

# Using small studies to answer big questions: Studying carbon dynamics at Concordia College's Field Station

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## Concordia College's Long Lake Field Station in Moorhead, MN

Pre-settlement, the area around Long Lake Field Station was a mix of upland prairie, aspen parkland, and maple-basswood forest.

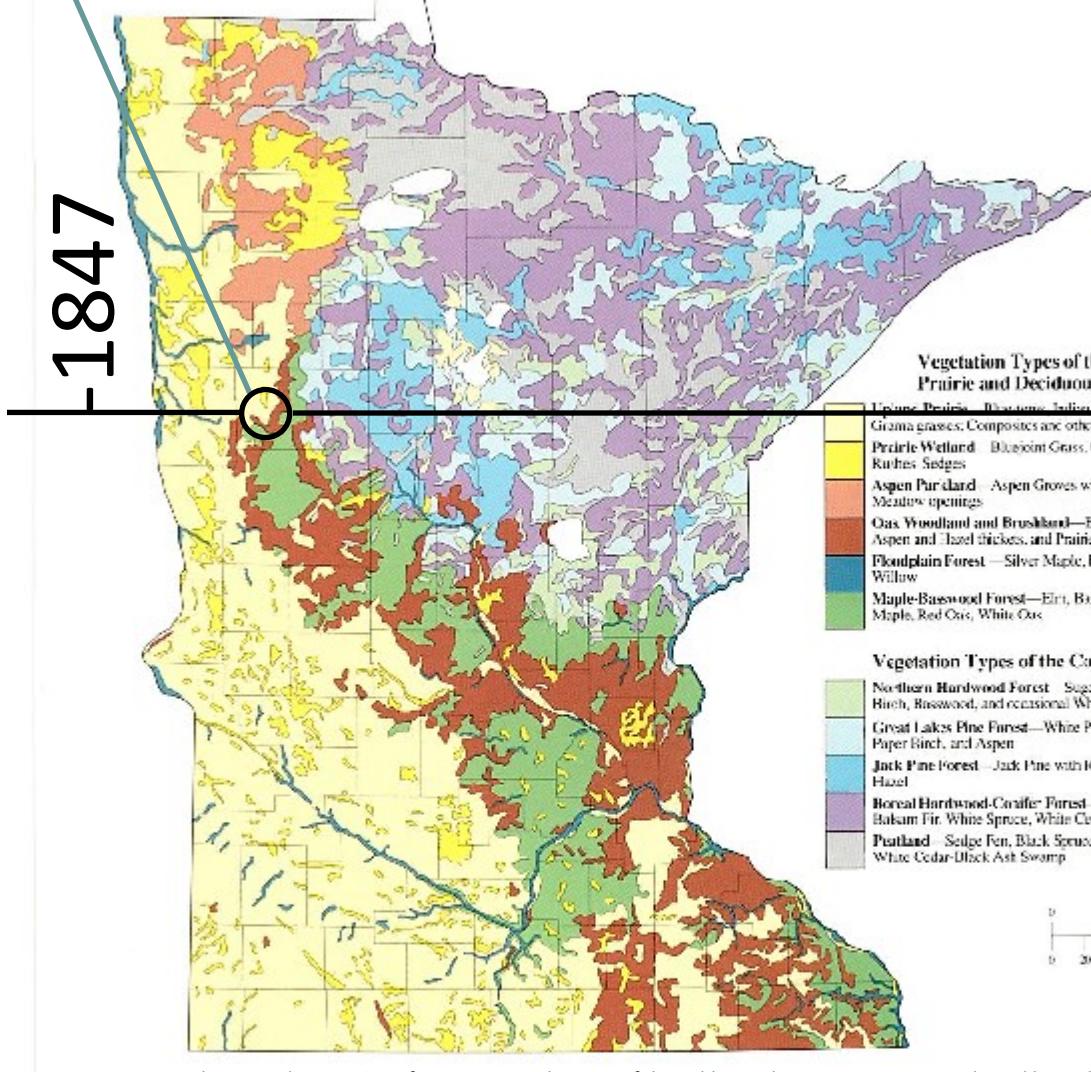
After settlement, the area was heavily farmed with row crops. Two farmsteads were located on the Long Lake Property.

