Assessment of prescribed burning effects in paludified black spruce forests in Ontario's Clay Belt region

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Chaire en aménagement forestier durable

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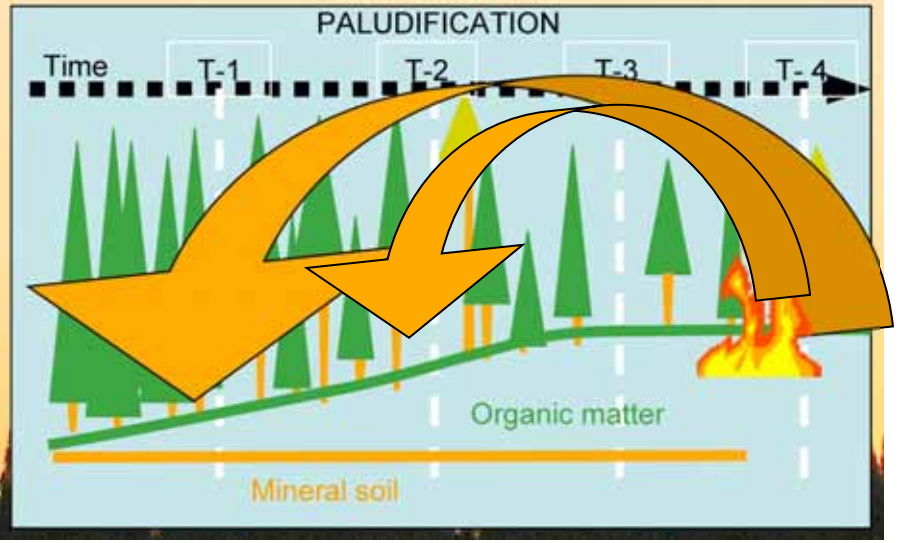
BOREAL FOREST
GREAT LAKES-ST. LAWRENCE FOREST
ACADIAN FOREST
CAROLINIAN FOREST
SUBALPINE FOREST
COLUMBIA FOREST
MONTANE FOREST
COASTAL FOREST
NONFOREST
TUNDRA
GRASSLANDS

Context of study: paludification, fire and forest management

- Paludification (Lavoie *et al*, 2005) (Fenton *et al*,2006)
  - Accumulation of organic matter (O.M.) along the forest succession
  - Waterlogged soil conditions
  - Reduced site productivity in the absence of severe wildfires

  (Simard *et al*, 2009)

- Effects of fire on the paludification process
  - Removal of O.M. by combustion
  - Physical and chemical effects on soil (Zackrisson *et al*.1996)
  - Restarts forest succession (Lecomte *et al*. 2005)
  - High and low severity fires

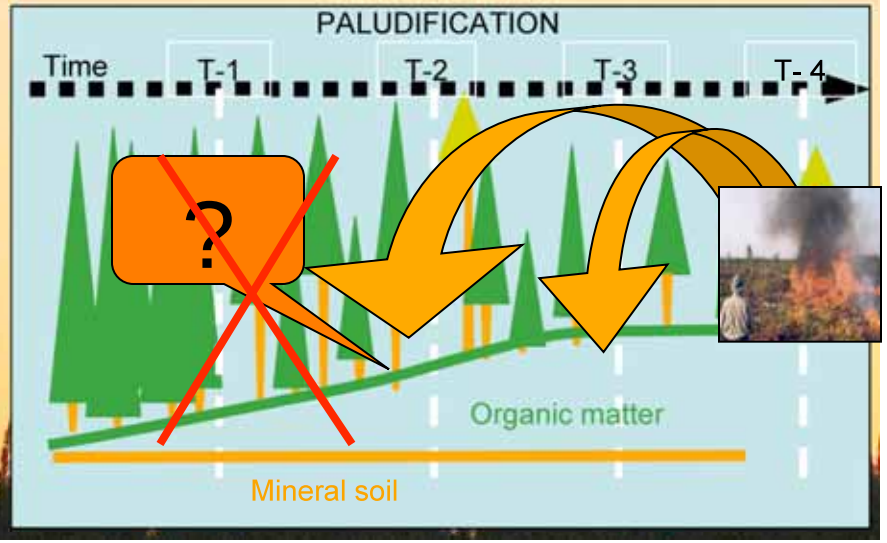


Context of study: paludification, fire and forest management

- Low impact harvesting effects
  - « Mimics » low severity fires
  - Could increase paludification

