HOW GRAZING ENHANCES GRASSLAND CARBON CAPTURE ON A WORKING RANCH

North Dakota Game & Fish Preliminary Data Presentation

Heritage Center, August 20, 2024

By Dr. Rebecca Phillips

Ecological Insights Corporation

In coordination with the Heaton Ranch, the North Dakota Natural Resources Trust, and Conservation Partners

OVERVIEW

- We are investigating the idea that managing grazers can improve forage production and carbon sequestration to benefit overall rangeland health.
- This idea is not new. Allan Savory wrote decades ago about the importance of grazing management to rangeland health.
- What has been missing until now are data showing how management affects ecosystem fluxes of carbon in real time.

HOW IS CARBON SEQUESTERED?

- *Carbon dioxide in the air becomes organic carbon in plants that moves into soil and becomes soil organic carbon.*

- *More than 50% of the carbon in rangelands is allocated below ground. This is quite different from annual crops that keep most of their carbon aboveground.*

Soil Core Scale

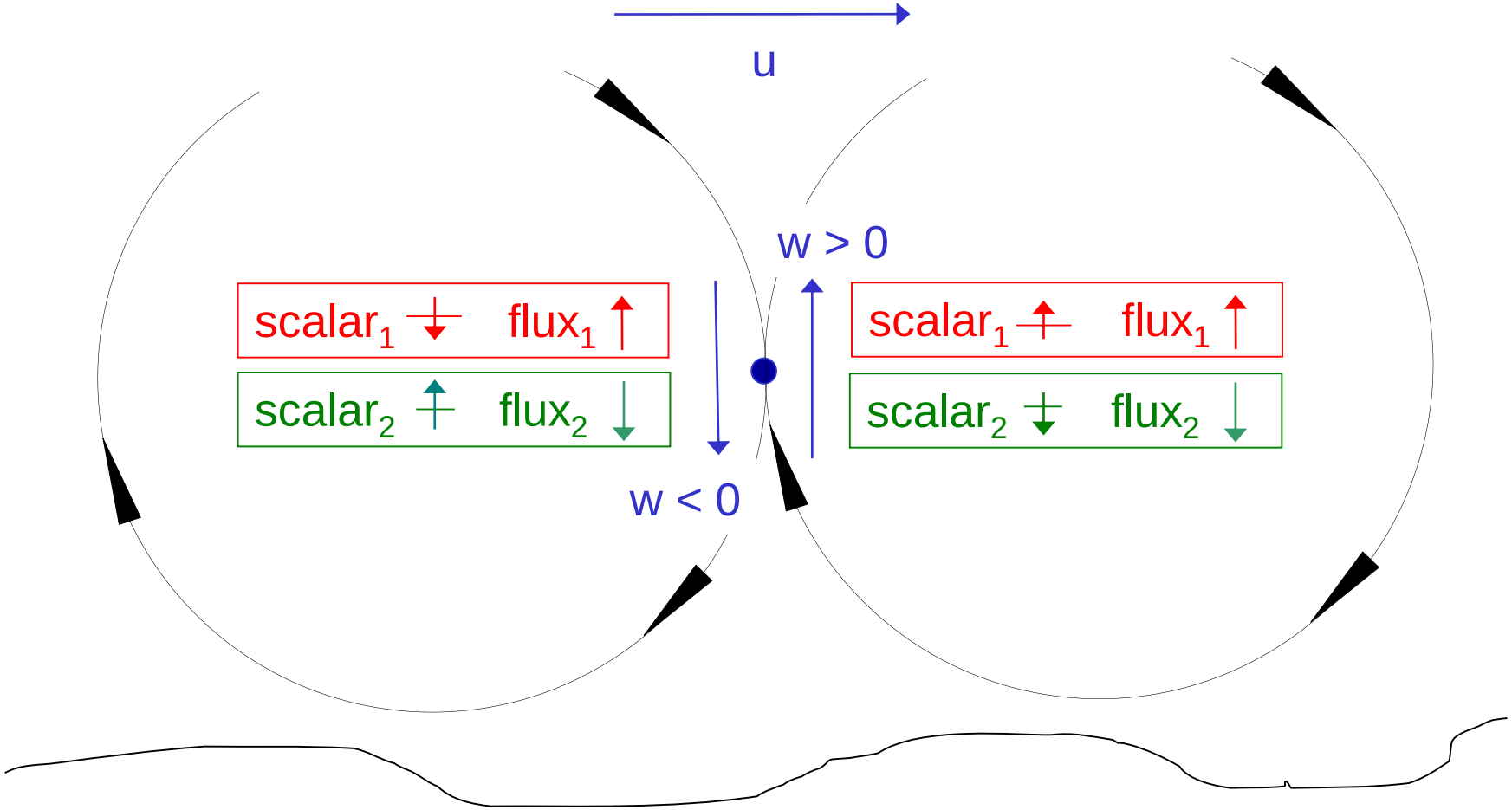
Leaf Scale

HOW IS CARBON MEASURED?