In 1974, the Concordia College Biology Department was given the property to use for undergraduate teaching and research.

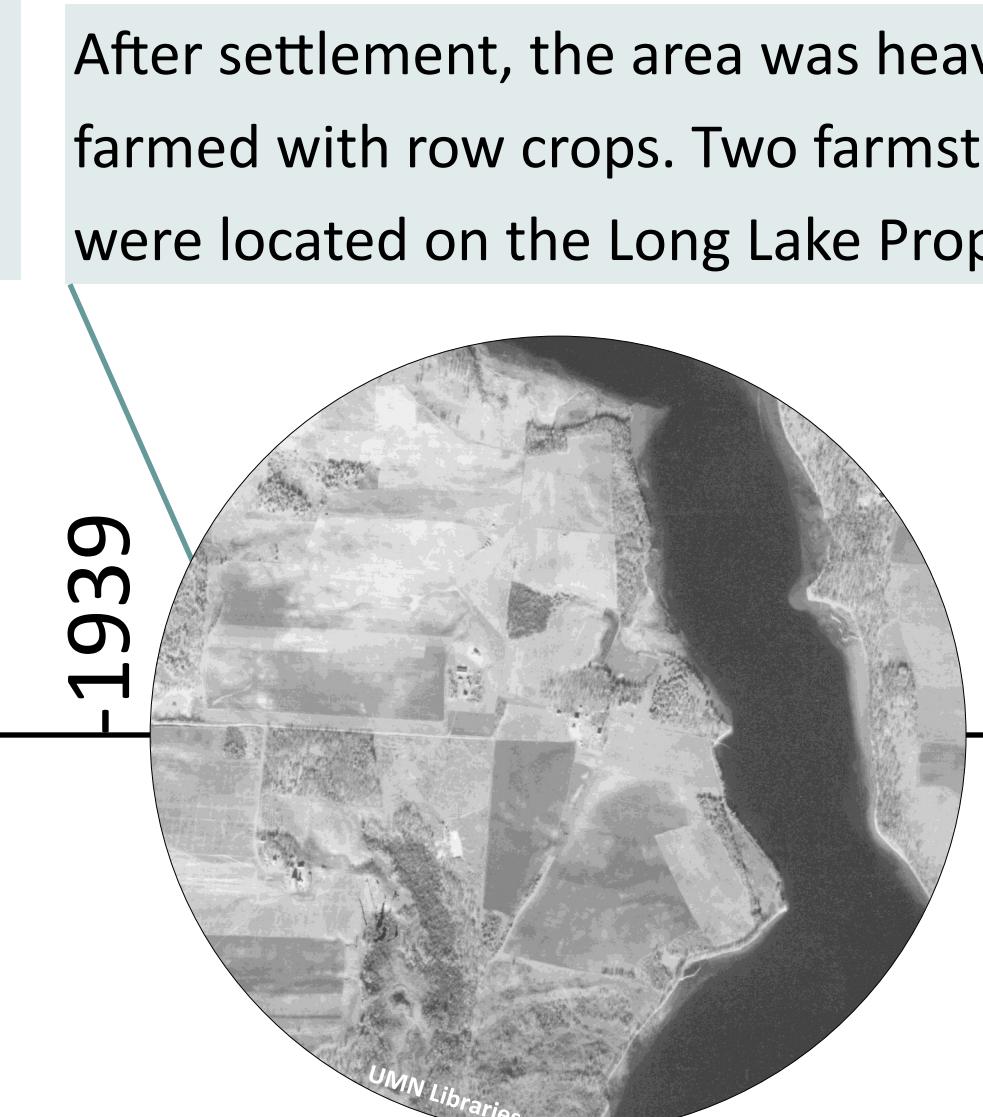
In 2009, the Concordia College Biology Department began restoring the shoreline on Long Lake . . .