    -> loss of forest potential

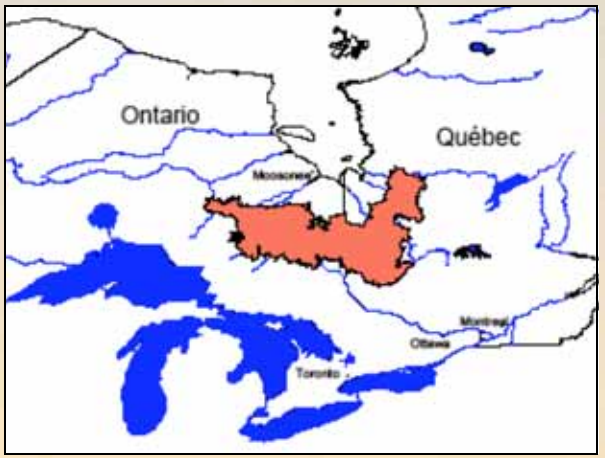
  (Fenton *et al*. 2005)
- Prescribed burning
  - Site preparation to control paludification in a managed landscape?



Objectives

- To assess retrospectively the effects of prescribed burning after clear cut on:
  - Level of soil paludification
  - Forest floor composition
  - Black spruce growth and regeneration

Methodology

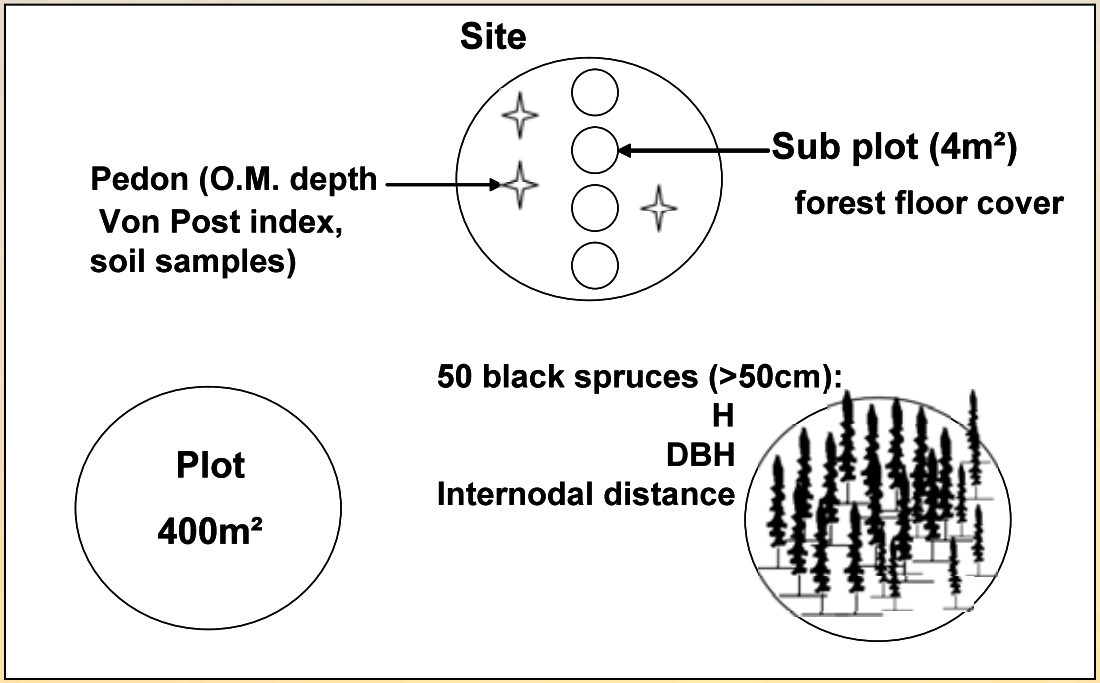


- Study area
  - Clay Belt of Eastern Canada: prone to paludification
  - Black spruce feather moss forest
- Treatments