ECOSYSTEM SCALE

Eddy Covariance

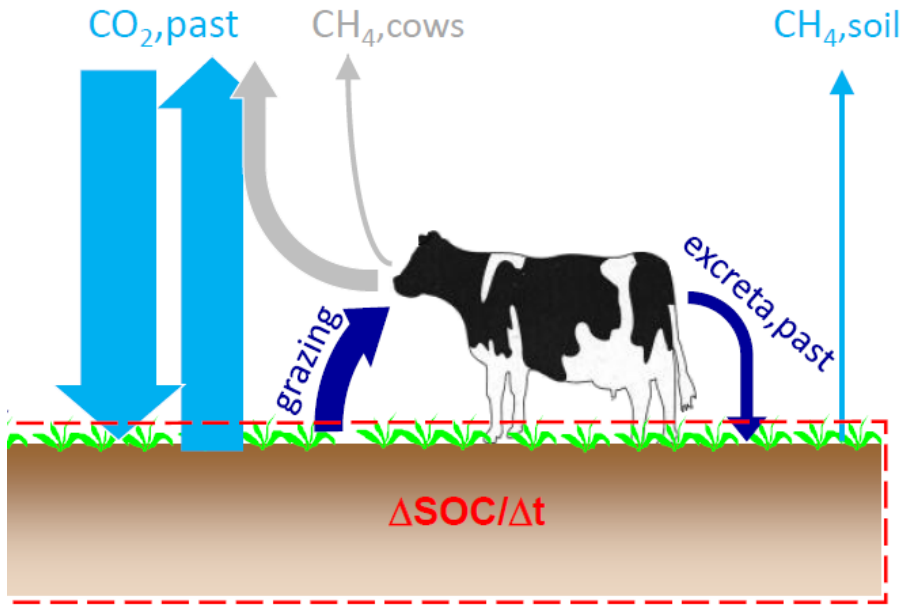
EDDY COVARIANCE MEASUREMENT PRINCIPALS



OUR GOAL

Determine how managed grazing alters the net ecosystem exchange of carbon dioxide and the annual net ecosystem carbon balance on a working ranch.

WHAT DO WE MEAN BY THE NET ECOSYSTEM CARBON BALANCE?



C into plants – C removed + C deposited = ΔSOC/Δt

THE PASTURE

One pasture split into 4 paddocks, each grazed a month apart
The other pasture is the ungrazed control

TWO IDENTICAL SYSTEMS

- 40 sensors
- 206 variables
- 24/7 measurements
- 365 days per year
- First year 35,040 obs.

