From Forest Nursery Notes, Summer 2008

76. © Effects of overstory retention and site preparation on growth of planted white spruce seedlings in deciduous and coniferous dominated boreal plains mixedwoods. Gradowski, T., Sidders, D., Keddy, T., Lieffers, V. J., and Landhausser, S. M. Forest Ecology and Management 255:3744-3749. 2008.

Forest Ecology and Management 255 (2008) 3744–3749

Contents lists available at ScienceDirect

Forest Ecology and Management

journal homepage: www.elsevier.com/locate/foreco

Effects of overstory retention and site preparation on growth of planted white spruce seedlings in deciduous and coniferous dominated boreal plains mixedwoods

Tomasz Gradowski [a], Derek Sidders [b], Tim Keddy [b], Victor J. Lieffers [a], Simon M. Landhäusser [a,*]

[a] Centre for Enhanced Forest Management, Department of Renewable Resource, University of Alberta, Edmonton, AB, Canada T6G 2H1
[b] Canadian Forest Service, Canadian Wood Fibre Centre, 5320 - 122 Street, Edmonton, AB, Canada T6H 3S5

ARTICLE INFO

Article history:
Received 24 September 2007
Received in revised form 5 March 2008
Accepted 6 March 2008

Keywords:
Aspen
Populus tremuloides
Picea glauca
Regeneration
Competition
Partial harvest
Boreal forest
Alberta
EMEND

ABSTRACT

Survival and growth of planted white spruce was assessed under partial harvest treatments and different site preparation techniques in mixedwood forests of two compositions prior to logging: deciduous dominated (d-dom) – primarily comprised of mature trembling aspen (*Populus tremuloides* Michx.) and coniferous dominated (c-dom) – primarily comprised of mature white spruce (*Picea glauca* (Moench) Voss). Levels of overstory retention were 0% (clearcut), 50% and 75% of original basal area, and site preparation techniques were inverted mounding, high speed mixing, scalping and control (no treatment). The survival and growth of white spruce were assessed seven years after planting. The experiment was established as a part of the Ecosystem Management Emulating Natural Disturbance (EMEND) experiment located in northern Alberta, Canada. In the c-dom, the 50% and 75% retention of overstory resulted in reduced growth and survival of white spruce seedlings compared to clearcuts. In contrast, in the d-dom, the seedlings performed best in sites that had 50% of the overstory retained. For the c-dom, the mounding and mixing treatments yielded the best growth of spruce seedlings, while scalping yielded the worst. In the d-dom, spruce growth was highest in sites with the mixing treatment. In the d-dom, growth and survival of the planted spruce was greater than in the c-dom. The natural regeneration of deciduous trees was suppressed by the retention of canopy regardless of original composition.

1. Introduction

Retention of overstory trees (e.g. shelterwood and partial-cut systems) has long been used as part of "ecosystem management" designed to increase biodiversity of post harvest habitat and to accelerate the recovery of habitat for late seral species through conservation of their propagule sources, maintenance of multi-layered canopy, promotion of understory variability, and provision of snags and coarse woody debris (North et al., 1996). Overstory retention also provides conditions that are conducive to the regeneration of shade tolerant tree seedlings. Conditions such as decreased exposure and reduced evaporative demands are thought to be the main drivers for improved seedling establishment and performance (Groot and Carlson, 1996). In contrast, too much retention of overstory trees might be negative for seedling growth as overstory canopy may slow warming of soil in the spring or reduce photosynthetic rates because of light limitation (Awada and Redmann, 2000; Landhäusser and Lieffers, 2001; Chen et al., 2004). While there have been several studies in Europe that have examined growth of *Picea abies* (L.) Karst. under different densities of residual canopy (e.g. Holgén and Hånell, 2000; Granhus et al., 2003), studies of the effect of different canopy types and densities to provide shelter for planted white spruce (*Picea glauca* (Moench) Voss) seedlings are rare for North American forests (Groot and Carlson, 1996; Man and Lieffers, 1999).

Canopy composition is known to affect understory conditions. Coniferous canopies such as white spruce provide shade all year, while deciduous canopies such as trembling aspen (*Populus tremuloides* Michx.) provide periods of high light transmission during the leaf-off periods in spring and fall (Constabel and Lieffers, 1996). White spruce also has much longer crowns and nearly five times the leaf area density of foliage compared to aspen growing on the same sites, resulting in much higher interception of light and precipitation (Stadt and Lieffers, 2000). We therefore, hypothesize that shelter provided by aspen trees will be much more benign to the growth of regenerating spruce seedlings than shelter from spruce trees.

* Corresponding author at: Centre for Enhanced Forest Management, Department of Renewable Resources, Earth Sciences Building, Edmonton, Alberta, Canada T6G 2E3. Tel.: +1 780 492 6381; fax: +1 780 492 1767.
E-mail address: Simon.Landhausser@ualberta.ca (S.M. Landhäusser).

0378-1127/$ – see front matter © 2008 Elsevier B.V. All rights reserved.
doi:10.1016/j.foreco.2008.03.008