  - CLAAG: Careful Logging Around Advanced Growth
  - CC: Summer Clear Cut
  - PB: Winter Clear Cut followed by Prescribed Burning
- Site selection: 24 sites
  - FEC classification
  - PB records
  - Harvest records

Treatment	Impact	Site age
CLAAG	Low impact	13-31 (23.6)
CC	Mechanical impact	20-42 (27.6)
PB	Physical and chimical impact	14-27 (19.16)

Methodology

- Data collection
  - Soil survey
  - Forest floor cover
  - Black spruce growth and regeneration



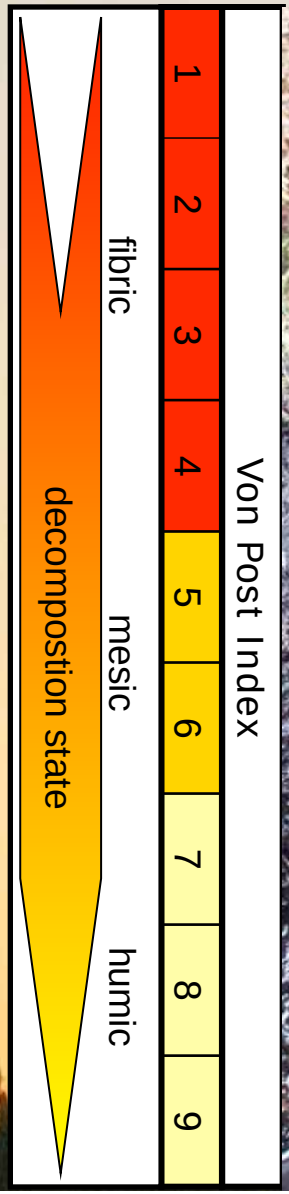
- Statistical analysis
  - General linear mixed models (random effect: site and plot)

