How the natural regeneration of black spruce (*Picea mariana* (Mill.) B.S.P.) can contribute to carbon sequestration in site-prepared boreal open woodlands

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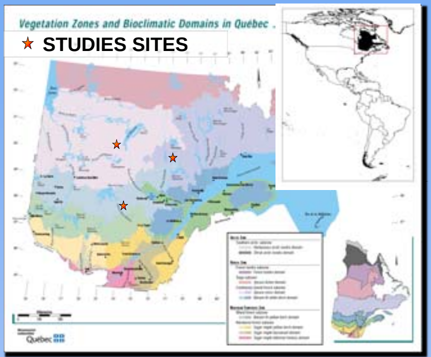
carbone boréal

CONTEXT

The spruce-moss forest bioclimatic domain of Canada's eastern boreal zone includes patches of open woodlands (OWs). These open areas are often represented by black spruce-lichen woodlands and are created naturally following natural disturbances (Gagnon and Morin 2001). No known natural mechanism of redensification of OWs has been observed so far (Jasinski et Payette 05). On the other hand, natural seeding is a potential viable mode of regeneration in response to proper site preparation treatments Tremblay 2009, Madec 2005). The afforestation of OWs by means of natural seeding offers GHG offset opportunities by creating new carbon sinks at lower costs than planting (Gaboury 2009).

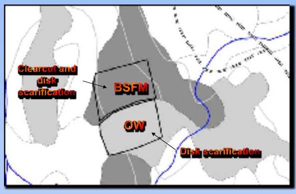


OBJECTIVES

Objectives of this project are to compare growth and yield of natural regeneration, in terms of height, diameter, age and biomass, in OWs and BSFM stands and to assess the contribution of natural egeneration in OWs afforestation efforts

EXPERIMENTAL DESIGN

A seven block-experimental design was established in 1999 within the spruce-moss forest, including two types of stand (OW and BSFM) to which were applied distinct silvicultural treatments (clearcut and disk scarification in BSFM stands, disk scarification in OWs)



- The dominant natural seedlings in OWs were 23% smaller than dominant seedlings in BSFM stands, in terms of height (Fig. 4)

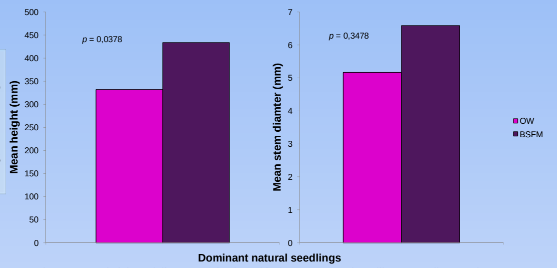


Figure 4. Stem height and diameter of dominant black spruce natural seedlings according stand types, 10 years after soil scarification

RESULTS

- The distribution of the year of germination of natural seedlings shows a different pattern between OWs and BSFM adjacent stands, with a more prolonged germination period in OWs than that in BSFM stands (Fig. 1)

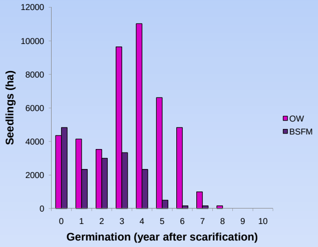


Figure 1. Distribution of the year of germination of black spruce natural seedlings according to stand types

- The stand carbon stocks in natural seedlings were similar in OWs and BSFM stands, 10 years after soil scarification (Fig. 5). The contribution of natural seedlings to the carbon stocks in the total tree regeneration (natural + planted seedlings) was 12% after 10 years in afforested OWs.

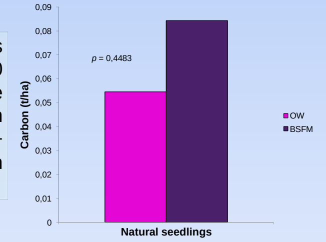


Figure 5. Stand carbon stocks in black spruce natural seedlings according to stand types, 10 years after soil scarification

- The difference in growth between natural seedlings in OWs and BSFM seem to fade slightly in recent years of growth, but seedlings in OWs were still 26 % smaller than seedlings in BSFM stands after 10 years (Fig. 2)

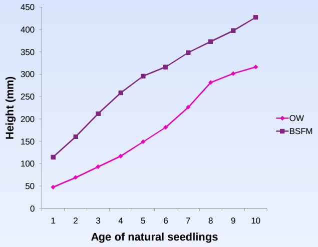


Figure 2. Height of natural black spruce natural seedlings according to age and stand types

- Growing conditions seem to improve over time in scarified beds of BSFM stands only (Fig. 3), though the number of germinated seedlings 5 years after scarification was very small (see Fig. 1)

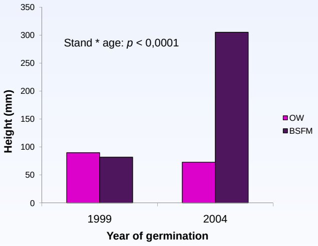


Figure 3. Height of 5 year-old natural seedlings according to the year of germination and stand types (N.B. 1999 and 2004 = 1 year and 5 years after soil scarification, respectively)

MAIN CONCLUSIONS

- The soil scarification in open woodlands (OWs) of the boreal forest produces a sustained (up to 8 years after soil scarification) and abundant regeneration of black spruce seedlings from natural seeding.
- The high number of natural seedlings compensate for their relatively modest growth rate, with regards to the accumulated carbon stocks 10 years after afforestation of OWs.
- The results suggest that the natural seeding in OWs, following soil scarification, can contribute significantly to the carbon accretion of afforested OWs in the boreal forest.

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