CARBON CAPTURE IN NORTH DAKOTA GRAZING LANDS

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Update to project proposed in 2022 by Jesse Beckers and Rebecca Phillips

Kick-off meeting, 21 April 2023

WHAT ARE WE DOING?

Objective:

- **Partner with industry and landowners to demonstrate how cattle ranching, energy development and carbon capture can be aligned to provide sustainable growth for the energy industry, ranchers, and wildlife of North Dakota**

WHY ARE WE DOING THIS? A LANDOWNER PERSPECTIVE

- *"Ranchers want to know ways they can manage livestock to add the most value in terms of carbon and other ecosystem services. If they alternate season of grazing, for example, how will this change the system under these conditions? If there is a monetary benefit to conservation practices, more would participate. If, for example, the price of carbon moved from 15 to 50 dollars, producers would stand in line to learn more about adopting practices that improve carbon." –* ***Lewis Heaton, North Dakota Rancher***

WHY ARE WE DOING THIS?
A NATURAL RESOURCE PERSPECTIVE

- *Grassland habitat is critical to many species and hosts a plethora of biodiversity. Wildlife, recreationists, and hunters rely on grasslands in North Dakota.*

WHY ARE WE DOING THIS? A POLICY PERSPECTIVE

- *If agriculture can help with lowering the carbon footprint, then this could be a win-win for the energy industry and local communities.*

WHY ARE WE DOING THIS? A SCIENCE PERSPECTIVE

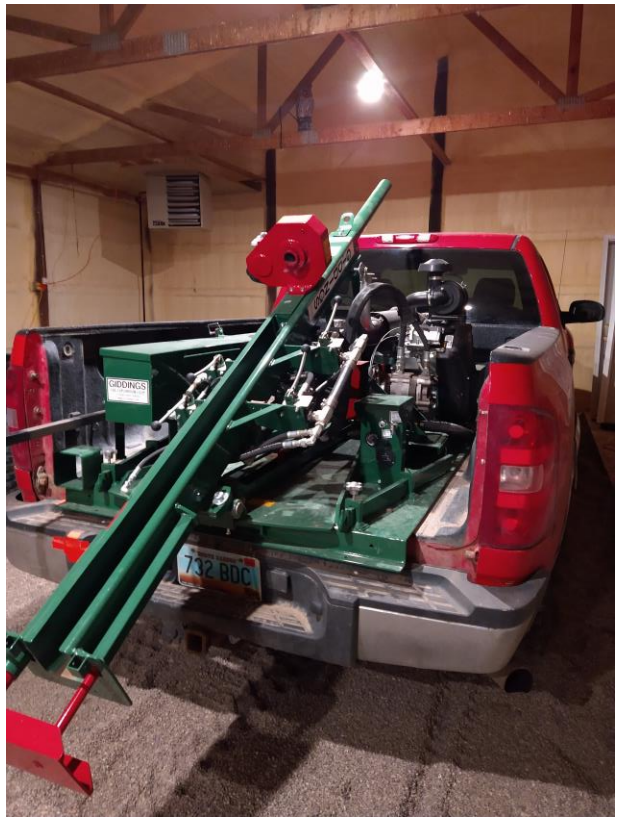
- *We need to determine how modern grazing systems influence the net uptake of carbon dioxide from the atmosphere into the grazing land ecosystem. Carbon capture is an ecosystem service, but we need to know how to optimize this service with management.*

