Decaying wood as a natural seedbed for yellow birch regeneration in managed stands: morphological and ecological implications

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Introduction

There is a declining representativeness of yellow birch (YB) (*Betula alleghaniensis*), in managed forests under selection system. An increase of shade tolerant species, at the expense of midtolerants, is noted throughout the north-eastern hardwood forests[1]. Inadequate gap size[2], lack of suitable seedbeds[3] and high competition on scarified site[1] have been pointed as possible explanation.

Deadwood and mineral soil are reputed to be important seedbeds for YB establishment. Those seedbeds provide very different conditions that could affect the traits of seedlings. Our study provide a better understanding of the role played by fallen deadwood (at physiological and morphological level) in forest ecosytems. This aspect of deadwood has been relatively little studied.

Objectives & hypotheses

A) Is the deadwood an important seedbed for YB regeneration?

Decaying wood is an important seedbed for YB regeneration (in proportion)

Sub-hypothesis:

Establishment under canopy facilitated on deadwood
Specific level of deadwood is an important component

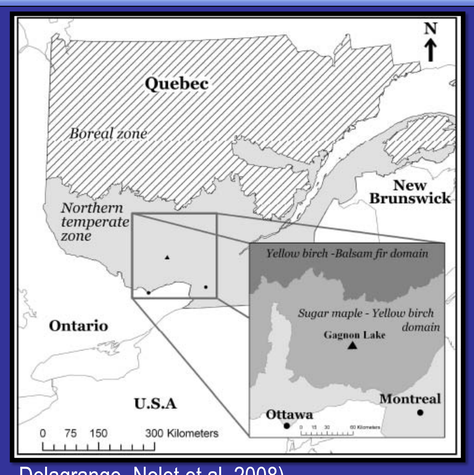
B) What are the effects of seedbed on morphological traits and growth?

There exists differences in growth, morphological and allocational traits between seedlings growing on deadwood vs mineral soil

Sub-hypothesis:

Growth vigour and survival will be improved (overall, better performance)

Methods



Delagrange, Nolet et al, 2008)

In sugar maple - YB domain

Outaouais in Réserve faunique de Papineau-Labelle

3 seedbed types: Deadwood, mossed deadwood, mineral soil

4 stands selectively cut

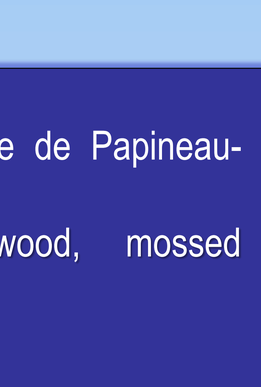
(± 30% of the initial basal area)
2 young (2002)
2 old (1994-95)

Phase 1- Survey of 1015 seedlings

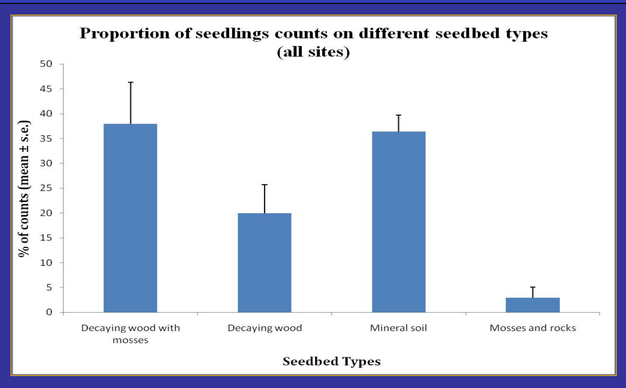
- ✓ Microsite and seedbed description (i.e. skid trail, mineral soil; trunk, deadwood)
- ✓ Light environment, height, diameter…
- ✓ Species identification of deadwood and decaying stage

Phase 2- Destructive sampling (270 individuals)

- ✓ Harvesting of above and belowground parts
- ✓ Volumetric water content, light, Prism



