# The influence of silvicultural treatments and coarse woody material (CWM) on forest carbon storage and sequestration

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# Background: Forest Carbon

- Forests valued for sequestering and storing carbon (Achat et al. 2015)

- Soil carbon increases with productivity (Kreye et al., 2023)

- Tree basal area, biomass, composition, productivity, and root production

- Decomposition depends on nutrient availability, microbial composition, and climate (Wojciech et al. 2019)

# Background: Canopy Gaps

- Gaps create structural complexity, provide sites for the establishment of certain tree species, and increase the rate of development of late successional forest conditions (Gray et al. 2002).

- Small versus large canopy gaps (Gray et al. 2002)

- Large canopy gaps tend to have increased moisture and higher temperatures with greater decomposition and nutrient availability(Gray et al. 2002).

# Background: CWM

- Soils beneath CWM and the organic horizon are known as "pedogenic hot spots" (Kim et al. 2017)

- Forests managed for wood production often have lower levels of CWM, which have negative impacts

- Changing forest management practices to retain more CWM will have several benefits (Kruys et al., 2002)

# Significance

- Forests are essential for being carbon sinks - CWM accounts for 8% of global carbon stocks (Laiho and Prescott 2004)

- CWM has been overlooked by researchers in the past due to low chemical output to soil (Wiebe et al, 2014), but will be a part of adapting forest management practices to accommodate a changing climate

- This research provides guidance to forest managers looking for more ways to sequester carbon in forests

- Contributes to overall carbon research in the lens of climate change

# Significance

- Soil holds most carbon on land (NASA) so we need to manage soils to maximize the amount of carbon forests can hold
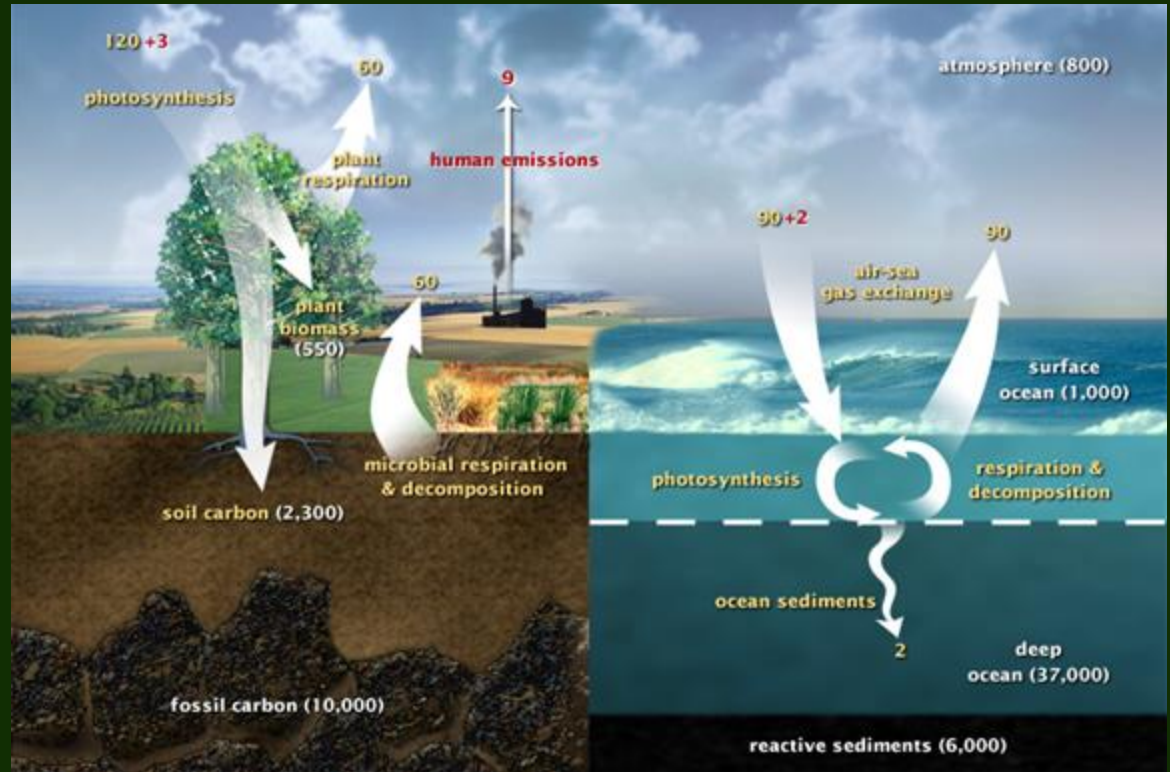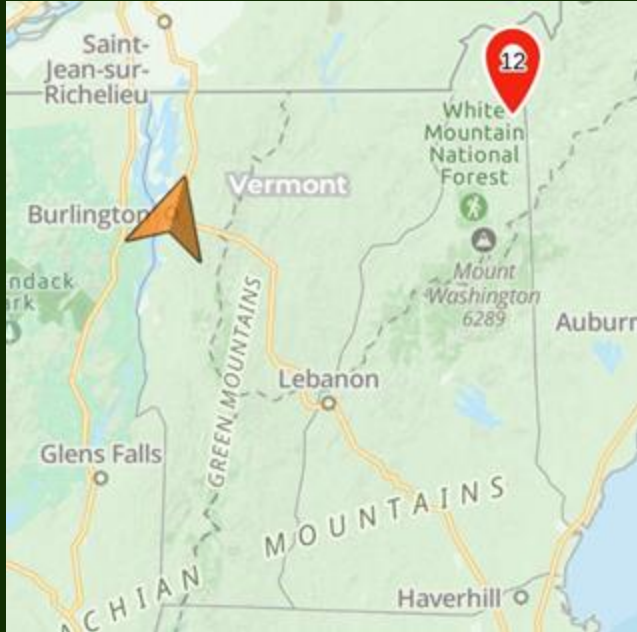
# Objectives