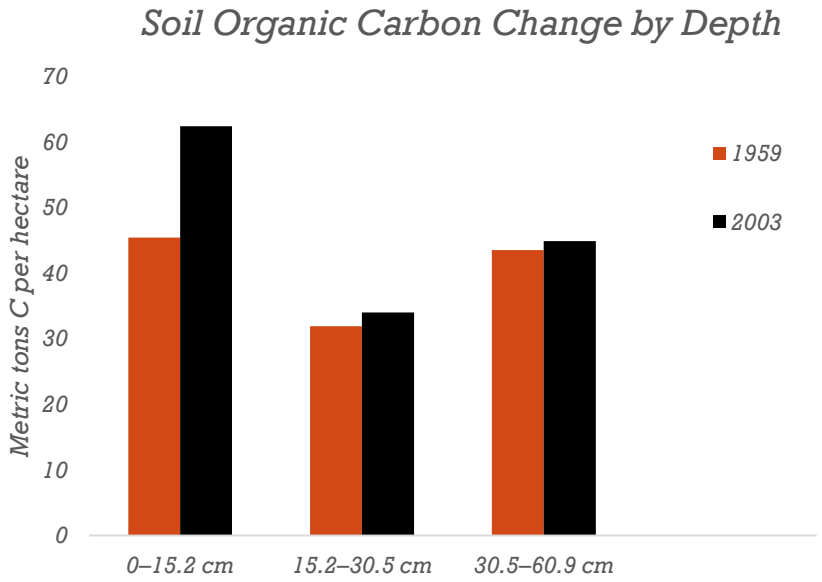
GRASSLANDS ARE IMPORTANT CARBON SINKS

Projected outcomes include:

- Enhanced oil and gas portfolios
- Improved habitat and soil quality
- Improved grassland production
- Potential for grassland carbon market

HOW DO WE MEASURE CARBON IN GRASSLANDS?





Data from:
Liebig, MA, Gross, JR, Kronberg, SL, Phillips, RL, Hanson, JD. 2010

WHAT MORE DO WE NEED TO KNOW AND WHEN?

Grazing Management

- *Influence of rotational grazing management on net ecosystem carbon uptake and the net ecosystem carbon balance*

Demonstrate in 2 years

- *How restored and managed grazing lands could support North Dakota agriculture, a resilient energy industry, and increase carbon utilization now and in the future*

HOW CAN WE ACHIEVE?

- *Apply advanced measurement technologies for real-time estimates of carbon uptake in managed grazing systems*
- *Test effect of rotational grazing on annual net carbon uptake*
- *Cumulate carbon uptake by monitoring for 2 years*
- *Model data for application at other sites*

HOW IS THIS RESEARCH DIFFERENT?

- *Soil Carbon*
  - Limited to inventories of soil carbon (tons per acre) at specific points in space and time, rather than rates of ecosystem carbon uptake (tons per acre per day or year) for an entire ecosystem

- *Atmospheric Carbon*
  - Linked directly to grazing lands management by providing rates of carbon uptake every 30 minutes over a large (50+ acre) land area. Carbon uptake depends upon environmental conditions, which we can evaluate and model. We can learn things more quickly.