Results

1. Soil survey
2. Forest floor cover
3. Tree growth and regeneration

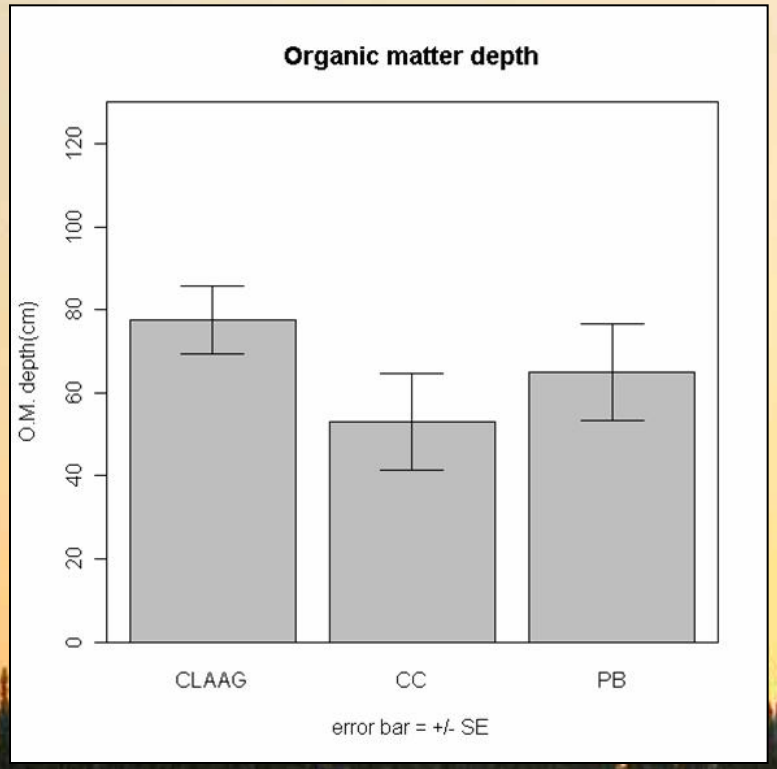
Soil survey

A bit of organic soil pedology…



Soil survey

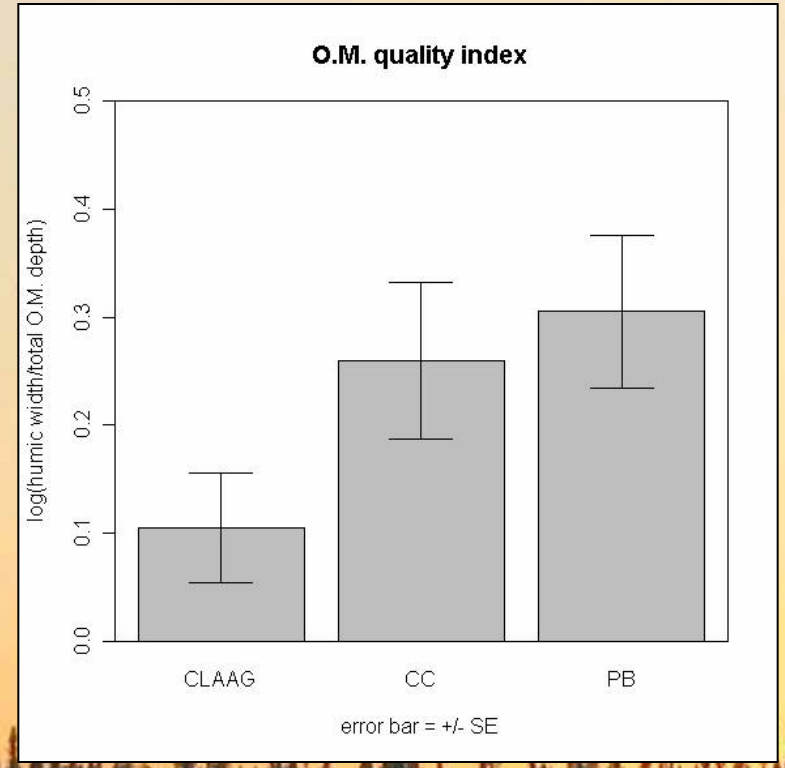
- O.M. depth
  - CC thiner O.M. soil -> compaction
  - No difference between CLAAG and PB



