UNDERSTANDING, DETECTING AND CONTROLLING PALUDIFICATION FOR AN ENHANCED PRODUCTIVITY OF POORLY DRAINED BLACK SPRUCE SITES
Contract # 2006/ 07:11

Keywords: paludification; black spruce; organic matter; peatland; growth; nutrient status; mosses; harvest techniques; site preparation; prescribed burns

Start Date: 31th day of May, 2006

End Date: 31th day of May, 2008

Project Objectives: To determine the actual growth rates of black spruce on sites that were harvested using past techniques (clear cut with and without prescribed burn) and current techniques (CLAAG in Ontario, CPRS in Québec).

To determine which harvest method and site preparation treatment results in the best regeneration establishment, highest growth rates, and foliar nutrition on paludified black spruce sites on the Clay Belt of Ontario and Québec

To determine which harvest method and site preparation treatment is the most effective at reducing paludification (peatland *Sphagnum* spp. cover, organic layer thickness, poor decomposition)

Description:

Methodology:

The first priority this season was to identify appropriate paludified sites in Québec and Ontario.

In Québec, with the help of Louis Dumas of Tembec (LaSarre) 30 sites were identified, which had received the following treatment in the past: summer clear cut (10), winter clear cut (10) and CPRS (10). Fifteen of these sites were sampled in 2006, 2 CPRS, 4 summer clear cut, 9 winter clear cut.

In Ontario, sites that had been harvested with the different methods under study were selected after discussions with Jeff Leach of Tembec (Kapuskasing), Rod Gemmel of Abitibi-Consolidated (Iroquois Falls) and George Graham of Hearst Forest Management Cooperative. Three classes of sites were identified, i.e. sites harvested (1) pre-1986 when narrow tired skidders were employed, (2) CLAAG sites from the early 1990s and (3) prescribed burns. The first two groups were primarily identified via the OMNR GIS database and ground truthed by a field crew. Once ground truthed the sylviculture records for the site were consulted (courtesy of Tembec and Abitibi-Consolidated). Four CLAAG sites will be taken from the sites identified by Art Groot (CFS) for a project in collaboration with Abitibi-Consolidated Iroquois Falls. Five prescribed burn sites had been largely identified by Kim Taylor in 2005. Additional prescribed burns were identified from existing burn reports and consultations with foresters working in the area during the period that the burns were carried out. These too were ground truthed by a field crew. In total over 30 sites were visited. At each site found to be at least initially acceptable the landscape characteristics were determined, i.e. that the site was not in a depression, that there was not too steep of a slope, and that the hydrology had not been disrupted by road construction. In addition, soil texture, and depth and character of the organic matter were assessed, surface vegetation was characterized (to confirm paludification), and height of the trees was measured. Five of these sites were sampled in 2006.

The sampling protocol used in both Québec and Ontario established 3 plots with a radius of 11,28m (400m^2). When each plots the height and diameter of all trees were measured as was their growth over the last three years. Stumps were counted. Three trees (large, medium, small) were randomly selected for stem analysis (cookies taken at several heights). A soil profile was dug at the base of each selected tree in which the water table position was determined and the von Post and depth of each layer was determined. A sample of the humus and mineral soil were taken for nutrient analyses.

Four sub-plots (diameter 1,13m, 4m^2) were installed and the cover of understory species (including mosses) were evaluated within each.

Progress on deliverables:

(1) Data collection and initial analyses : complete
(2) Foliar nutritional analyses: this deliverable was not possible to complete this year as the possibility to visit the sites when the needles needed to be taken was not possible.
(3) Growth curves of black spruce: complete

These are preliminary results (Figure 1 following page), based on an uneven number of sites per treatment, but they do suggest that there is a difference in the growth rate of black spruce among the different treatment types, particularly for the large and medium sized trees. The lower height in later years for the “clear cut summer” curve reflects the smaller number of trees of that age. This phenomena is constant, and the curves are most reliable in the early years.