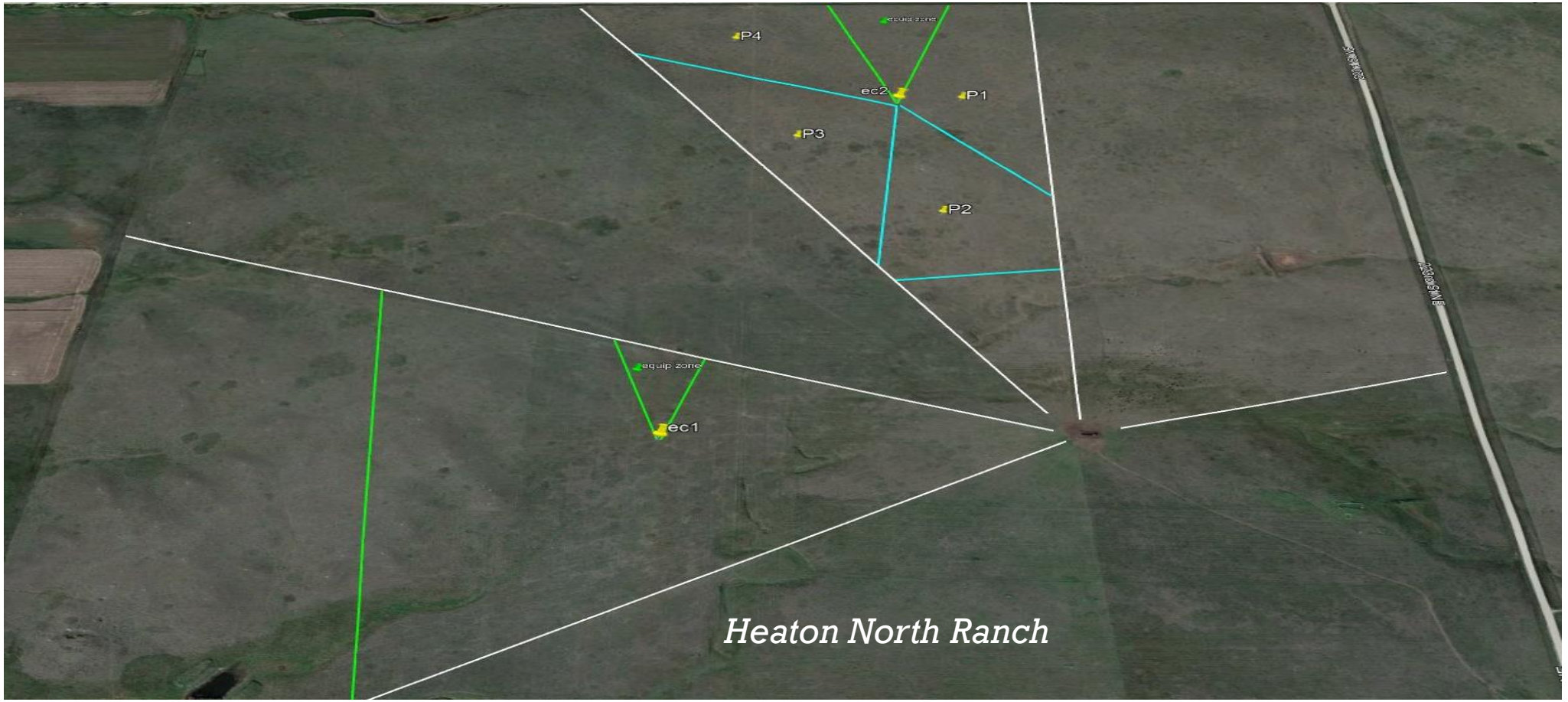
- *Both are Valuable*

WHAT DO WE NEED FOR THIS PROJECT?

FIELD SITE CONSIDERATIONS:

- *Two large pastures without obstructions and minimal topographic or canopy variation (flat without woody veg): 1 with managed grazing and 1 control (REQUIRED)*
- *Landowner that will participate in project and work collaboratively with the NDNRT to ensure management activities are properly tracked and consistent each year (REQUIRED)*
- *Cellular service access (REQUIRED)*
- *Diversity of grassland vegetation, preferable native prairie or restored grassland*
- *Location where outreach efforts and tours could be facilitated for local farmers, ranchers, elected officials, and business managers.*