And restoring tallgrass prairies . . .

And building a multiuse field station facility with classroom, kitchen, and shower.



1847



1939

In 1974, the Concordia College Biology Department was given the property to use for undergraduate teaching and research.



1974

2009

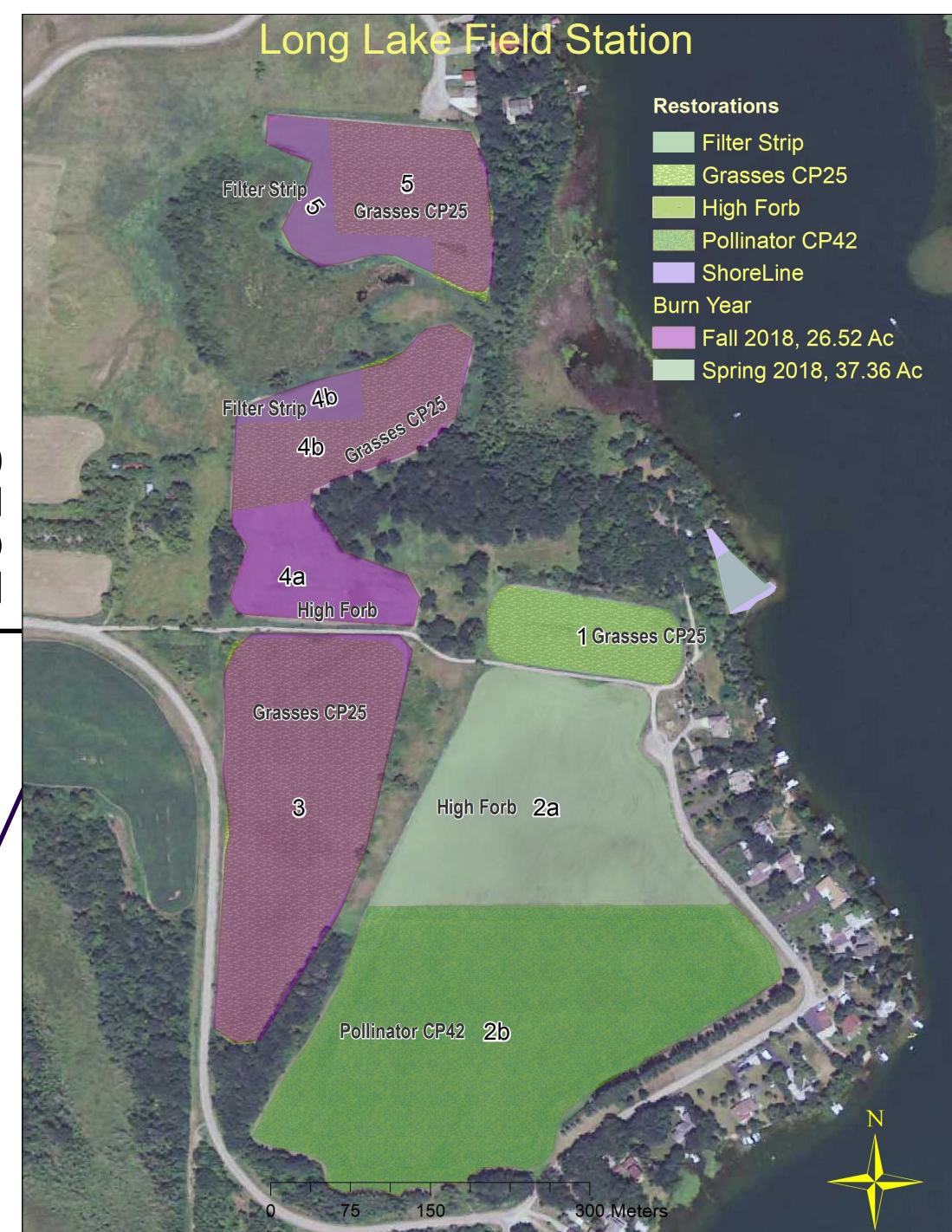
In 2009, the Concordia College Biology Department began restoring the shoreline on Long Lake . . .



