

Soil Nutrient and Organic Matter Responses to Fire, Harvesting, and Salvage logging in the Chisholm Fire



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Questions to be Addressed:

1. Which sites are more productive from a nutritional standpoint – harvested or burned?
2. What are factors responsible for differences in nutrient availability?

Objectives

1. To identify properties of forest floor, mineral soil, and foliar nutrition under different types of disturbances
2. To identify the role of saproxylic beetle and bryophyte communities in the turnover of nutrients

Four Studies

Forest floor, mineral soil, and foliage properties

Fine woody debris decomposition

Bryophytes and fine woody debris decomposition

Saproxylic beetles and coarse woody debris
decomposition

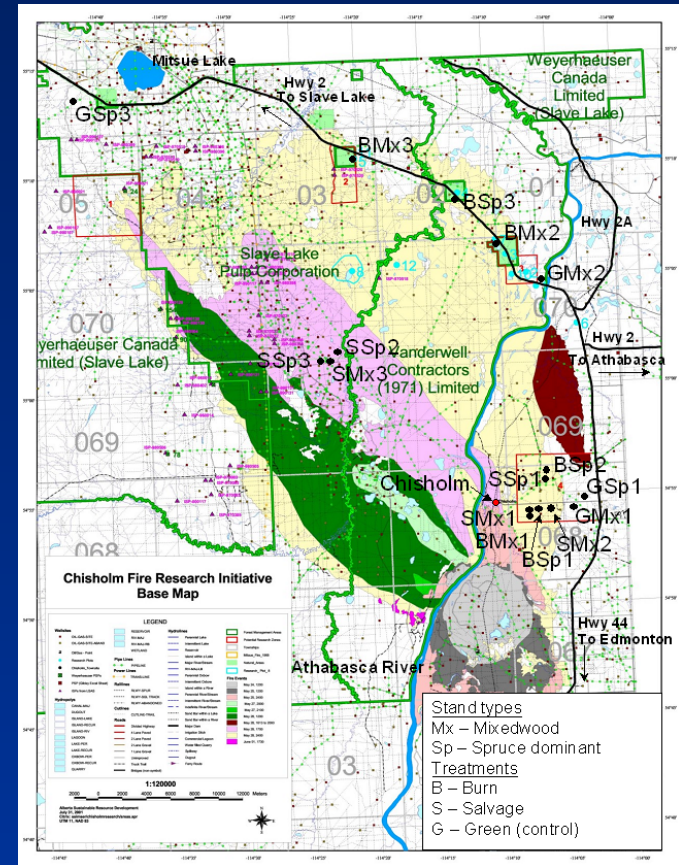
Research plots established in 2001 and 2002