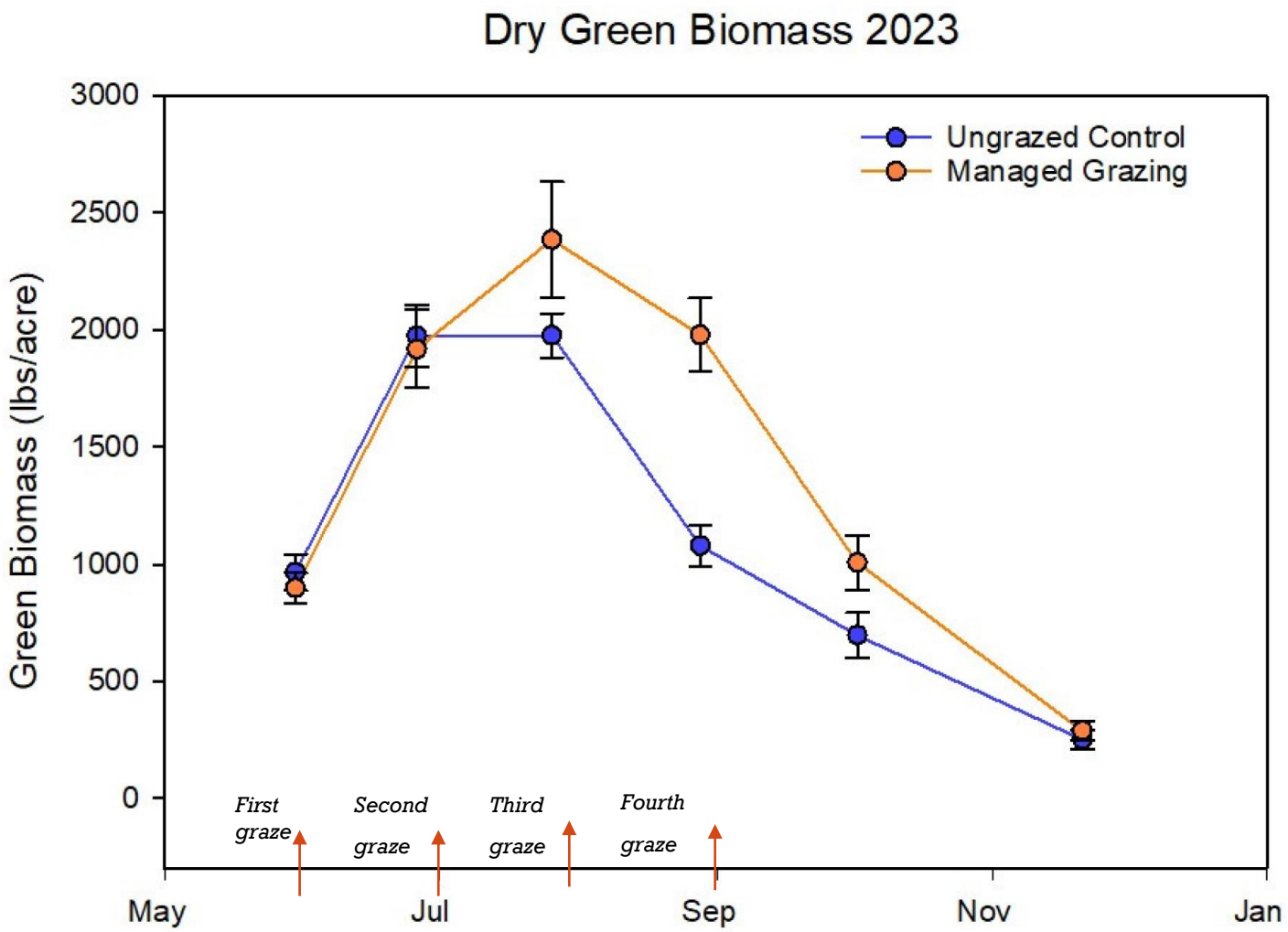
Management:

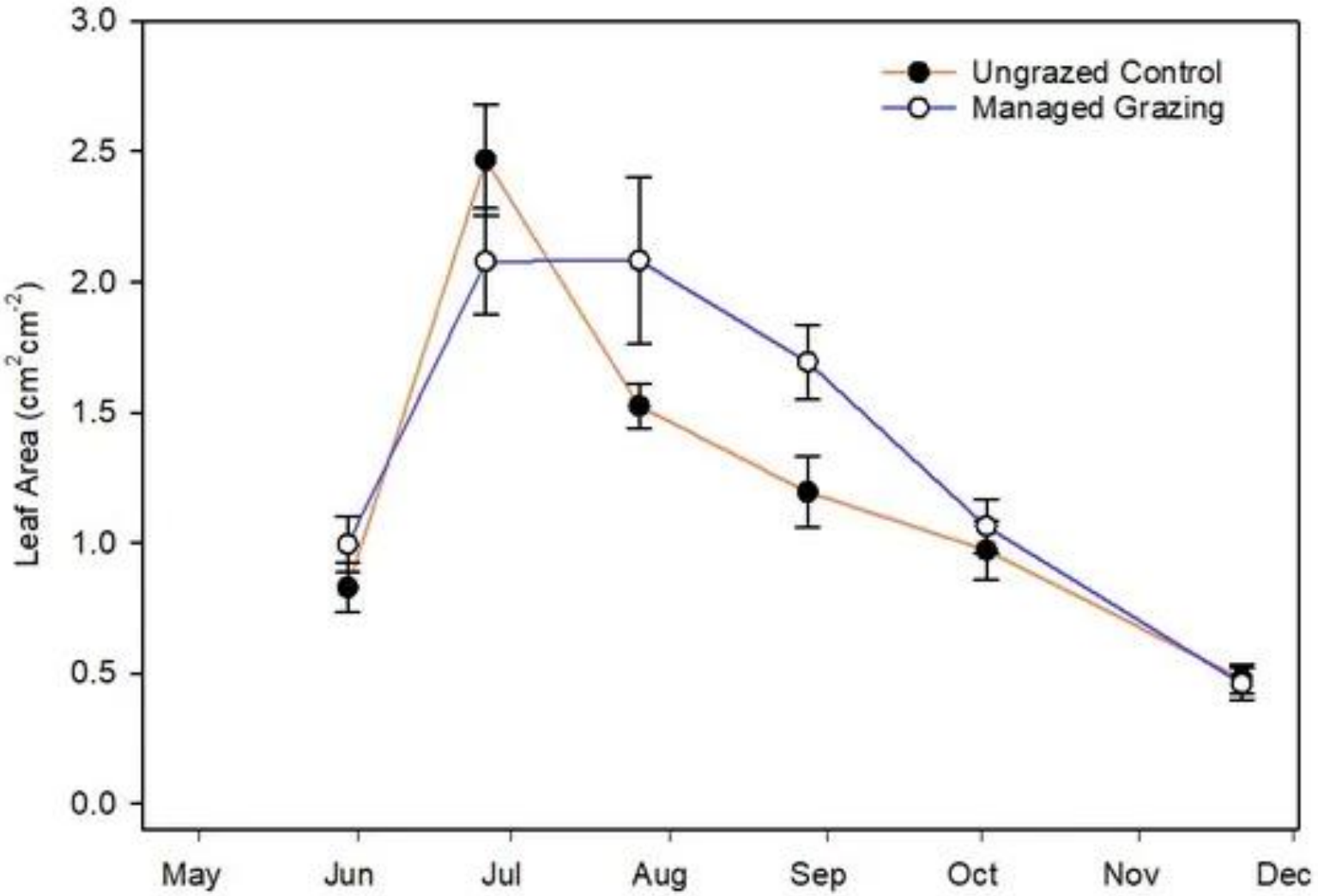
Graze each paddock until 50% of the leaf area is removed

