

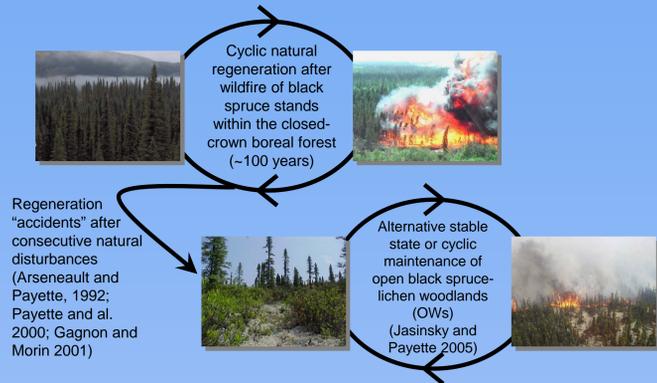
How the growth of planted black spruce and jack pine seedlings contribute to the carbon sequestration of site prepared open woodlands in Québec's boreal forest



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Rationale



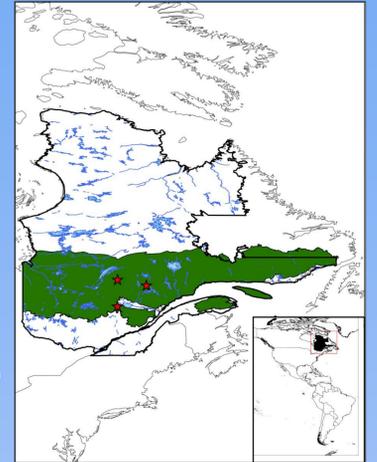
Previous results (Hébert et al. 2006) on the afforestation of OWs showed that three years after establishment, disk scarification increases growth and survival of young planted seedlings, but values of total height were 18% higher in black spruce-feathermoss stands (BSFM) than in OWs.

Questions

- Is the difference in growth between the afforested open woodlands (OWs) and BSFM stands may fade out within 10 years?
- Is the site index (SI) at 10 years in planted OWs corresponds to the SI (1.43 m) used in the estimated sequestration rate of afforested OWs in Gaboury et al. (2009)?
- What is the contribution of the planted trees to the total carbon stocks in 10 year-old afforested OWs?

The study

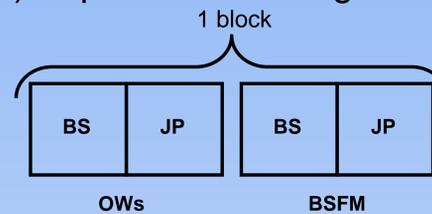
- This study aimed at testing the hypothesis that the lower growth observed in three year-old planted seedlings in OWs (Hébert et al. 2006) will recede after ten years of growth.
- Seven experimental blocks distributed among three sites in the central part of Québec's closed-crown boreal forest (red stars) were used for this study.



1) Silvicultural approaches

- Careful logging (BSFM stands only)
- Disk scarification (both OWs and BSFM stands)
- Plantation of containerized seedlings (2 species : Jack Pine (JP) and Black Spruce (BS))

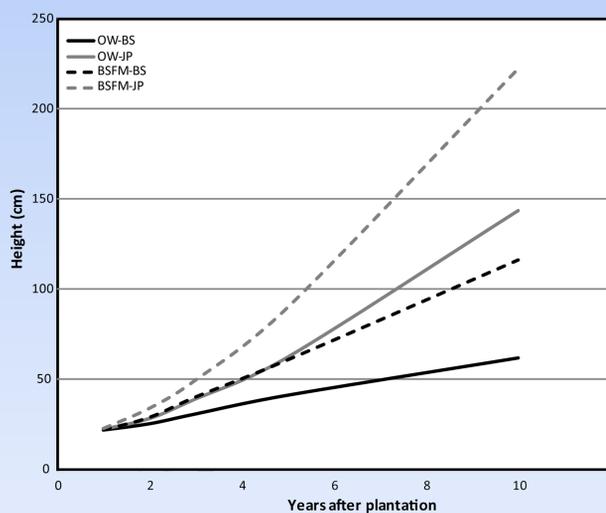
2) Experimental design



- 7 Blocks
- Full factorial design
- Multi factorial ANOVAs

Results

1) Growth curves of planted trees



10 years after plantation, there is still a difference in tree height between OWs and BSFM stands: trees in BSFM stands were X% higher than trees in OWs for both species after 10 years.

