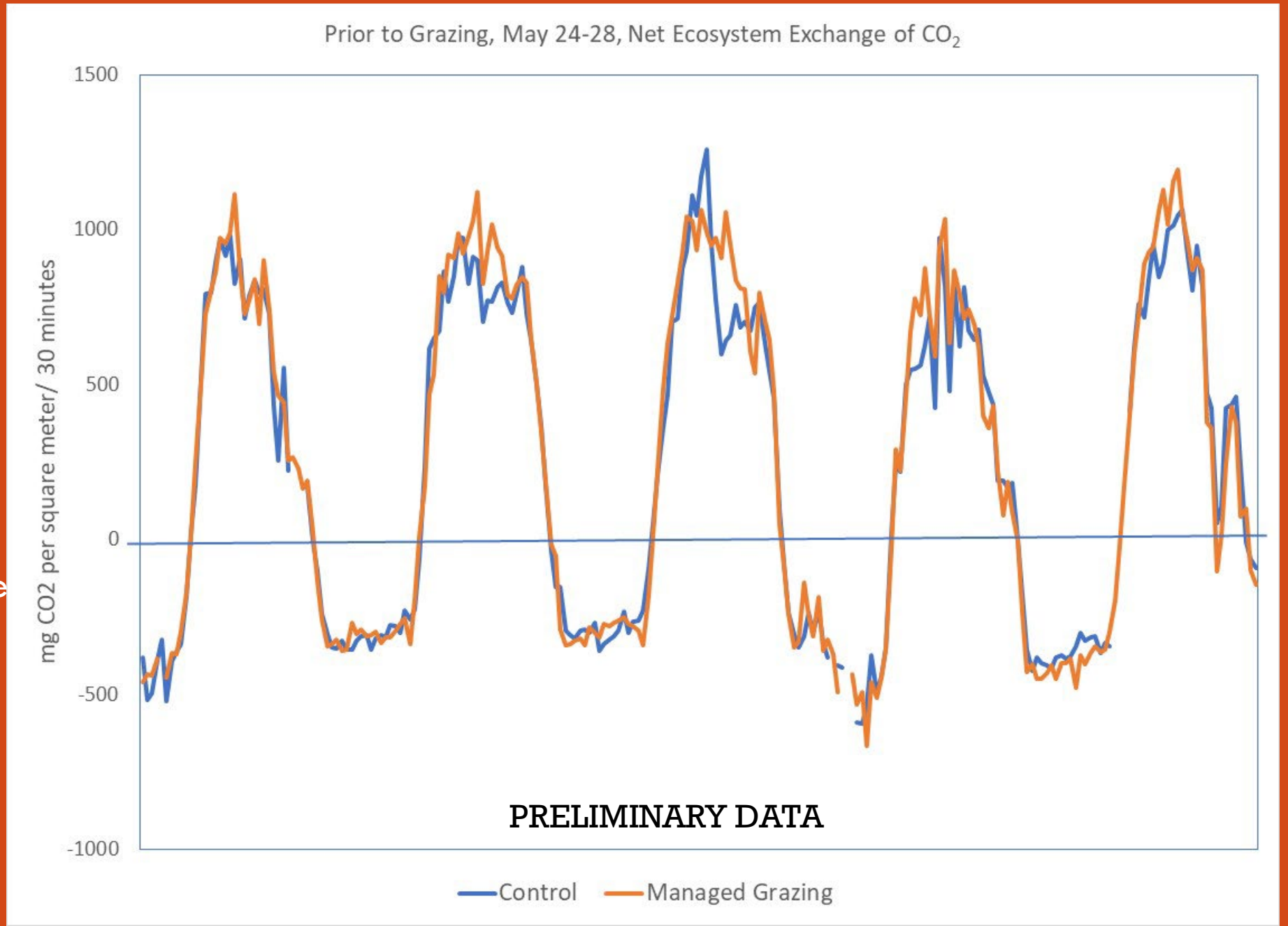



Graze each paddock until 50% of the leaf area is removed
Track forage recovery over time
Determine actual amount of forage and leaf area removed by grazers

Net Ecosystem Exchange of CO2

CO2 uptake daytime →

CO2 release nighttime →



GOAL: THE ANNUAL NET ECOSYSTEM CARBON BALANCE (NECB)