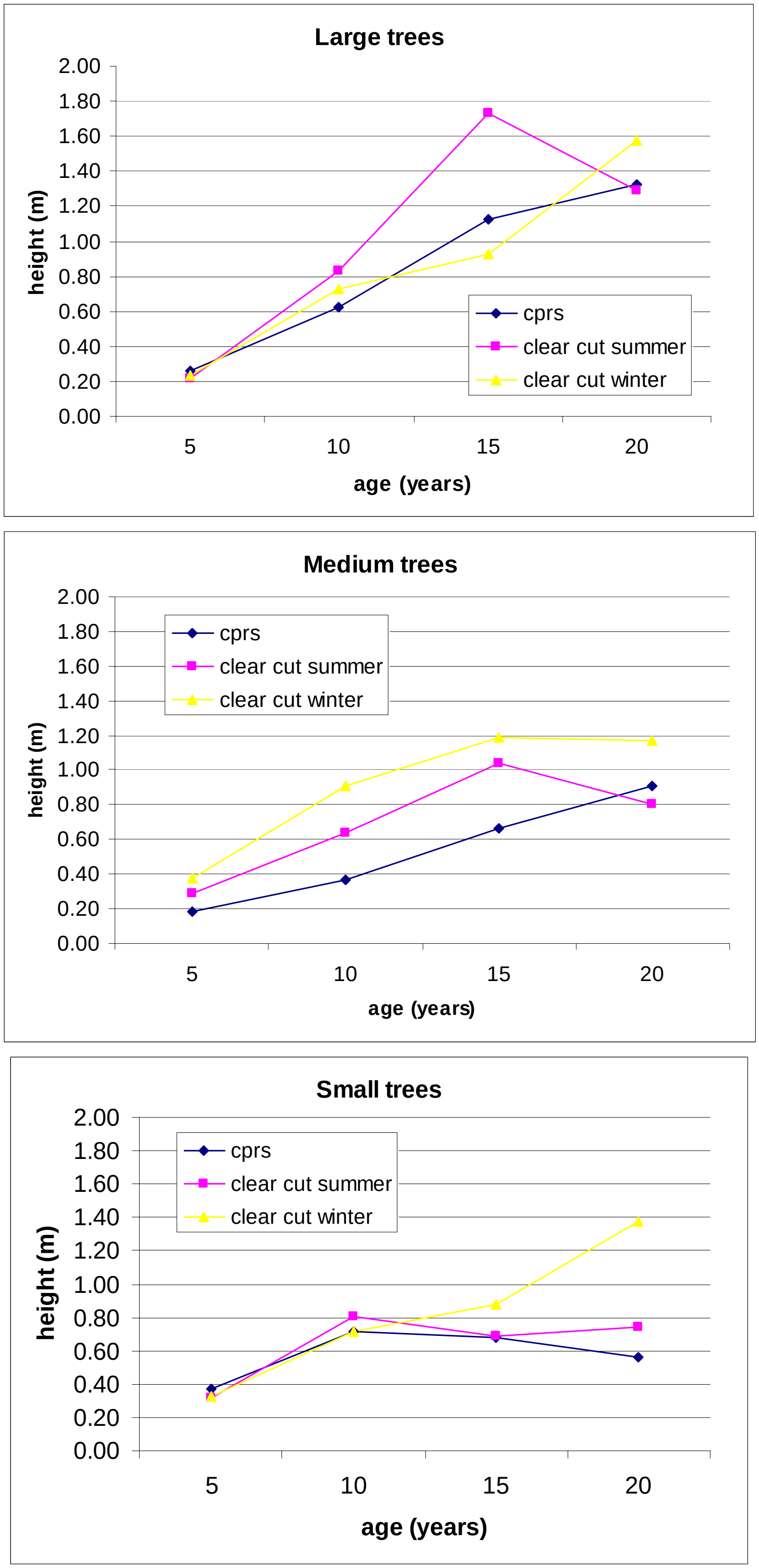

Figure 1 : Growth curves for large, medium and small trees from cprs, clear cut summer and clear cut winter sites.

(4) Paludification variables:

Water table position varied among treatments, and among tree sizes. The variation in water table position for the three tree sizes in the CPR suggests that the large trees might be on the most favorable sites. Overall, water table was deeper in the summer clear cut.