However, JP trees height in OWs was similar to BS trees height in BSFM.

2) Planted trees height and biomass (8 to 10 years after plantation)

Total height and biomass were measured on 4 dominant trees in each plot.

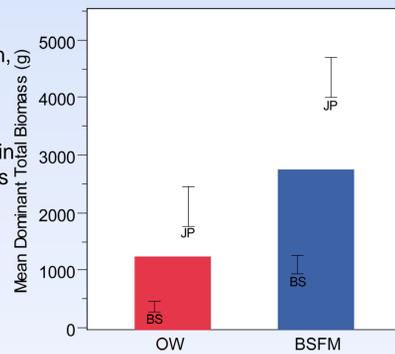
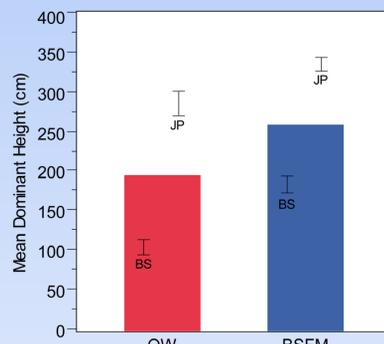
Planted trees were significantly higher in BSFM (65%) than in OWs independently of species.

JP trees were higher than BS trees in both stand types.

Dry biomass includes 5 compartments : root, stem, branch, leaf and cone.

10 years after plantation, total biomass was higher in BSFM stands than in OWs independently of planted species.

JP trees accumulated more biomass than BS trees over the same period.

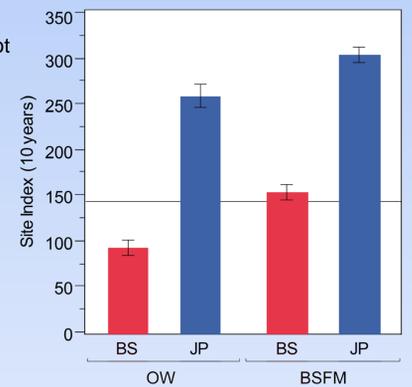


3) Sites index (at 10 years)

Height at 10 years of four dominant trees in each plot was measured to determine site index.

The SI_{10yr} of JP trees was significantly higher than that of BS trees in both stand types.

BS trees didn't reach the SI used in the afforested OWs simulations of Gaboury et al. (2009) (the grey line at 1,43 m, corresponding to 175 m³ ha⁻¹ at 70 years)

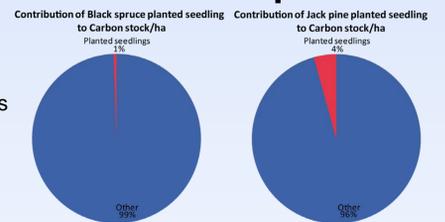


4) Contribution to carbon sequestration

After 10 years, JP trees appear a better alternative than BS trees with regards to their contribution to the total carbon stocks of afforested OWs :

→ JP : 1.15 t C ha⁻¹

→ BS : 0,195 t C ha⁻¹



Conclusion

After 10 years, the growth of planted trees is lower in afforested open woodlands (OWs) than in adjacent and comparable managed black-spruce feathermoss (BSFM) stands, independently of planted species. However, total height and biomass are substantially higher for jack pine (JP) than black spruce (BS) trees in both stand types. In an afforestation strategy of boreal OWs, JP might represent a better alternative than BS, since their contribution to the total carbon stocks in afforested OWs is approximately four-fold that of BS 10 years after plantation.

References

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