Determine actual amount of biomass and leaf area removed

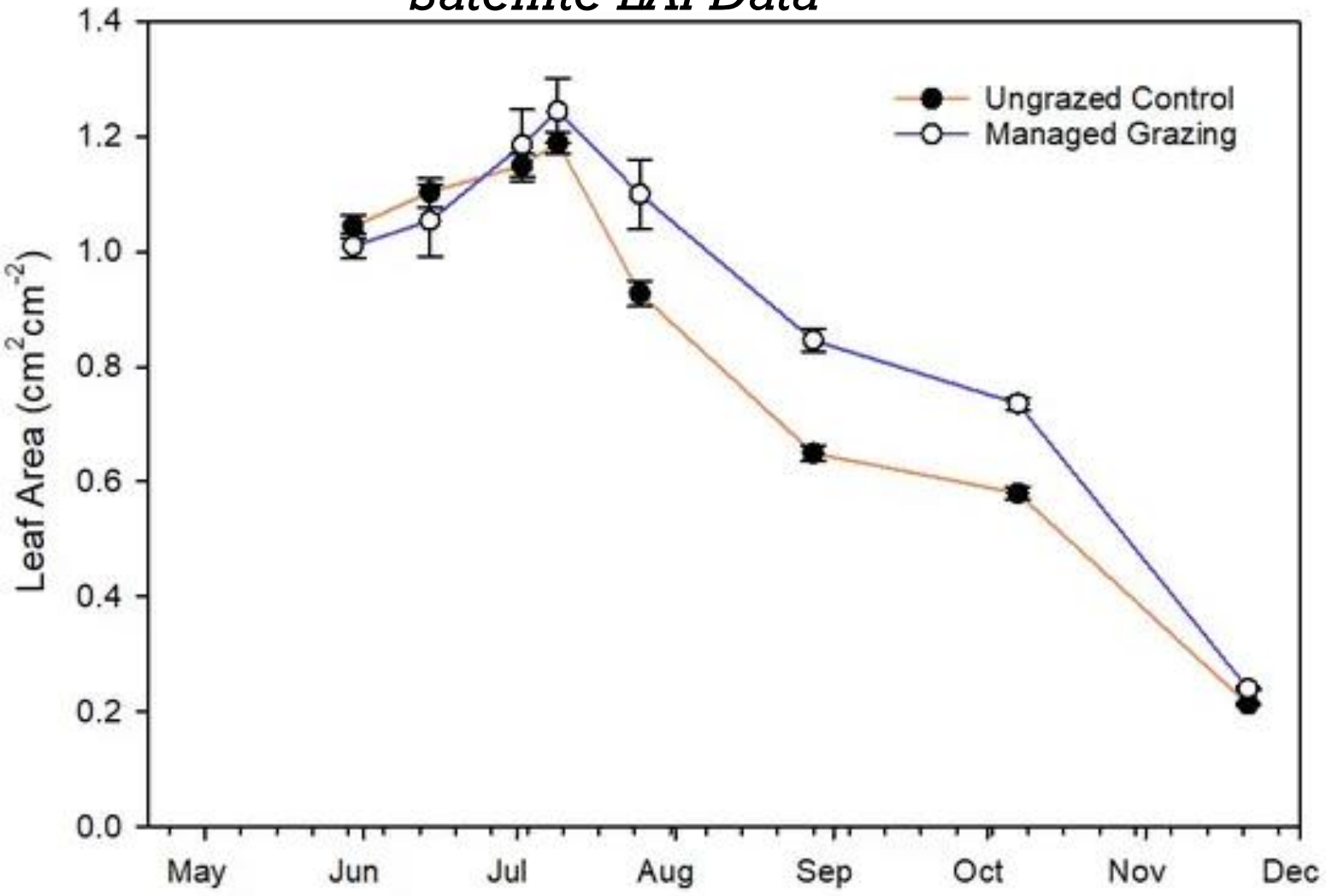
MONTHLY GREEN ABOVEGROUND BIOMASS PRELIMINARY DATA

Collected at 16 points for each pastures before each grazing event

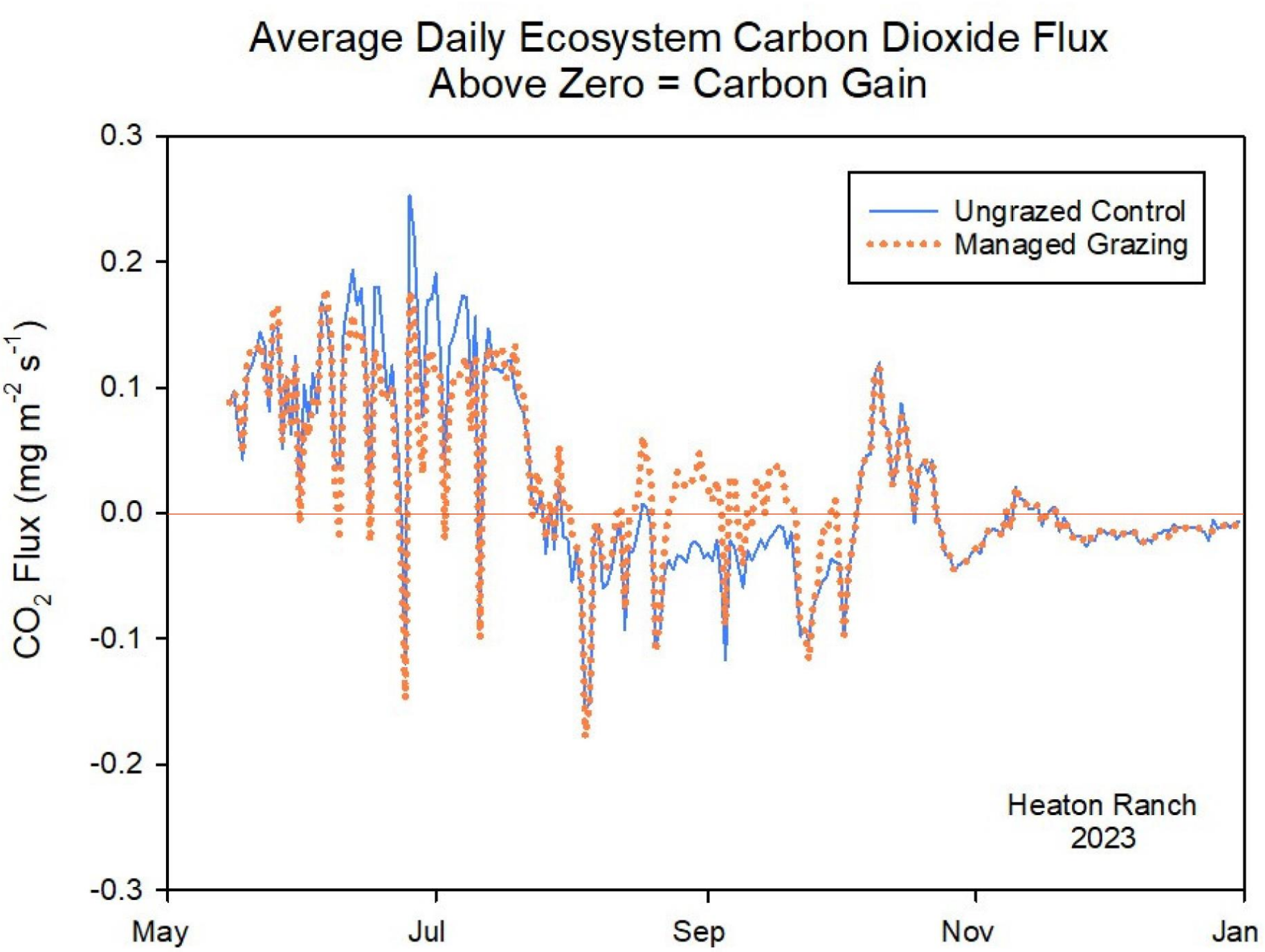

Dry Green Biomass 2023
Green Biomass (lbs/acre)
3000
2500
2000
1500
1000
500
0
Ungrazed Control
Managed Grazing
First graze
Second graze
Third graze
Fourth graze
May
Jul
Sep
Nov
Jan


Ungrazed Control
Managed Grazing
Leaf Area (cm²cm⁻²)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

Satellite LAI Data



CARBON DIOXIDE FLUX PRELIMINARY DATA


Average Daily Ecosystem Carbon Dioxide Flux
Above Zero = Carbon Gain
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
CO_2 Flux (mg m^{-2} s^{-1})
May
Jul
Sep
Nov
Jan
Ungrazed Control
Managed Grazing
Heaton Ranch
2023

SO HOW DOES THIS EXPERIMENT HELP RANCHERS AND RANGELANDS?

Businesses want to show they are offsetting their carbon emissions by paying for carbon to be sequestered

Here, we show we are doing more than sequestering carbon—we are building rangeland health and producing sustainable beef

This could be huge for ranchers if they worked together to market high quality carbon credits to companies that want to go green

Research aims to quantify carbon storage in grasslands

JEFF BEACH ND Monitor Aug 12, 2024 0