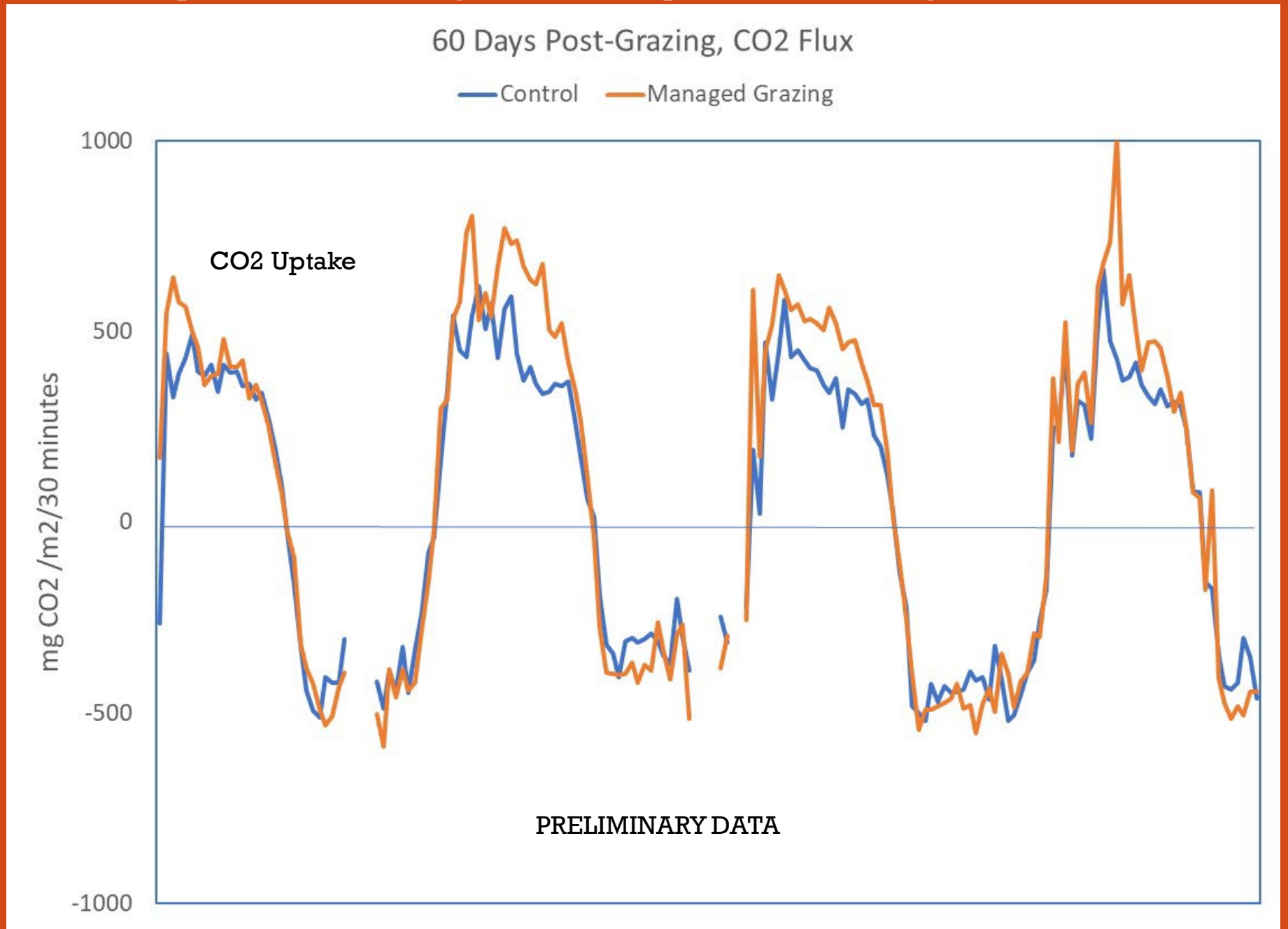
NECB = Net Ecosystem Production (CO2-C) + C deposits (manure) – C exports (harvest)

NECB Example ~30 miles from our field site, 3 years of crops, Liebig et al. 2022:

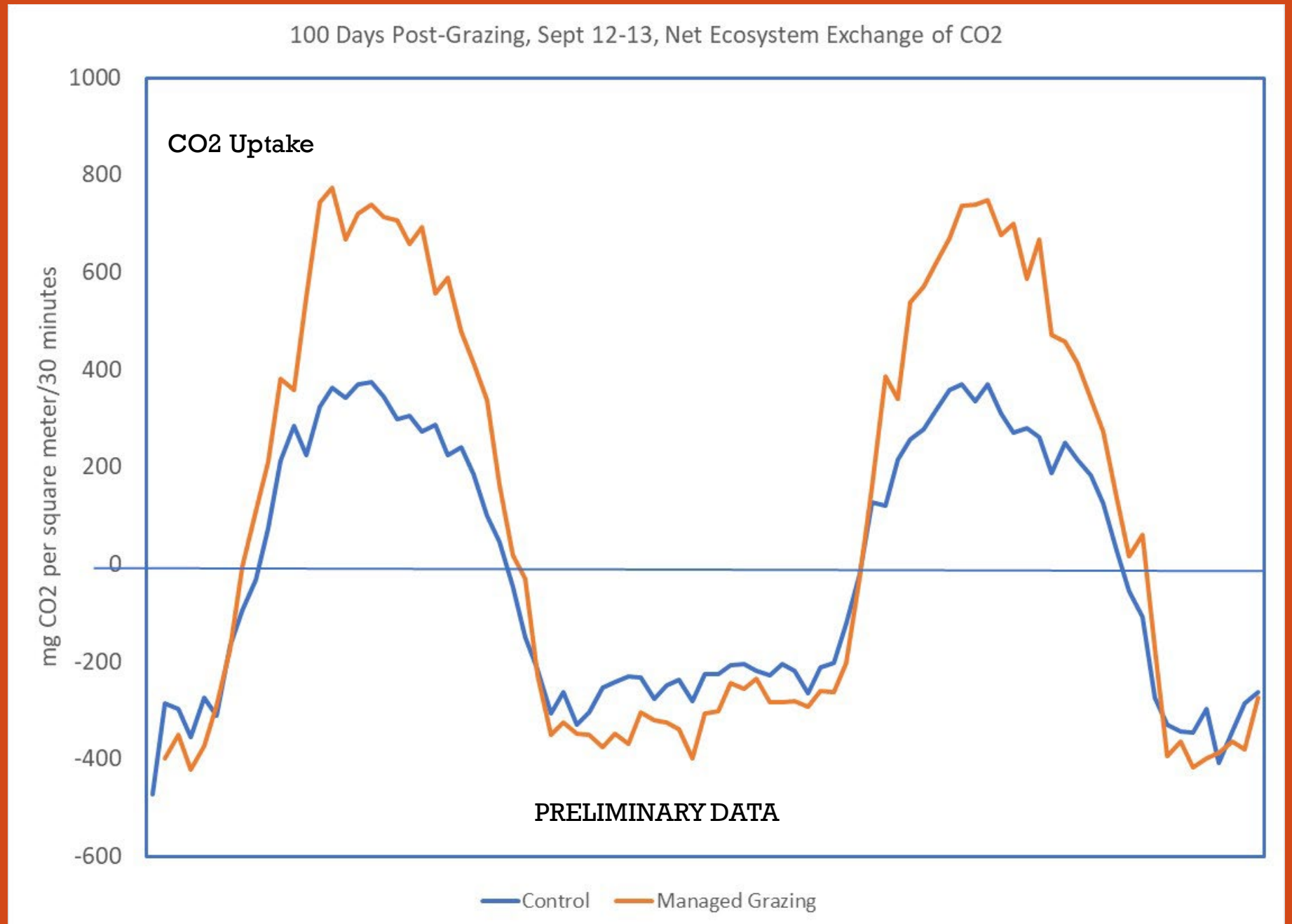
TABLE 4 Maximum leaf area index (LAI_{max}), aboveground biomass (AGB), grain yield (GY), harvest index (HI), net ecosystem production (NEP = −NEE, see Table 2), and net ecosystem carbon balance (NECB) during a 3-year rotation of spring wheat–corn–soybean (2016–2018)

Year/crop	LAI_{max}	AGB	GY	HI	NEP	NECB[a]
		$g\ m^{-2}$			$g\ C\ m^{-2}\ yr^{-1}$	
2016/spring wheat	2.36	993	317	0.32	−34	−164
2017/corn	2.21	1501	868	0.58	120	−253
2018/soybean	3.06	631	320	0.51	7	−121
Mean	2.54	1042	502	0.47	31	−179
SE	0.26	252	183	0.08	46	39