Soil survey

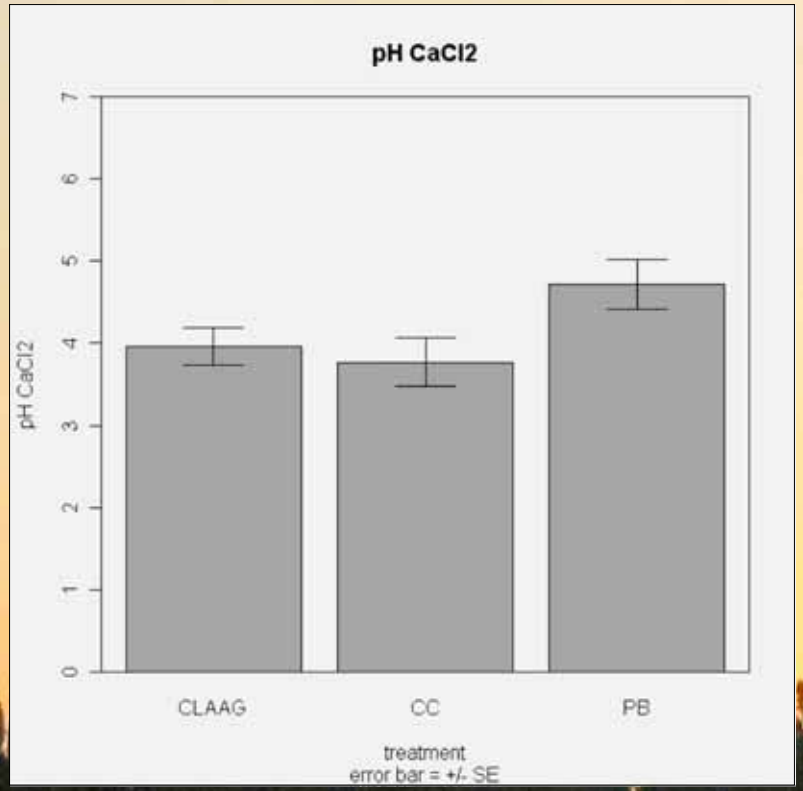
- Soil quality index

  Humic OM / total OM



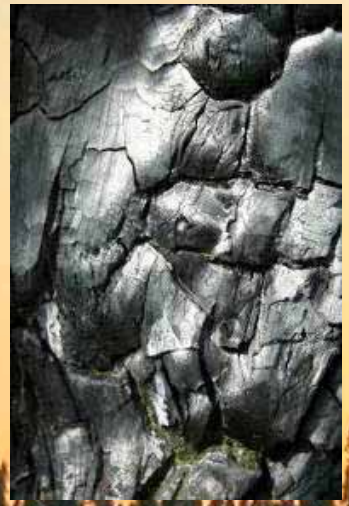
Soil survey

- Chemical analysis
  - Higher pH on PB sites
  - No significant difference for nutrient contents



Soil survey

- summary
  - **No difference of OM depth**
  - **Soil is more decomposed on PB and CC sites**
  - **Humus quality is higher on PB sites**
  - **Soil acidity is lower on PB sites**

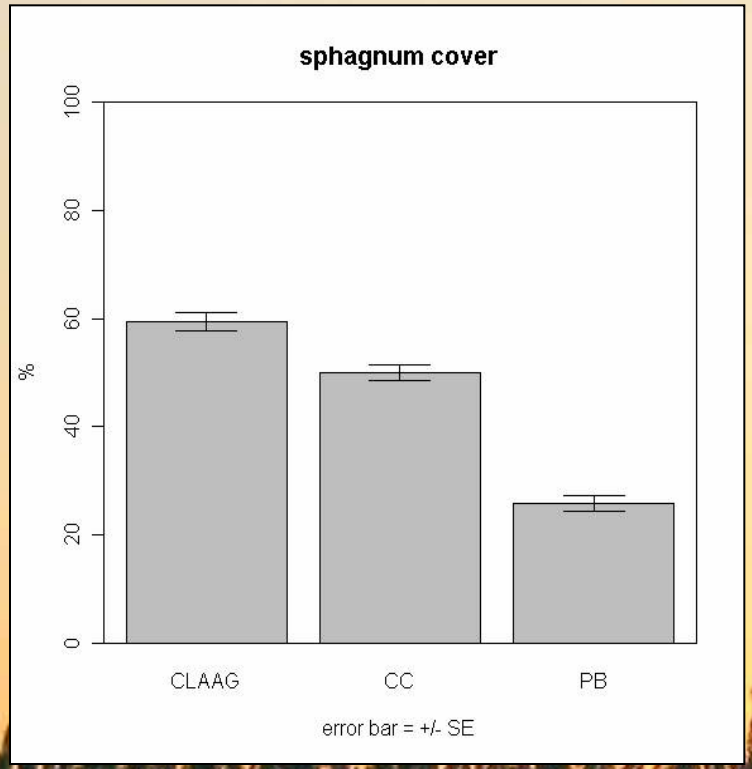


Forest floor cover

- Sphagnum
  - Rapid growth
  - The sponge tactic
- Ericaceous shrubs
  - Chemical competition
  - Scaffolding effect

