Do tree species affect C distribution in soil physical fractions in the Canadian boreal forest?

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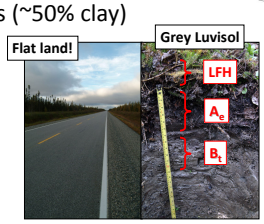
Understanding the role of the boreal forest in the global C cycle is essential to increasing our ability to **predict** and **mitigate** the consequences of climate change. Compared with deciduous tree species, black spruce is known to store a large amount of C in the **O layer (LFH)**, but less is known about mineral soil layers.

Hypothesis

Different stand types (**black spruce**, **mixedwood**, **trembling aspen**) affect C distribution in mineral soil physical fractions.

Study Sites

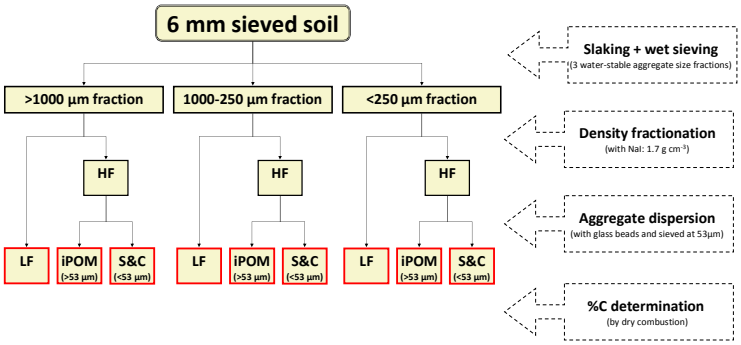
- Eastern boreal forest of Canada (Clay Belt)
- **Homogeneous site conditions** resulting from the proglacial lake Barlow-Ojibway, 8000 B.C.:
  - glaciolacustrine deposits (~50% clay)
  - flat topography
  - moderate drainage
- MAT: 0.8°C; MAP: 890 mm
- Luvisols [Alfisols]
- 90-year-old stands



Soil Sampling

- 24 sites (8 blocks of **3 stand types**)
- 4 mineral soil samples by site (depth: 0-15 cm)

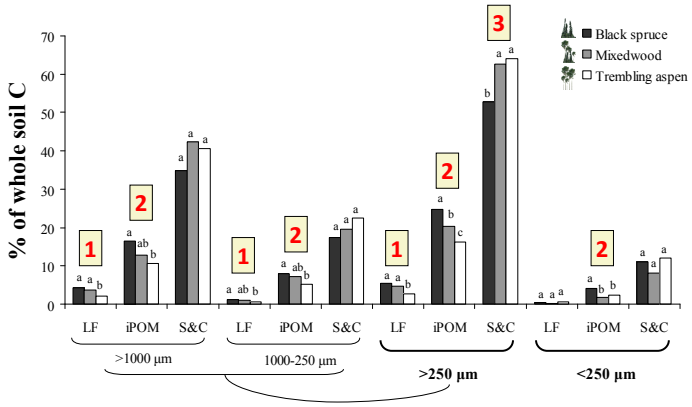
Analyses



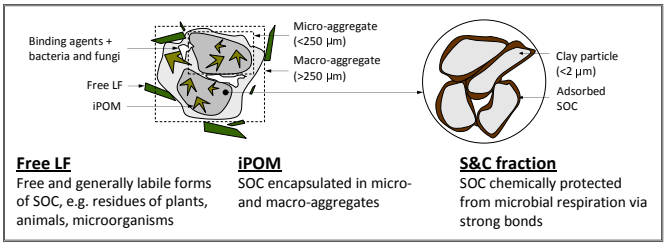
- This yielded **9 size-density fractions** (3 per aggregate-size fraction):
  - Free light fraction (**LF**)
  - Intra-aggregate particulate organic matter (**iPOM**)
  - Silt & Clay fraction (**S&C**)

Results

- According to a mixed linear model:
  - No difference ($p > 0.05$) between stand types for **whole soil C content.**
  - A significant difference ($p < 0.05$) between stand types for the **proportion of C content in soil physical fractions.**



- 1 More SOC in the **LF** under spruce > mixedwood > aspen
- 2 More SOC in the **iPOM** under spruce > mixedwood > aspen
- 3 More SOC in the **S&C** under aspen = mixedwood > spruce



Conclusions

- Black spruce ↑ the amount of C in the less protected SOC fractions.
- The potential increase in T°C with climate change might cause losses of these less protected SOC fractions under black spruce.
- Planting monocultures of black spruce after cutting mixedwood forests should be reconsidered.

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