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Growth of white spruce underplanted beneath spaced and unspaced aspen stands in northeastern B.C.—10 year results

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ABSTRACT

Establishing white spruce (*Picea glauca* (Moench) Voss) by planting it under established aspen (*Populus tremuloides* Michx.), stands has substantial potential as a technique for regenerating boreal mixedwood stands. The presence of an aspen overstory serves to ameliorate frost and winter injury problems and suppresses understory vegetation that may compete with white spruce. In this study we examine the growth of white spruce during the first 10 years after being planted underneath a 39 year-old stand of trembling aspen following thinning and fertilization. Results indicate successful establishment and reasonable growth rates of white spruce planted under thinned and unthinned aspen stands, even with aspen basal area of 51 m^2 ha^{-1}. Thinning of overstory aspen to 1000 or 2000 stems ha^{-1} did not increase light reaching seedlings, but did result in improvements in light above the shrub layer and in diameter and height growth of the underplanted seedlings. However, these increases in growth of underplanted spruce may not justify the expense of thinnings. Fertilization of these stands prior to planting had no effect on spruce growth. Growth of spruce underplanted at this site near Fort Nelson was similar to that at two other stands near Dawson Creek, B.C.

Information on treatment effects on light, beam fraction, air temperature, and soil temperature are presented. Measurements of light obtained using LAI-2000 and hemispherical photography were compared with those obtained from hourly PPFD measurements. Results indicate that while both methods provide estimates of transmittance that are highly correlated with those provided by actual light measurements, they provide substantial underestimates of actual light levels.

1. Introduction

Establishing white spruce (*Picea glauca* (Moench) Voss) under aspen (*Populus tremuloides* Michx.), 20–40 years before the harvest of the aspen is a highly cost-effective scenario for boreal mixedwood management (Comeau et al., 2005). When white spruce is established prior to harvesting, this advance regeneration can be protected during harvesting and can provide effective regeneration of the spruce component of the stand (Lieffers et al., 1996; Ruel et al., 2000; Greene et al., 2002). This relay of growth periods and harvest of the two species creates the most productive type of spruce aspen mixture (Man and Lieffers, 1999) and closely mimics natural succession in the western boreal forest (Lieffers et al., 1996).

A major advantage to planting under a maturing aspen canopy is the ability to establish spruce in an environment that has better growing conditions than in clearcuts, particularly in terms of reduced frost injury, and abundance of other competing vegetation. Light levels under aspen stands appear to reach minimum levels between 10 and 25 years following disturbance, and increase after that time due to development of canopy gaps (Lieffers et al., 2002). However, other vegetation such as bluejoint reedgrass (*Calamagrostis canadensis* (Michx.) Beauv.) can cause light levels at seedling height to reach their lowest levels by age 2 or 3 following disturbance (Man et al., 2008). In stands over 40 years old, light levels above 20% are commonly observed (Groot et al., 1997; Lieffers et al., 2002; Comeau et al., 2006). In addition, overstory aspen cover reduces the vigor of shrubs, herbs and grasses, which can negatively affect the growth of small white spruce (Lieffers and Stadt, 1994; Comeau et al., 2004).

Retention of overstory cover reduces the risk of growing season frost and overwinter injury (Groot and Carlson, 1996; Pritchard

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