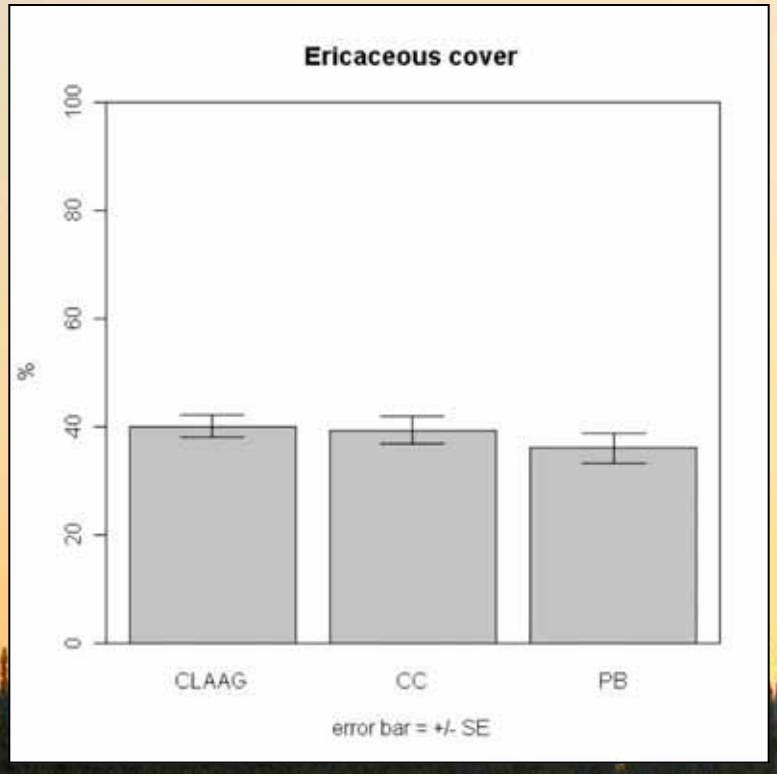
Forest floor cover

- Sphagnum
  - Lower sphagnum cover on PB sites



Forest floor cover

- Ericaceous shrubs
  - No difference observed
  - Higher variability on PB sites



Forest floor cover

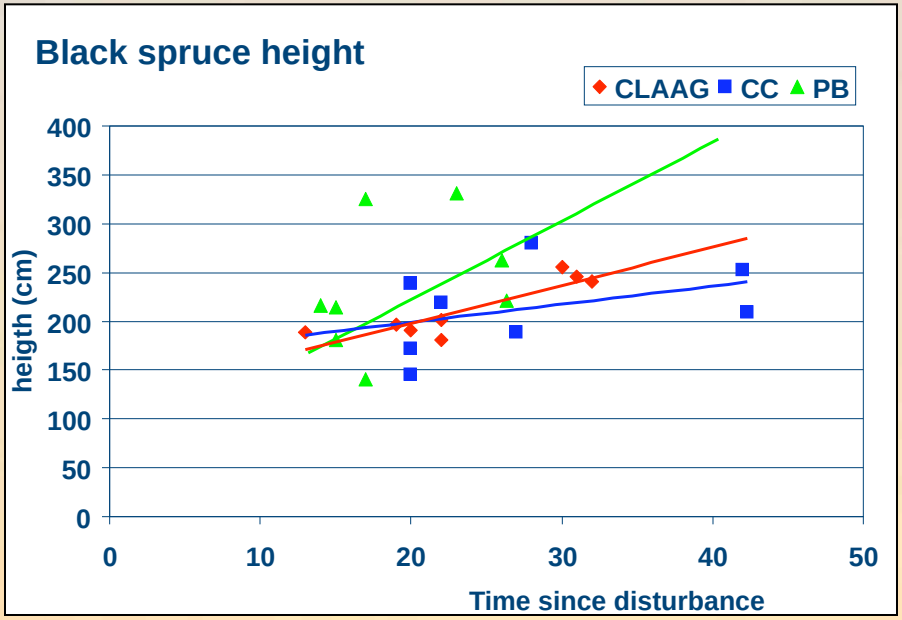
- Summary:
  - PB diminishes sphagnum cover
  - Ericaceous cover could be increased by prescribed burning (Mallik 2003)