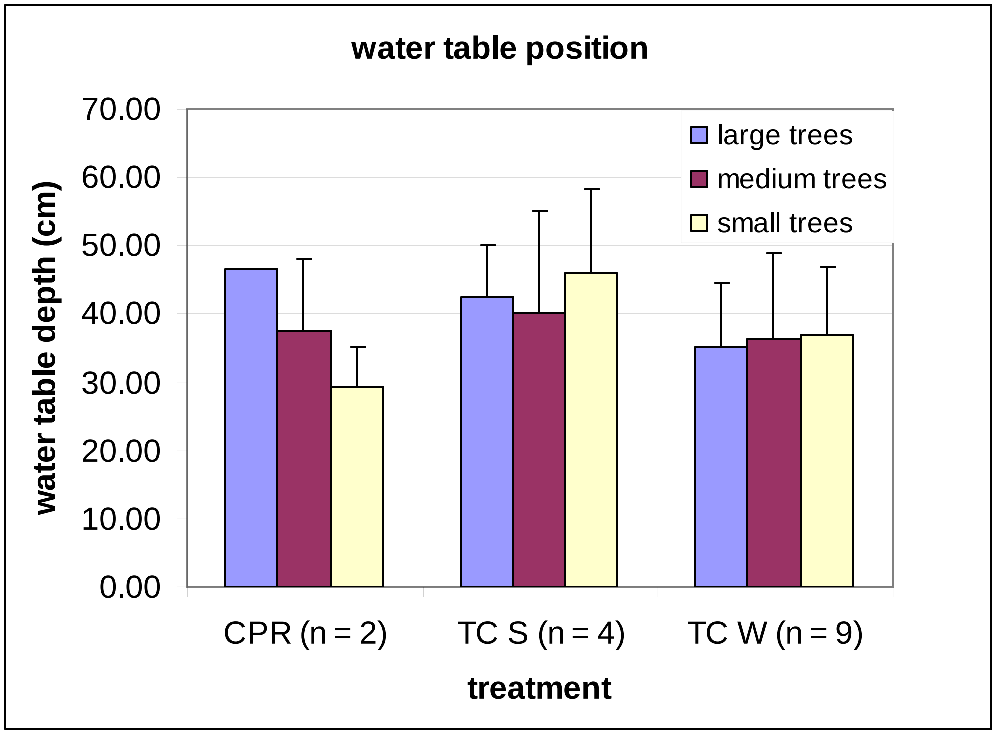

Figure 2: Water table position (depth) among treatment types and tree sizes. TC S = Total cut summer; TC W = total cut winter. Values are means ± standard deviation.

Organic matter thickness: The thickness of the three layers of the organic matter (fibric, mesic and humic) varied among the treatments and tree sizes (Figure 3 following page). The key difference is that the summer clear cut sites had a thicker humic layer than the other two treatment types. This may be important as the humic layer is better decomposed, and thus provides an environment with more available nutrients, than the fibric and mesic layers.

