

# Habitat Restoration & Soil Organic Carbon

# Zie Goodman

College Park Scholars – Science & Global Change Program Environmental Science & Technology – Soil & Watershed Science zgoodm10@terpmail.umd.edu CPSP359G College Park Scholars Academic Showcase, May 9, 2025



# Introduction

Extensive agricultural use has caused many soils to become degraded. This is the case for soils at Emory Waters Nature Reserve, a site for recent habitat restoration projects. Carbon levels in these restored soils can be an indicator of both their health and each individual habitat's ability to sequester carbon. The soil organic carbon (SOC) is made up of both active carbon and stored away, inactive carbon. In times of climate change, understanding soil as a carbon sink and flux is crucial. I hypothesized that different habitats would demonstrate a significant difference in SOC content, which could be explained by the habitats' characteristics and restoration age.

# Methods

- I sampled topsoil at a depth of 20 cm; 5 replicates at each site
- I collected bulk density (BD) samples of topsoil using a soil core of volume 513 cm<sup>3</sup>. I dried each sample at 80° C for 48 hours and calculated BD by dividing the volume of the core from the dry mass of soil.
- Oven-dried soil samples were burned at 550° C for 4 hours. The mass lost on ignition is equal to the soil organic matter (SOM).
- I used a conversion factor of 1.724 to calculate SOC: SOM = 1.724 \* SOC
- I used BD to calculate total carbon stock:

## Map of Study Sites



## Materials

- Shovel
- Tape measure
- Soil corer
- pH meter
- Oven & muffler furnace
- Crucibles
- Scale & sieve

The six sampling sites at Jug Bay Wetlands Sanctuary along the Patuxent river: YM = young meadow; MM = medium-aged meadow; OM = old meadow; YF = young forest; OF = old forest; PB = pine barren.

#### Sample Site Descriptions

Young meadow (YM) of 17.2 acres and 3 years in age is located at Emory Waters Nature Preserve. medium-aged meadow (MM) of 2.0 acres and 5 years in age is located at Emory Waters Nature Preserve. old meadow (OM) of 2.0 acres and 30+ years in age is located at the Sanctuary Proper. The young, reforested forest (YF), 3 years in age, is located at Emory Waters Nature Preserve. The old, naturally formed forest (OF) is located at Emory Waters Nature Preserve. Pine barren (PB) is located at Paris N. Glendening Nature Preserve.

# C = % SOC \* BD \* Depth

• I ran ANOVA and Tukey Tests to analyze statistical significance.

# Results



Grams of SOC per gram of soil of meadow, forest, and pine barren habitats of different restoration ages at a depth of 20 cm (p = 6.83E-7). SOC = soil organic carbon; YM = young meadow; MM = medium-aged meadow; OM = old meadow; YF = young forest; OF = old forest; PB = pine barren.



Site Mission: Promoting conservation of estuarine ecosystems through education, research, stewardship, and volunteering.

## Discussion

I determined that restoration age and habitat type were significant factors on SOC content of forest habitats. In accordance with SOC data, Jug Bay's broadleaf forests serve as the most effective carbon sink compared with sanctuary meadows. I expect the SOC content at the restored habitats to continue increasing as the vegetation develops, based on overall good indicators of soil health. Thus, once full restoration is attained, the young forest and young meadow are projected to achieve greater SOC content than their older counterparts. I recommend that as future restoration projects occur, broadleaf and graminoid vegetation be incorporated to ensure higher levels of SOC and SOM consolidation. I noted to Sanctuary Staff that the restored meadows had very acid soils, and there are plans in place to lime the soils to encourage habitat growth. I was grateful for the opportunity to contribute towards the success of restoration at Jug Bay and am excited to continue pursuing field work based in environmental conservation.





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