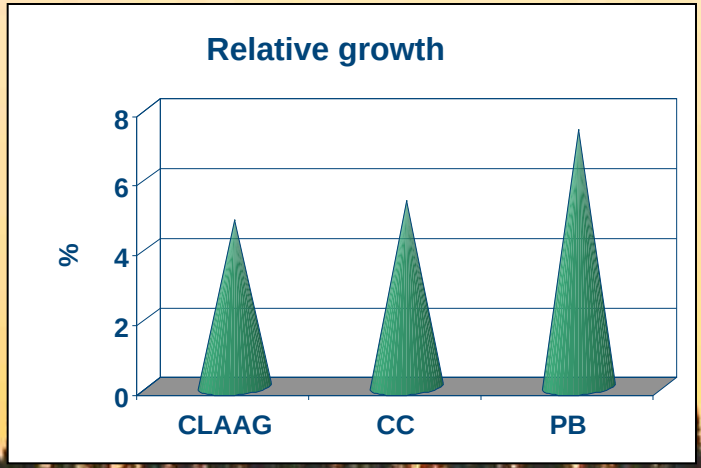
Black spruce growth and regeneration

- Mean height
  - higher trees on PB sites when controlling for time since disturbance
- Relative growth

(tree top/ tree height)*100

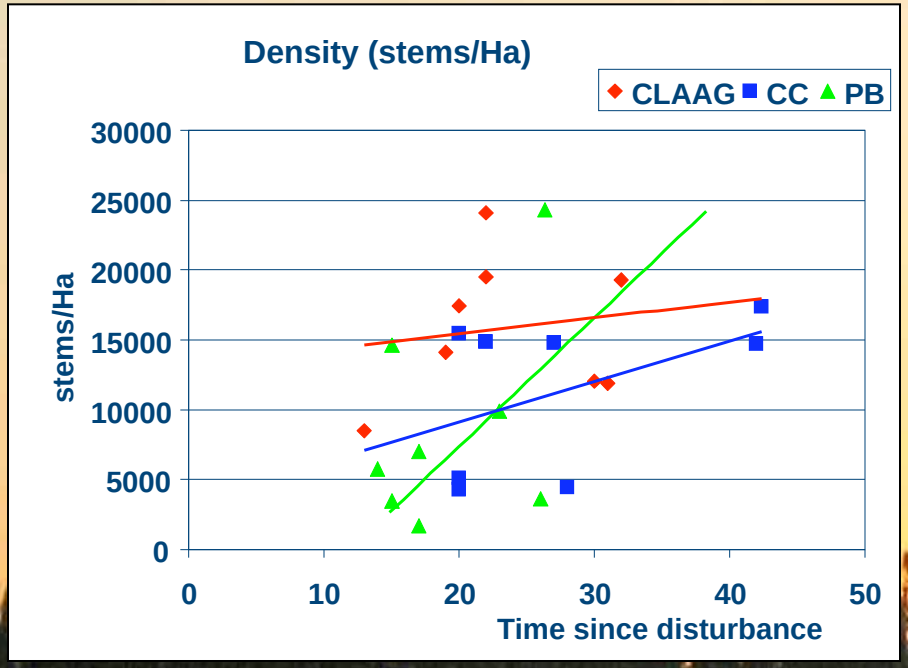
  - Higher relative growth on PB sites





Black spruce growth and regeneration

- Tree density
  - Lower density in PB sites
  - Difference diminishes with time



Black spruce growth and regeneration

- Summary:
  - Better growth on PB sites
  - Stand density is reduced temporarily after a PB

Conclusions

- Compared to CLAAG and CC, Prescribed Burning seems to have an effect on:
  - Humus decomposition properties
  - Forest floor cover
  - Black spruce growth

Implications

- Natural disturbance based management applications:
  - Prescribed burning could be used to control paludification processes in potentially produtive stands.
  - Prescribed burning is able to emulate some of the effects of wild fires.

Acknowledgments

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