1. Examine the relationship between forest overstory conditions, deadwood, and soil C concentration, and

1. Examine the influence of CWM on spatial patterns of C, nitrate and ammonium

# Field Site

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12 *Acer saccharum* logs in Second College Grant (SCG), NH. Harvested and placed in the canopy gaps in 2017

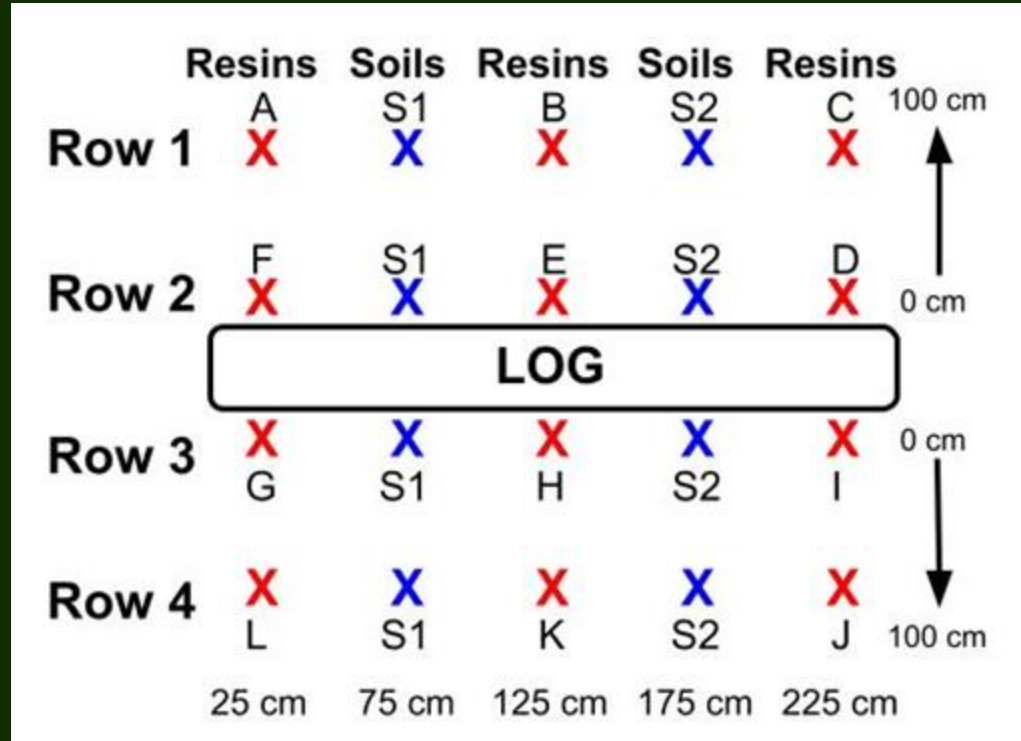In differing canopy openness percentages (SM_GAP = 39-46%, LG_GAP = 24-52%, MATRIX = 5-9%, CNTL = 4-7%).