2018



2018



Now, this Field Station provides endless opportunities for student research, classwork, and community engagement.

## Long-Term Carbon Census Study

In the summer of 2018, Dr. ArchMiller and her research students established 30 permanent plots in various ecosystems at Long Lake. The goal of this Carbon Census Study is to measure carbon stocks and dynamics through time as restoration continues on site.

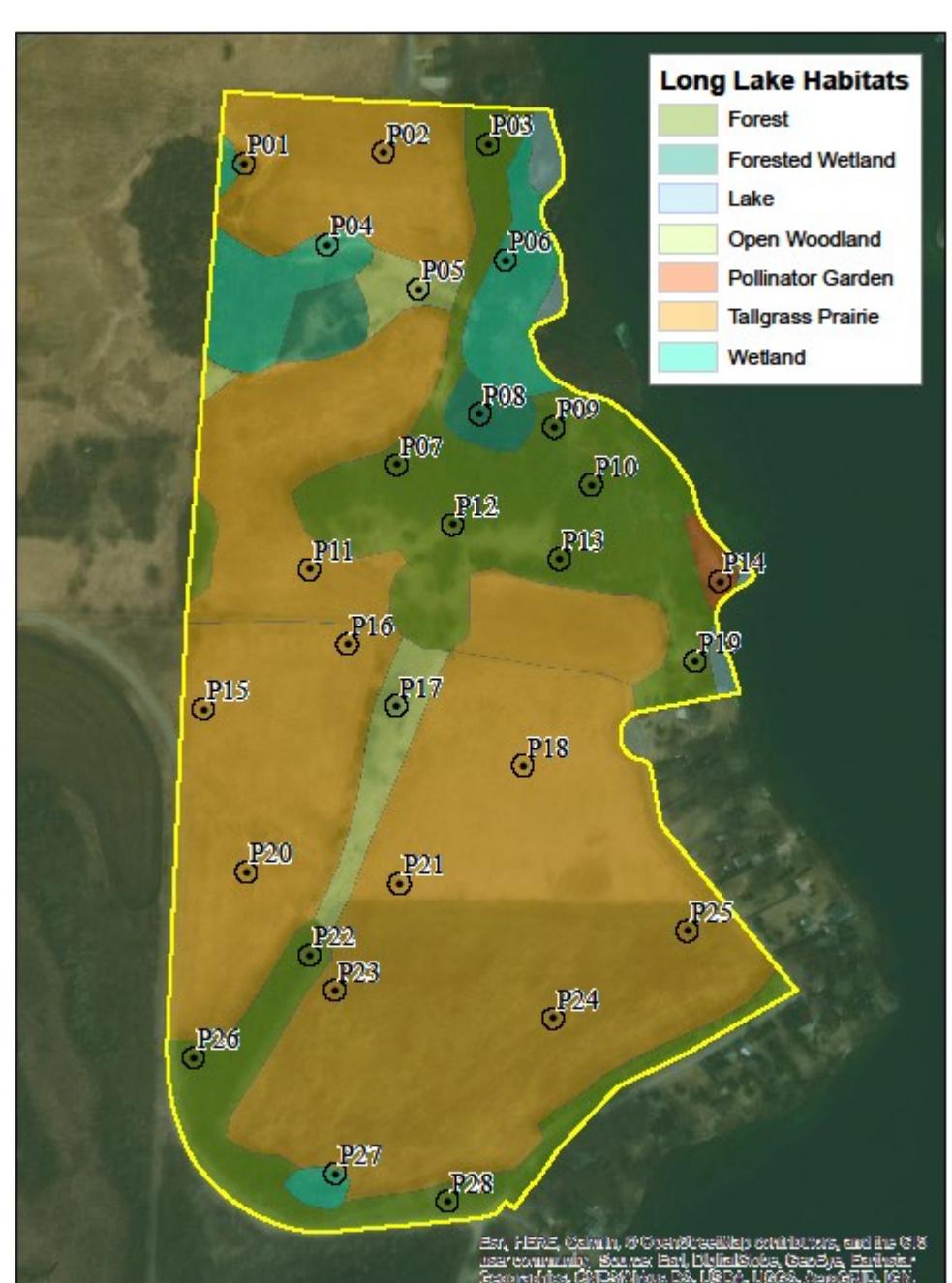
Annually, we will measure:

- Overstory and understory biomass and litter
- Soil respiration, which is the flux of CO<sub>2</sub> from soil as a result of root & soil microbe activity
- Species diversity

With this data, we will be able to explore how the site as a whole is reacting to changing climate and weather patterns, and we will better understand the role that management activities play in controlling carbon dynamics across the Long Lake landscape.

Additionally, this study will generate a lot of data from which students will be able to ask questions about

the interactions between restoration, climate, prescribed burns, biodiversity, carbon, and time.



## Prescribed Burns and Prairie Dynamics

Fire is an essential part of the health of an ecosystem, specifically affecting the biodiversity of the plant community. More competitive, dominant plants contribute a large amount of biomass to an ecosystem. Additionally, these species tend to use a large amount of resources and infringe on resource availability of other species. Recently, the loss of wildfires in prairie ecosystems has lead to decreased plant diversity and the accumulation of litter.

**The objective of this project was to determine the effect of the spring burn on understory biomass and diversity at Concordia's Long Lake Field Station.**

### Methods

We collected understory biomass samples from 3 subplots within each of 12 prairie plots. Half of the plots were recently burned in Spring 2018, and the others were last burned in 2014 (see maps). Biomass included all of the understory plants (live and dead) within a

30 x 30 cm quadrat. We then sorted live plants to species and weighed the biomass after drying it in an oven for 48+ hours at 60 °C.