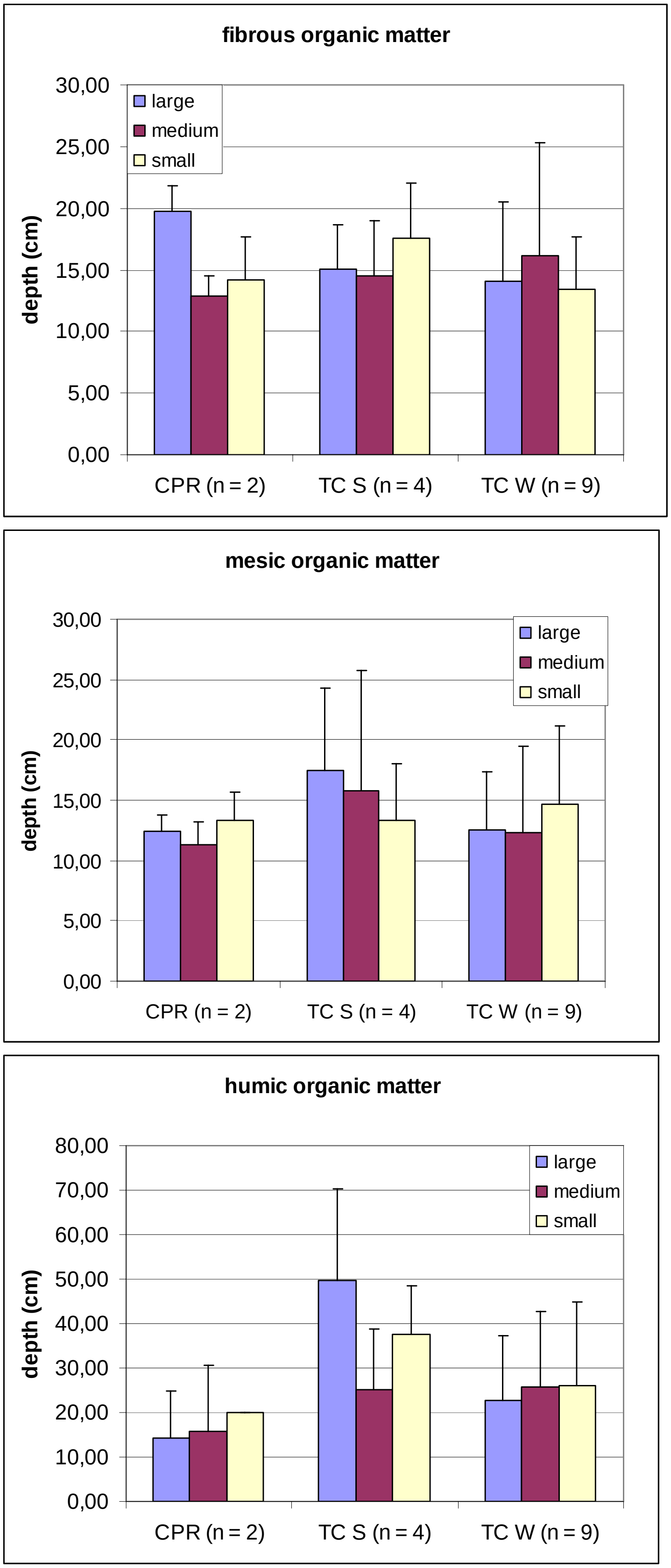

Figure 3: Thickness of organic matter layers for the three tree sizes.

Understory composition: The composition of the understory varied among the three treatments, with differences in cover in the ericaceous shrubs and alder and willow species. The two clear cut treatments showed a reduced cover of the ericaceous species compared to the CPRS (Figure 4). However, the cover of shrubs (alder and willow) were considerably higher in the clear cut treatments compared to the CPRS (Figure 5).

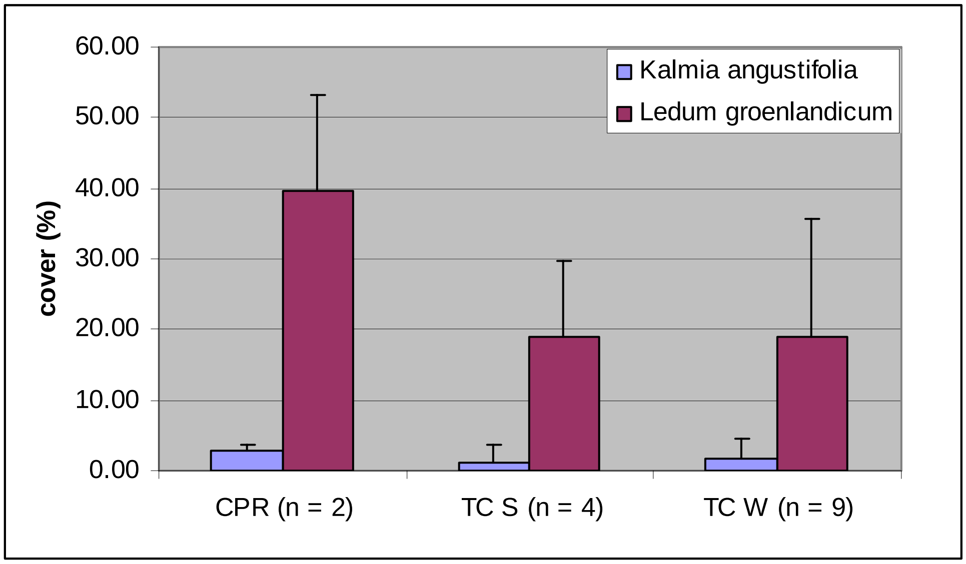

Figure 4: Percent cover of two ericaceous species in the three treatment types. Values are means ± standard deviation.