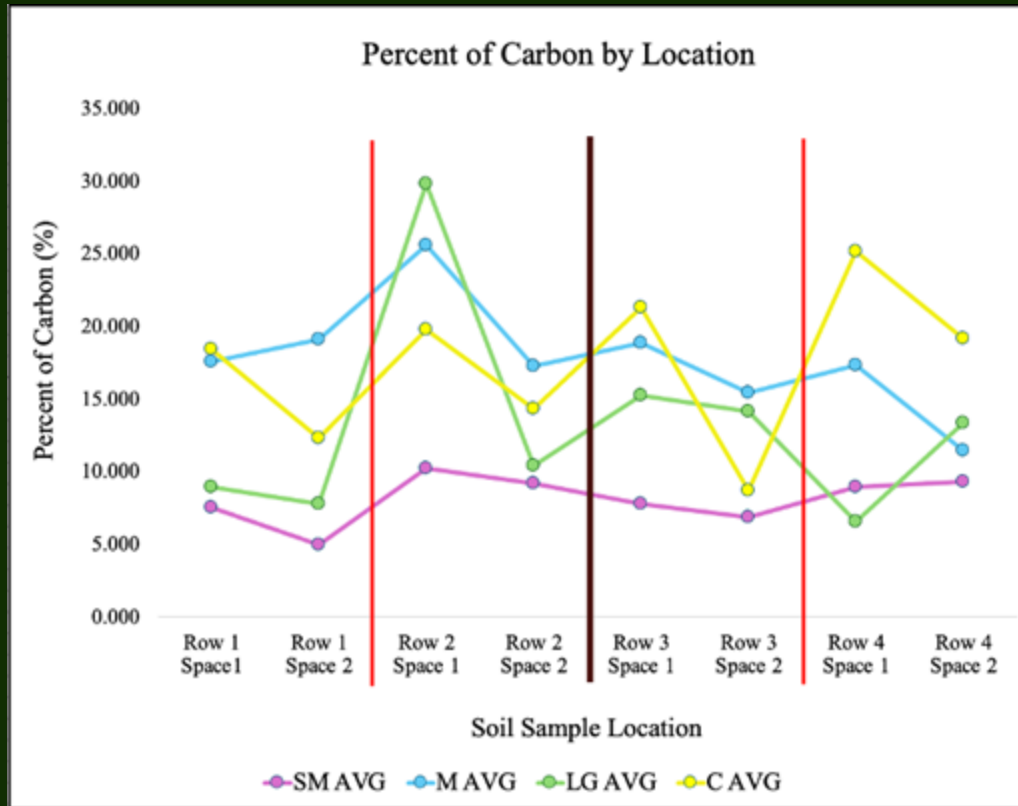| Log_ID | Treatment | Canopy Openness (%) |
|--------|-----------|---------------------|
| 1 | SM_GAP | 47.5 |
| 2 | SM_GAP | 43.9 |
| 9 | SM_GAP | 39.1 |
| 5 | LG_GAP | 41.5 |
| 6 | LG_GAP | 24.3 |
| 7 | LG_GAP | 51.6 |
| 3 | MATRIX | 5.9 |
| 4 | MATRIX | 8.4 |
| 8 | MATRIX | 6.2 |
| 10 | CNTRL | 5.7 |
| 11 | CNTRL | 6.4 |
| 12 | CNTRL | 4.3 |

# Soil Sampling Methods

Samples taken around the log to figure out how much carbon is going into the soil relative to percent canopy openness above the log