FIELD SITE IDENTIFIED FOR THIS RESEARCH



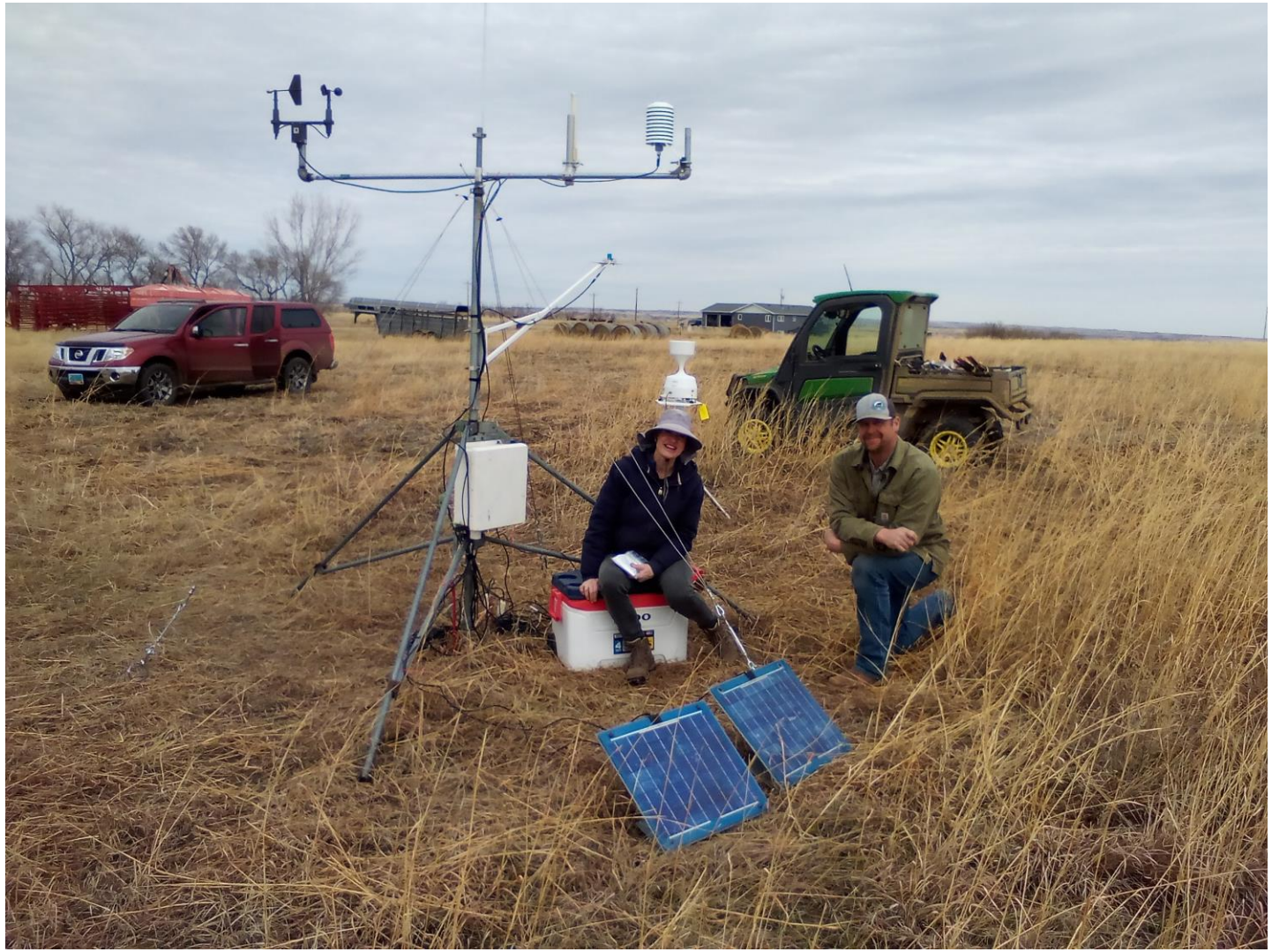
CORE SITE FOR CARBON UPTAKE, MCKENZIE

Net ecosystem production
Precipitation
Sensible heat flux
Latent heat flux
Incoming solar radiation
Photosynthetically active radiation
Soil heat flux
Soil moisture and temperature
Air temperature
Relative humidity

Net carbon balance
Net water balance
Net energy balance

BOTH ABOVE AND BELOWGROUND CARBON UPTAKE EVERY 30 MINUTES

SATELLITE SITE, WILLISTON



Photosynthetically Active Radiation

Wind speed, direction

Soil and air temperature

Rainfall

Soil moisture

Humidity

Leaf area

SO HOW WILL GRAZING BE MANAGED AND WHAT PLANT DATA WILL BE COLLECTED?

- *Asynchronous Grazing*
  - *4 Paddocks*
  - *Graze intensively in either Spring, Early Summer, Late Summer, or Fall in 2023*
  - *Change the seasonality of grazing among pastures in 2024*
    - *Does asynchronous grazing influence aboveground production?*
    - *Does asynchronous grazing influences plant community composition?*

IF MANAGED GRAZING INFLUENCES CARBON UPTAKE….HOW CAN WE EXPLAIN?

We are looking for not only the importance of grazing to carbon uptake, but also how to explain the grazing response

- *Plant community changes?*
- *Aboveground-belowground carbon allocation ratio?*
- *Weather?*

THANK YOU