Two stand types
Mixedwood
Spruce

Four treatments
Burned
Salvage logged
Harvested
Control

Three replicates

Total of 24 sites



Forest
Floor,
Mineral
Soil,
Foliage
Properties



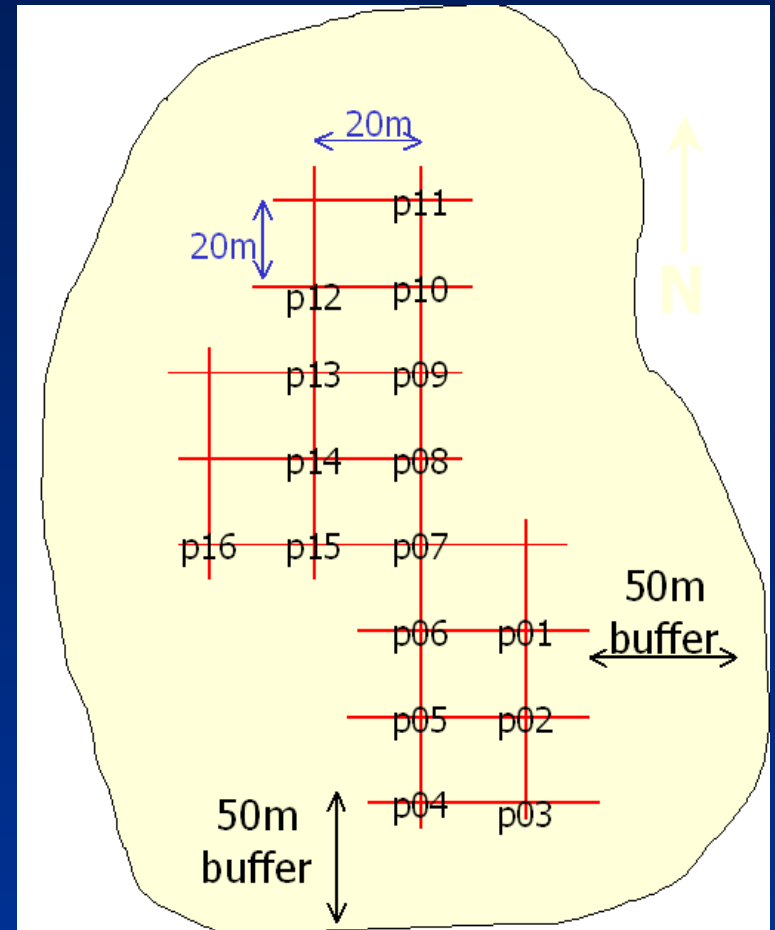
Photo: M. Blank, CFS

Forest Floor and Mineral Soils

At each of the 24 sites

Grid established

Forest floor and soil
sampled at each point



Physical and Chemical Analyses

Physical properties

Depth, mass, bulk density

Chemical properties

pH, total and extractable N (ammonium and nitrate), C, P, S, exchangeable cations (K, Ca, Mg, Na), cation exchange capacity

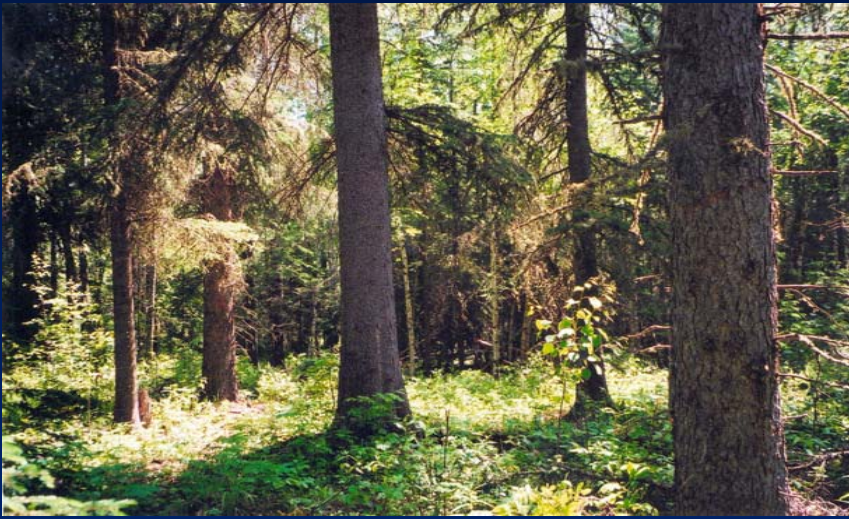
Statistical Analyses

Tested for normality and homogeneity

Analysis of variance

Separation of means using Tukey or Tukey
Kramer's test

Bonferroni correction



Control



Burned

Forest Floor Properties



Harvested site



Salvage logged



Photo: M. Blank, CFS

Forest Floor Properties

Physical properties of interest:

Depth, mass, bulk density

Chemical properties of interest:

Calcium, magnesium, carbon, pH, CEC

No consistent effects across disturbances

Mineral Soil Properties

Physical properties of interest:

Bulk density

Chemical properties of interest:

Calcium, magnesium, carbon, pH, CEC

No consistent effects across disturbances

Foliage

Regenerating aspen
foliage from mixedwood
stands

Leaves collected in 2003
Nutrient concentration
variable

No consistent effects



Fine Woody Debris

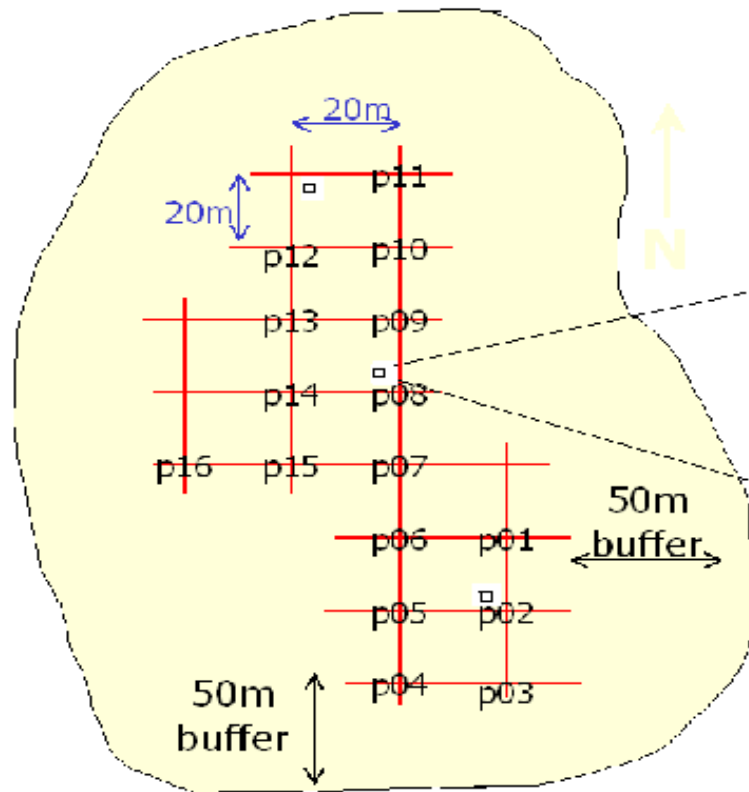
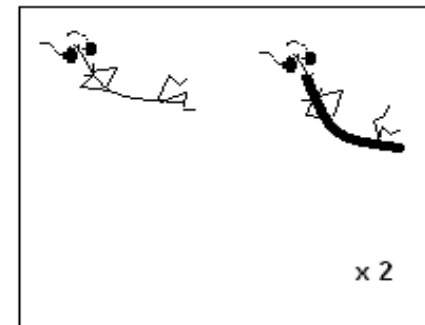


Experimental design:

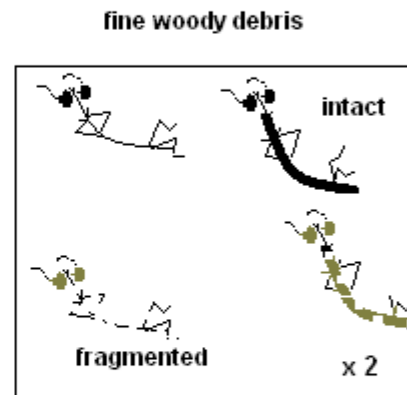
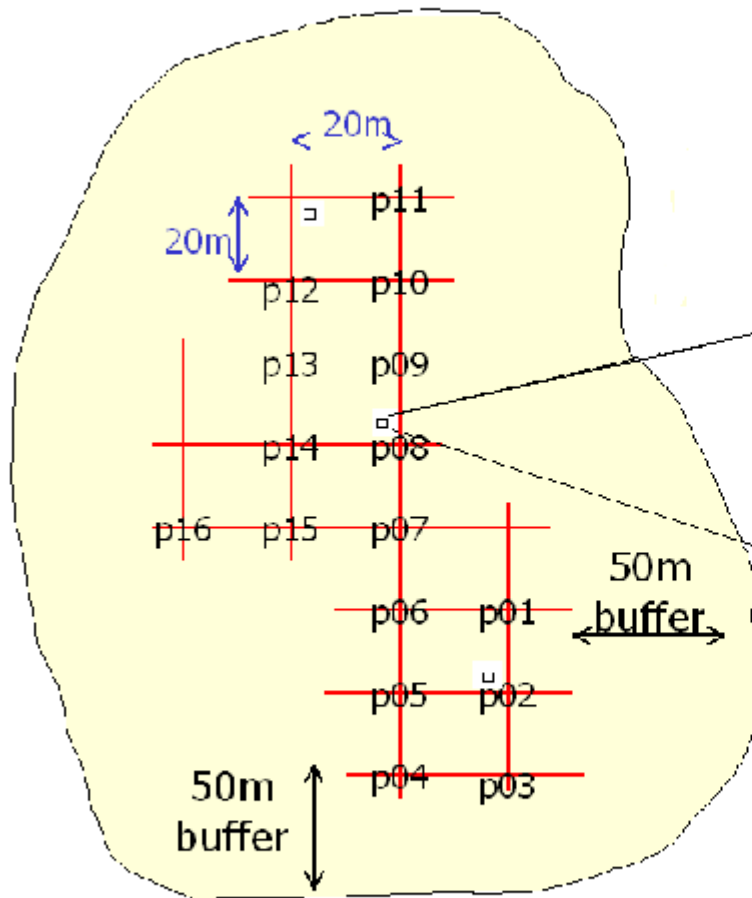
Same sites as the ones chosen for soils
(24 sites)