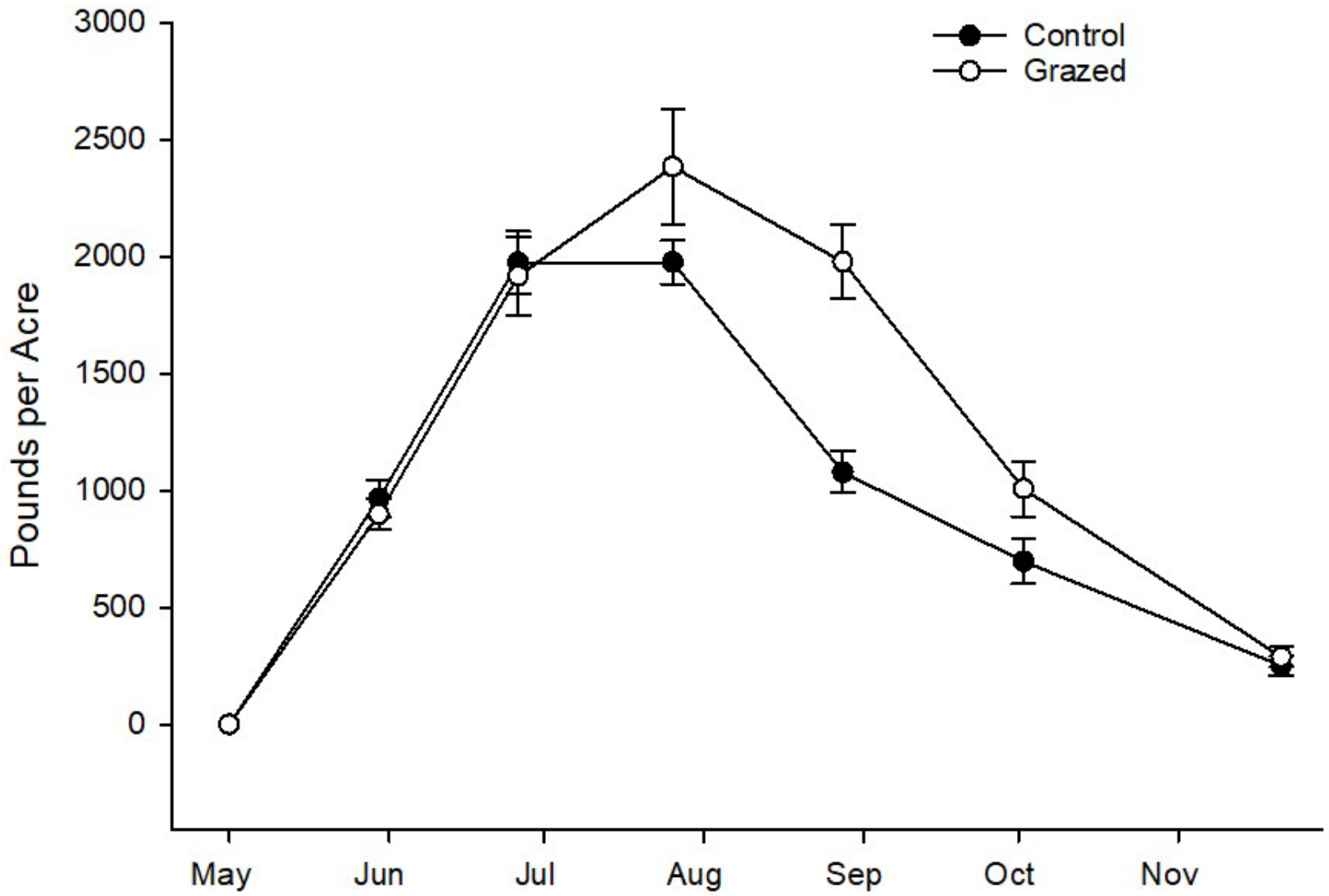
60 Days Post-Grazing Net Ecosystem Exchange of CO2