Results and discussion



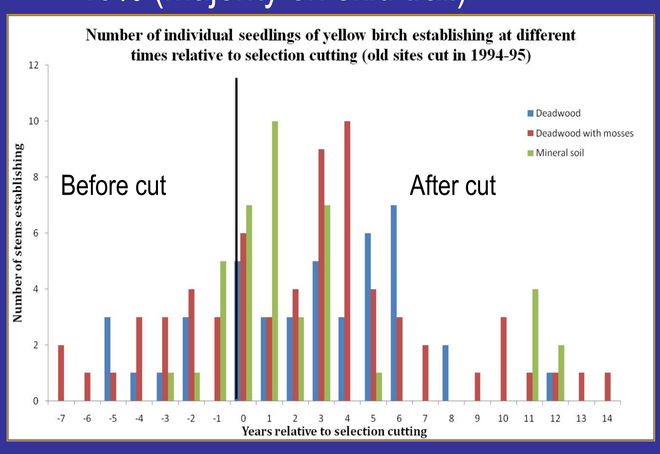
A) Descriptive results

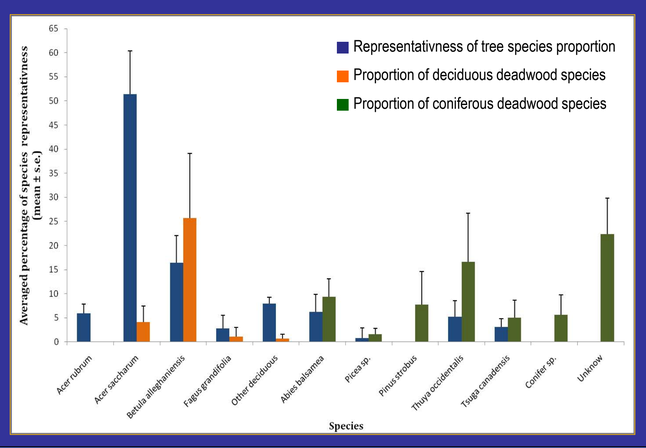
1- Where they grow?

- ✓ 60% of all seedlings were found on deadwood (stumps, trunks)
- ✓ Mineral soil accounts for nearly 40% (majority on skid trail)

2- When they got established?

- ✓ Stems already present before cut numerous on deadwood
- ✓ Establishment seems to be more continuous on deadwood
- ✓ Establishment on mineral soil is scarce 3 years after cut





3- Stand composition vs deadwood species

- ✓ YB deadwood seems to facilitate establishment of seedlings
- ✓ Overall, deadwood of conifers is important
- ✓ Deciduous deadwood, other than YB, has a poor ability to support YB seedlings

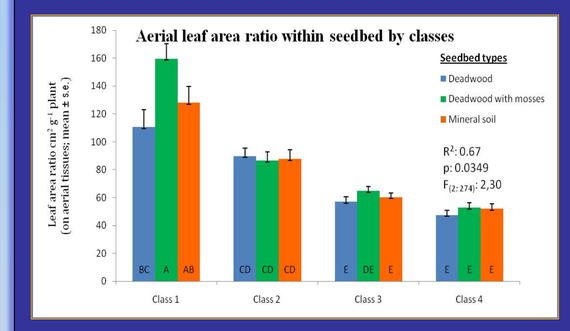
Results and discussion

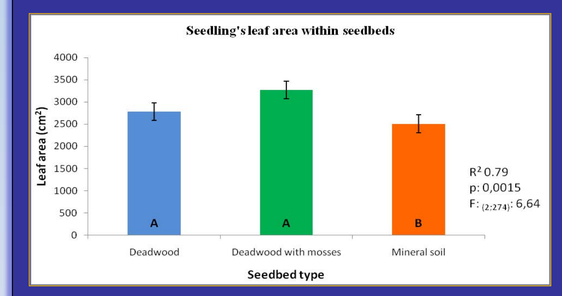
B) Ecophysiological aspects

Mixed model:

Light + **Site** + **Seedbed** + Site x Seedbed + **Class** + Site x Class + Seedbed x Class + Site x Seedbed x Class

Mixed model of ANCOVA (fixed and random factors)



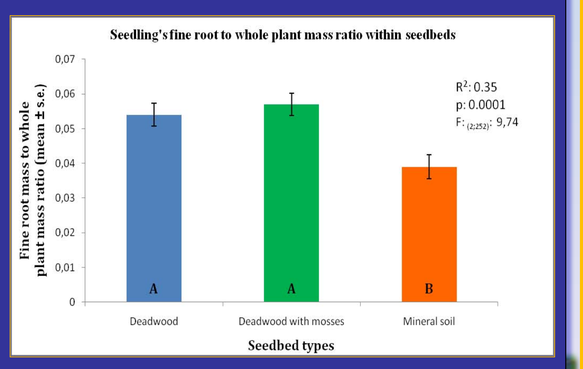


Aerial LAR = Leaf area/total aerial biomass

- ❖ Aerial LAR higher on deadwood with mosses, (class 1) = better efficiency
- ❖ Probably linked to water content of deadwood
- ❖ Higher potential of photosynthesis (gain vs loss)

FRMR = Fine root mass / total biomass

- ❖ Higher ressource acquisition (water) on deadwood
- ❖ May explain the higher aerial LAR in class1



Conclusion to take-away

Higher proportion of seedlings on deadwood

Species level of deadwood is important (YB and conifers)

The establishment of YB on deadwood should be considered as the natural way to get a seedling bank

Differences in morphology in smaller class (aerial LAR) = better efficiency

This higher efficiency could explain the particularly long YB survival on deadwood

Higher water content and reduced competition on deadwood could explain morphological diferences

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References:

1- Lorenzetti, F., S. Delagrange, D. Bouffard and P. Nolet. 2008. «Establishment, survivorship, and growth of yellow birch seedlings after site preparation treatments in large gaps». *Forest Ecol. Manag. vol. 254, no 2, p. 350-361.*

2- Webster, C. R., et N. R. Jensen. 2007. «A shift in the gap dynamics of *Betula alleghaniensis* in response to single-tree selection». *Can. J. of Forest Res. vol. 37, no 3, p. 682-689.*

3- Marx, L., et M. B. Walters. 2008. «Survival of tree seedlings on different species of decaying wood maintains tree distribution in Michigan hemlock-hardwood forests». *J. Ecol. vol. 96, no 3, p. 505-513.*