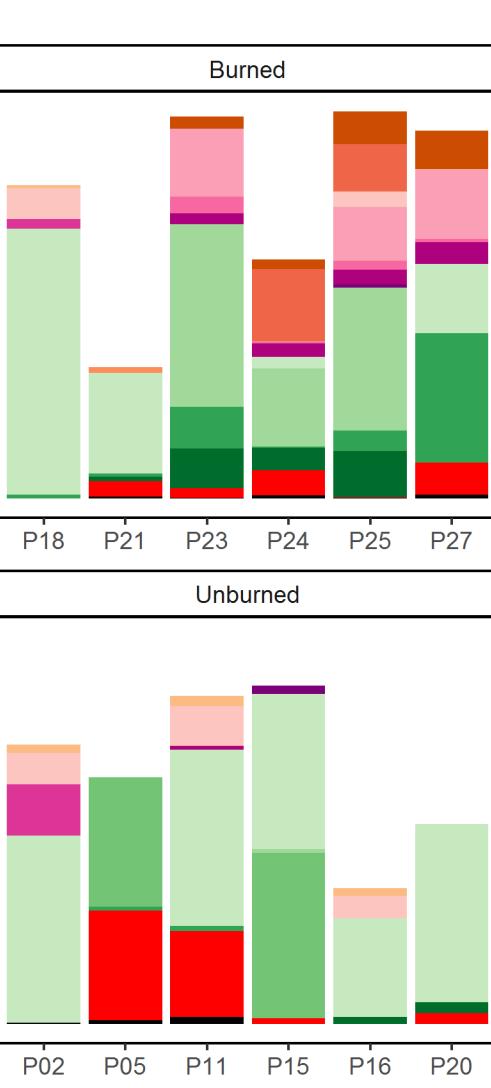


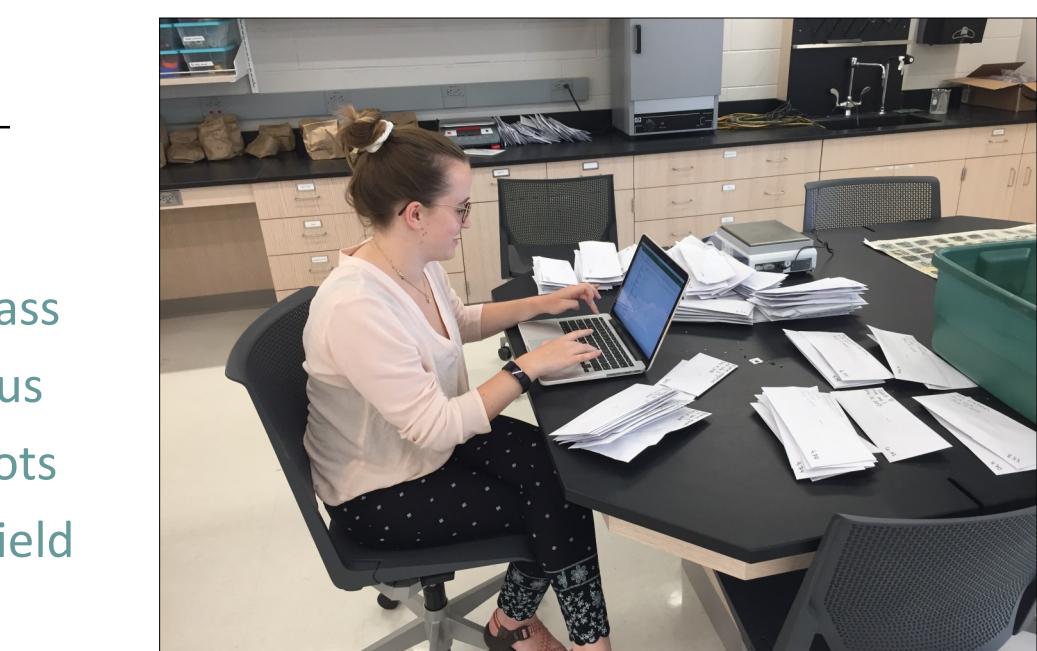
Figure 1. Total prairie biomass (live in pink and dead in gray) versus burn status across 12 plots at Concordia College's Field Station. Lowercase letters indicate effects at  $p < 0.05$ . Error bars = SE.

### Results

Burns decreased total biomass, specifically the dead litter (Fig. 1). We also found that of the live biomass, which was similar between prairies, the burns decreased the amount of invasive species and increased the floral diversity (Fig. 2).

**This study indicates the importance of prescribed burns to maintain tallgrass prairie health.**

Figure 2. Total live biomass by species and plot versus burn status across 12 plots at Concordia College's Field Station.



The variety of habitats at Concordia College's Long Lake Field Station gives students the chance to work on diverse research projects studying topics such as native pollinators, lake ecology, and small mammal population dynamics. Faculty from many different disciplines teach at the facility, including:

- Ecology
- Mammology
- Plant Taxonomy
- Limnology (study of lakes and streams)
- Environmental and Sustainable Studies
- Religion
- Philosophy
- Education

In addition, Concordia faculty and staff recently worked with local community groups and businesses to halt the expansion of a gravel mining operation adjacent to and within the watershed of Long Lake.

**Maintaining a vibrant field station such as Concordia College's provides myriad experiences for a better education for our students, productive and long-term research opportunities, and**

**a better community for all.**

**CONCORDIA  
COLLEGE**  
Moorhead, Minnesota