Soil samples will be taken in the lower O and upper A horizons
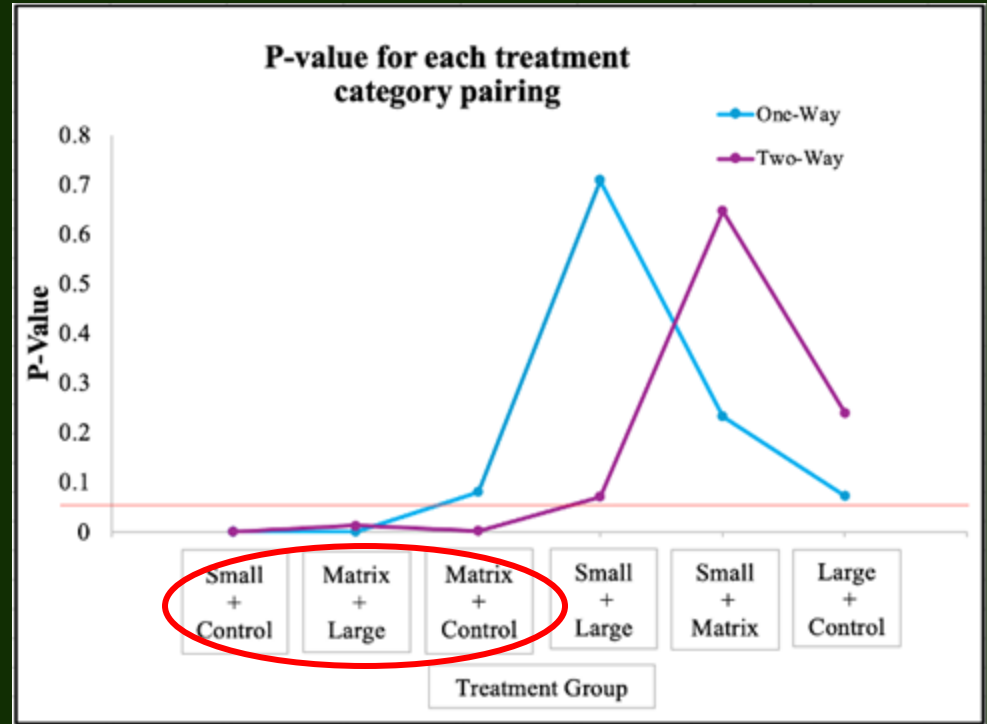
# Soil Sample Analysis

# Soil Sample Analysis

P-values were calculated using a one-way ANOVA and a two-way ANOVA without repetition

Statistical significance between 5.7% canopy openness

# Soil Sample Analysis

Statistical significance between 5.7% canopy openness

| | R1S1 | R1S2 | R2S1 | R2S2 | R3S1 | R3S2 | R4S1 | R4S2 |
|---|---|---|---|---|---|---|---|---|
| SM | 7.51833333 | 4.985 | 10.2116667 | 9.10833333 | 7.76 | 6.86666667 | 8.96 | 9.32166667 |
| C | 18.5066667 | 11.96 | 19.735 | 14.2916667 | 21.23 | 8.67 | 25.8133333 | 18.535 |

Anova: Two-Factor Without Replication

| Source of Variati | SS | df | MS | F | P-value | F crit |
|---|---|---|---|---|---|---|
| Rows | 342.342506 | 1 | 342.342506 | 30.7460713 | 0.00086453 | 5.59144785 |
| Columns | 150.304261 | 7 | 21.4720373 | 1.92842191 | 0.20290794 | 3.78704354 |
| Error | 77.9415854 | 7 | 11.1345122 | | | |
| | | | | | | |
| Total | 570.588353 | 15 | | | | |

# Percent C Model

Combines all the variables the logs are exposed to including

tree canopy openness %,
location of the soil sample,
if the area is a wetland or not,
soil moisture,
soil temperature,
percent carbon in the soil,

Accommodating all these variables will create a clearer image of which canopy openness condition stores the most carbon

# Questions?

## Special Thanks:

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# Picture References

URL: http://www.budongo.org/news/search-for-limiting-soil-nutrients-in-budongo

URL: https://daily.jstor.org/canopy-gaps-define-growth-in-the-forest/

URL: https://earthobservatory.nasa.gov/features/CarbonCycle