Undisturbed and Burned Treatments

fine woody debris



Harvested and Salvage logged Treatments



Chemical analyses

Similar to the ones shown previously but done on woody debris

Statistical analyses

Similar to the ones shown previously

Chemical properties of interest over years:

Intact woody debris

Carbon and available phosphorus decreased

Ammonium nitrogen increased

Fragmented woody debris

Carbon decreased

Intact vs fragmented woody debris:

Total nitrogen and exchangeable calcium lower in fragmented woody debris than in intact woody debris

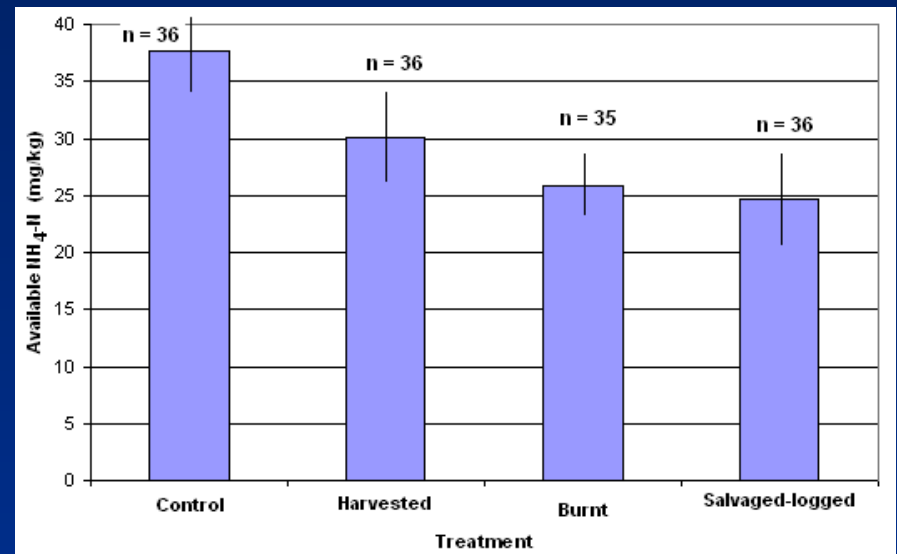
Ammonium nitrogen greatest in small, fragmented woody debris compared to large class size and intact debris

Chemical properties of interest among treatments:

Ammonium nitrogen ($P = 0.09$)

Control was higher than the three disturbance treatments

Presence of mosses on control plots



Bryophyte and Fine Woody Debris



Photo: M. Blank, CFS

On one burned site:

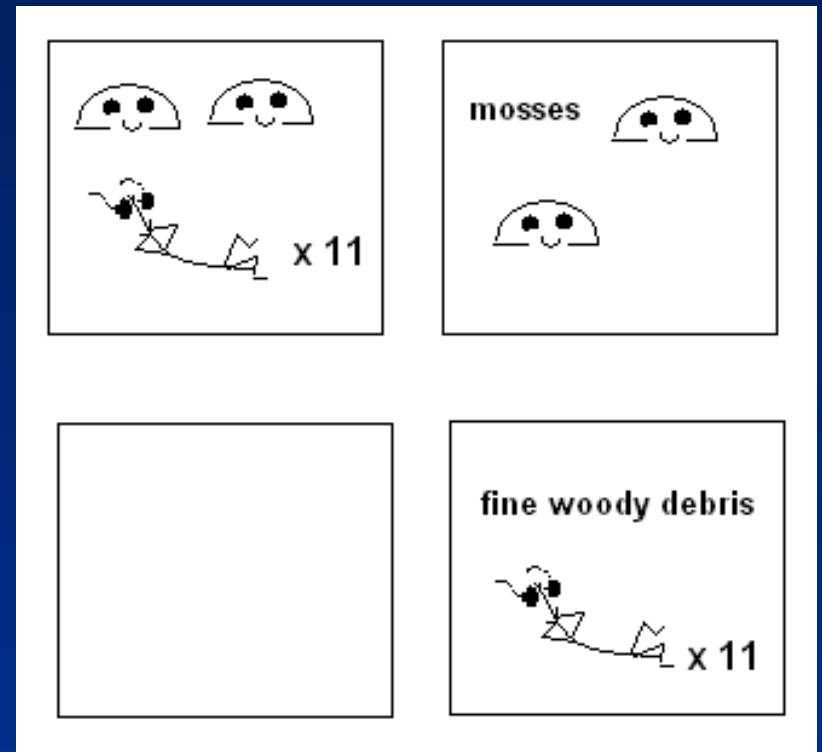
High moss/debris

Low moss/debris

High moss/no debris

Low moss/no debris

Three replicates



Chemical analyses

Similar to the ones shown previously but done on soil and woody debris

Statistical analyses

Similar to the ones shown previously

Chemical properties of interest over one year:

Fine woody debris

Carbon decreased

Exchangeable calcium increased

Soil

Exchangeable calcium increased

No moss effect as was speculated

Saproxylic Beetles and Woody Debris

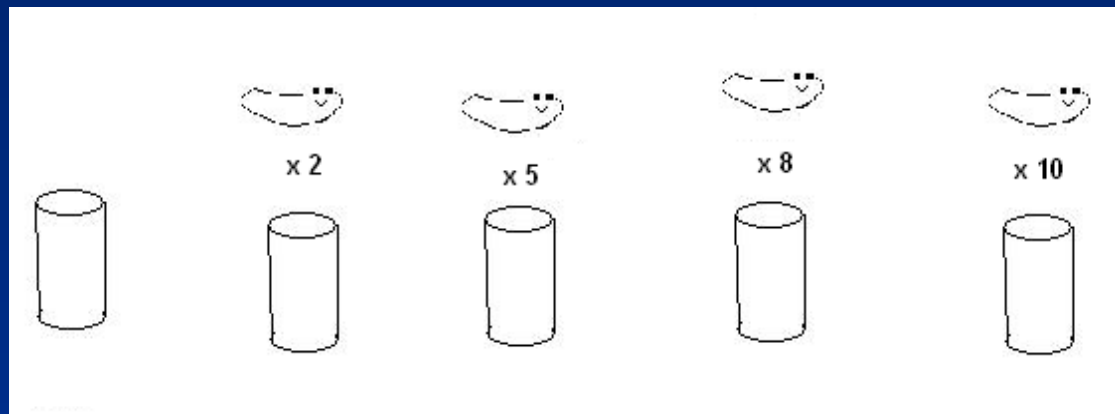


Photo: M. Blank, CFS

Logs inoculated with 0, 2, 5, 8 or 10 beetle larvae in enclosures

Four replicates

Control enclosures



Chemical analyses

Similar to the ones shown previously but done on soil

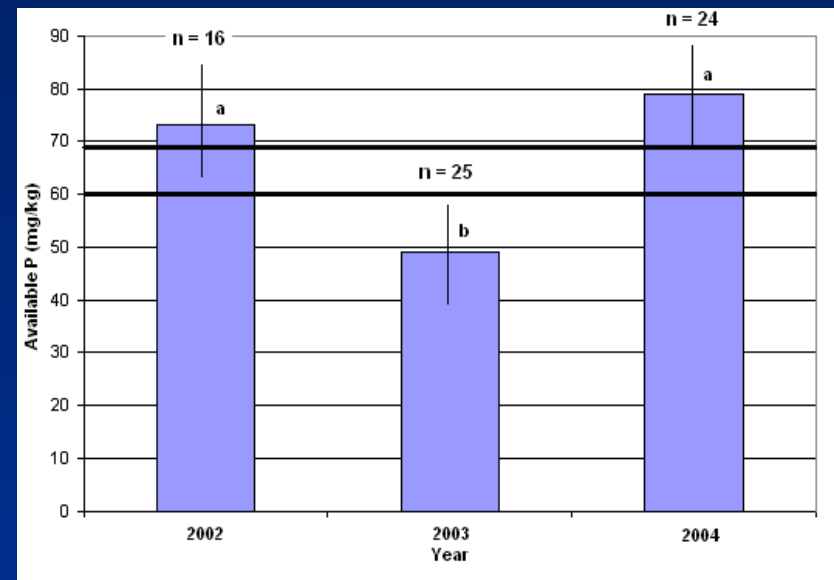
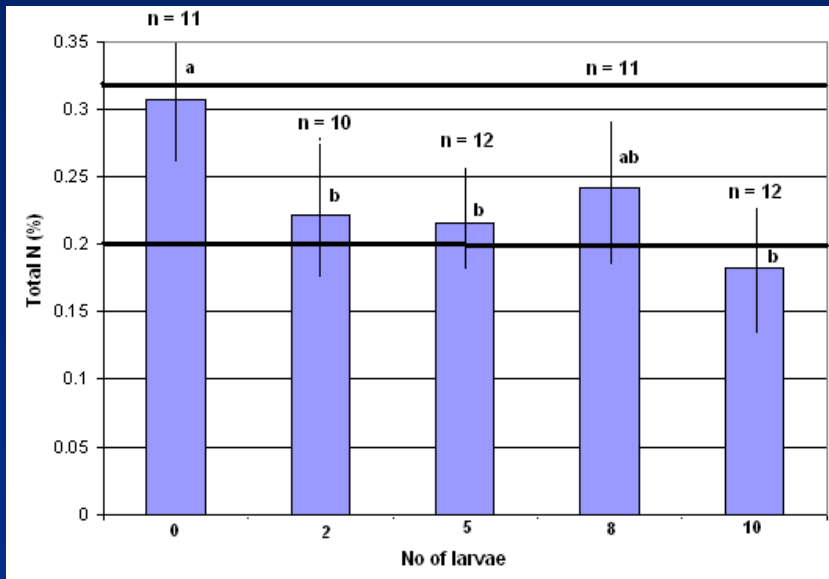
Statistical analyses

Similar to the ones shown previously

Chemical properties of interest :

Total nitrogen

Available phosphorus



Summary

- Effects of disturbances on soil properties were not consistent across wildfire, salvage-logged and harvest treatments
- Changes in chemical composition of woody debris reflected decomposition over time, and was somewhat faster in fragmented debris
- Disturbance types did not have major effects on decomposition of fine woody debris
- Mosses did not affect decomposition of woody debris in one year
- Beetle larvae affected soil nitrogen and available phosphorus

Conclusions

Unexplained variability

Further research required to identify other driving variables



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