100 Days Post-Grazing Net Ecosystem Exchange of CO2



Dry Matter in Green Biomass 2023



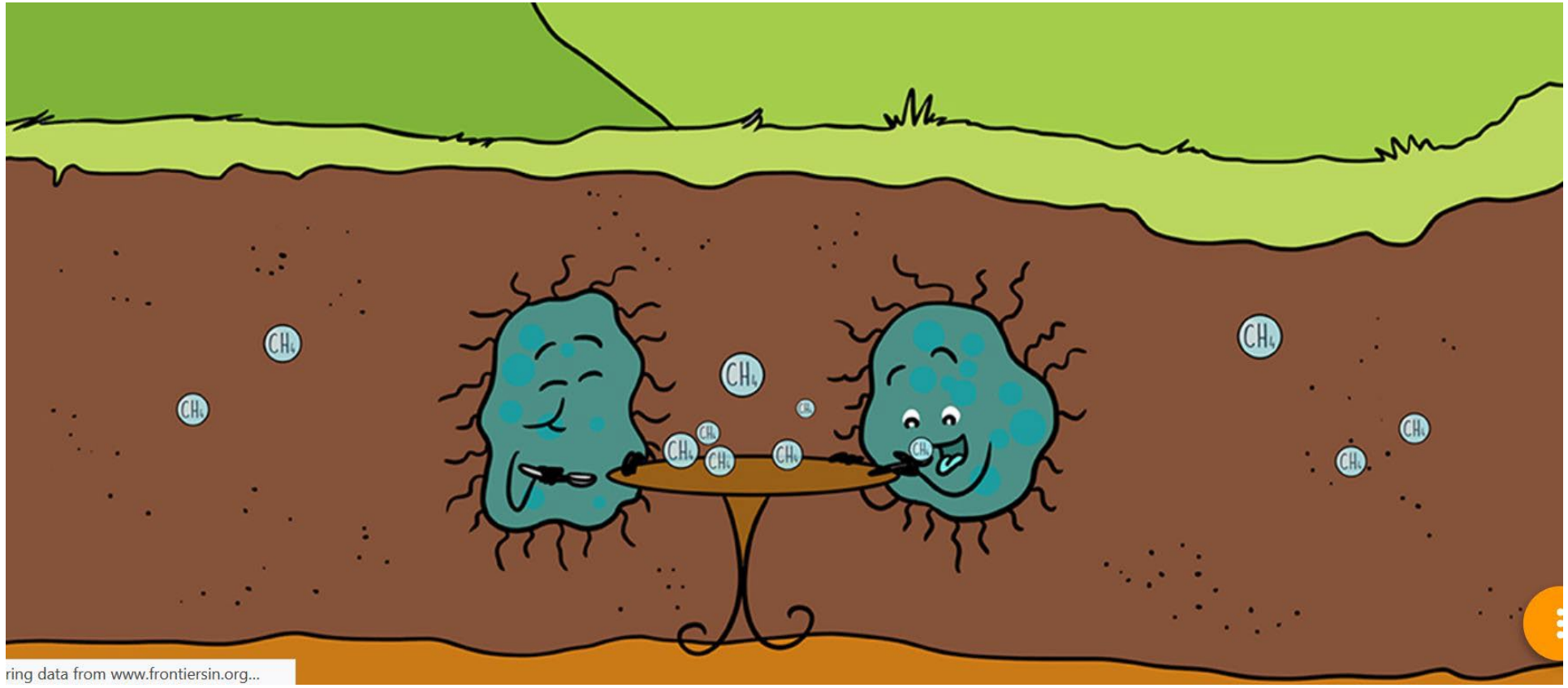
FUTURE DIRECTIONS

Grazing Management

Carbon and **Methane** Fluxes

One possible methane mitigation pathway where data are lacking—consumption of methane by soil organisms

Methane (CH_4) munchers live just beneath the surface of the soil



They consume methane that diffuses from the atmosphere.

Could grazers could be managed to increase both CO_2 and CH_4 uptake?

ATMOSPHERIC METHANE EXCHANGE

“I FEEL LIKE I’M DOING SOMETHING GOOD—GOOD FOR THE LAND, THE CATTLE, THE CONSUMER. MAKES ME FEEL GOOD ABOUT RANCHING.”

A NORTH DAKOTA COMMUNITY PARTNERSHIP

- Oil and Gas Research Program
- North Dakota Petroleum Council
- National Fish and Wildlife Federation
- North Dakota Game and Fish
- Hess Oil (now Chevron)
- North Dakota Grazing Lands Coalition
- North Dakota Stockman's Association
- Mercer County SCD
- Badlands Advisory Group
- Northern Great Plains Joint Venture

North Dakota oil & gas research program

NORTH DAKOTA GAME AND FISH

NORTH DAKOTA GRAZING LANDS COALITION

National Fish and Wildlife Foundation

NORTH DAKOTA NATURAL RESOURCES TRUST

THANK YOU


NORTH DAKOTA STOCKMEN'S ASSOCIATION
NORTH DAKOTA GRAZING LANDS COALITION
NATIONAL FISH AND WILDLIFE FOUNDATION
NORTH Dakota Be Legendary.
Game and Fish
HESS
MERCER COUNTY SOIL CONSERVATION DISTRICT
North Dakota oil & gas research program
NORTH DAKOTA NATURAL RESOURCES TRUST
NORTH DAKOTA OIL AND GAS DIVISION