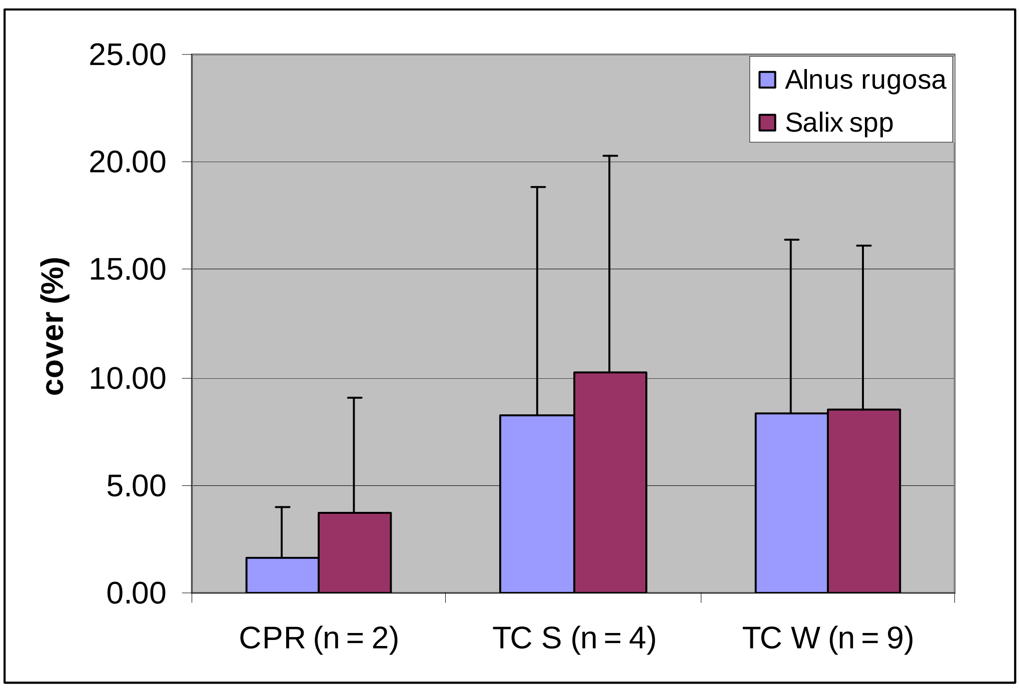

Figure 5: Percent cover of alder (aulnus) and willow (salix) species in three treatment types. Values are means and standard deviations.

(5) Regeneration: Stocking (regeneration density) was not included in the final sampling design, as many of the sites had been planted or thinned.

Conclusion: Although preliminary, the results from the field season of 2006 seem to indicate differences in growth rates among the different treatment types, particularly for a faster growth rate in the two clear cut treatments for the larger trees on the sites. This difference may be explained by the lower water table in the clear cut treatments, and thicker humic and mesic layers in the organic profile. Clear cut treatments also reduced the cover of ericaceous species, believed to be competitors with black spruce. However the increase in shrub cover in the clear cut treatments may indicate that a different type of competition takes place in these sites. Further site sampling in summer 2007, including foliar nutrient status, and subsequent analyses will clarify these trends.

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Partners: Tembec (Québec and Ontario); Canadian Forest Service; OMNR (Inventory Monitoring and Assessment Division; Forest Fire Management Section)

Clients: Forest managers in both industry and government

Users: Forest managers in both industry and government

Deliverables:

	Completed
Data collection and initial analyses	September 31st , 2006
Preliminary (based on 1 year's field data) growth curves of black spruce after specific forest treatments on the Clay Belt	March 7 , 2007
Preliminary (based on 1 year's field data) quantitative evaluation of three different forest harvest and associated site preparation techniques on paludification variables (e.g. organic layer thickness, water table position, understory composition)	March 7 , 2007
Folia nutrition analyses	Incomplete
Preliminary (based on 1 year's field data) an assessment of the black spruce regeneration after past and present forest harvest techniques and associated site preparation	Incomplete

techniques in comparison to expected values.	

Acceptance: The results should allow forestry companies operating in the area to determine what treatment types result in the best growth of trees on deep organic sites. Accurate growth curves will permit a more accurate estimate of annual allowable cut by government managers.

Awareness: This project addresses a pressing need on the Clay Belt and the participation of the Model Forest will increase the awareness of forest managers of the work undertaken under its banner, and it's utility. The project will provide insight on harvest and management of deep organic sites, an integral part of the Lake Abitibi Model Forest Landscape.

Decisions: As deep organic sites (paludified sites) do not respond to harvest in the same manner upland sites, specific guidelines are needed for deep organic sites in order to be able to manage them sustainably. This project will provide baseline information on how sites respond to different forest techniques, and will also provide suggestions on which technique will best guarantee long term sustainability.

Knowledge: This project will provide baseline information on how sites respond to different forest techniques, and will also provide suggestions on which technique will best guarantee long term sustainability.

Measurement – How: completed deliverables, i.e. databases compiled

Measurement – Who: participation and satisfaction of industry partners

Measurement – What: completed deliverables

Measurement – Why: interest and participation of forest users

Goals and Objectives: This project fits within the first objective of the model forest, to develop knowledge that will lead to the application of sustainable forest management. The growth curves for black spruce on deep organic sites within the model forest will permit the development of sustainable harvest levels that are specific to our area. Furthermore the study will be able to suggest a harvest technique that results in the best conditions for regeneration.

Budget: Provide a breakdown of the actual expenses using the following headings:
The following totals do not include in-kind contributions from UQAT, CFS, Tembec, LAMF.

1. Personnel: 58,224.65$
2. Materials & Supplies: 200$
3. Equipment: 117$
4. Travel: 9,132.71
5. Other: -NA