- *Funded grant proposals developed as Principal or Co-Principal Investigator (2002-present): $4, 215,740.00*
- *Journals, Rangeland Remote Sensing*
  - *Remote Sensing of Environment*
  - *JGR Biogeosciences*
  - *Environmental Management*
- *Journals, Microbiology*
  - *ACS Earth & Space Chemistry*
  - *Oecologia Journal*
  - *Nature Scientific Reports Journal*
  - *FEMS Microbiology Ecology Journal*
- *Journals, Carbon, Methane, Nitrous Oxide*
  - *Global Change Biology Journal*
  - *Rangeland Ecology and Management Journal*
  - *Soil Biology and Biochemistry Journal*
  - *Global Biogeochemical Cycles Journal*
  - *Journal of Geophysical Research*
  - *Agriculture, Ecosystems, & Environment Journal*
- *Journals, Rangeland Eddy Flux:*
  - *Biogeosciences Journal*
  - *Agronomy Journal*
  - *Ecosystems Journal*
  - *Global Change Biology Journal*
  - *Journal of Environmental Quality*

QUALIFICATIONS R.L. PHILLIPS

Ph.D. Environmental Science & Engineering, *University of North Carolina, Chapel Hill, NC*

M.S. Rangeland Ecology, *Colorado State University, Fort Collins, CO.*

B.S. Biology and Physical Science, *MS University for Women, Columbus, MS.*

Project Manager, *8 yrs., Flextronics Inc., Fitchburg, MA.*

THANK YOU

North Dakota Game and Fish

HESS

Mercer County Soil Conservation District

North Dakota oil & gas research program

North Dakota Natural Resources Trust

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