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UNDERSTORY PRESCRIBED BURNING FOR VEGETATION CONTROL IN RED PINE AND WHITE PINE MANAGEMENT

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INTRODUCTION

Natural regeneration usually fails to establish on red pine (*Pinus resinosa* Ait.) and eastern white pine (*Pinus strobus* L.) sites that have been harvested (Bryson *et al.* 1996; Chapeskie *et al.* 1989; Wray 1986). Artificial regeneration of red pine and white pine on harvested sites (clear-cuts) has been more successful. However, because of insufficient tending, many of these plantations are currently overtopped by aspen (*Populus tremuloides* Michx.), red maple (*Acer rubrum* L.), and balsam fir (*Abies balsamea* [L.] Mill.) trees (Bryson *et al.* 1996; OMNR 1995). In protected areas where harvesting is not permitted (e.g., parks), pine communities are disappearing because of fire suppression, low recruitment, and succession to other species (Heinselman 1996; M^{c}Rae *et al.* 1994). In the Boundary Waters Canoe Area Wilderness (BWCAW), Heinselman (1996) estimated that red pine and white pine occupies 5 percent of the area, compared to an historical 25 to 30 percent. This loss may have been even greater if the BWCAW had not been protected from logging since the mid 1970s.

Because of fire suppression and low regeneration success (Carleton and Gordon 1992; Day and Carter 1990), there is a shift toward older age classes. This does not fit the fire-dominated negative exponential pattern that Van Wagner (1978) used to show the age class distribution of the presettlement fire-adapted pine forest (Maissurow 1935; Van Wagner 1970; Day and Carter 1990). In terms of natural white pine, more than 70% of stands in northwestern Ontario (Bowling and Niznowski 1996) and 63% of stands in central Ontario (OMNR 1995) are older than 80 years.

FIRE-ADAPTED SPECIES

Dey and Guyette (1996) sampled several red pine and white pine sites in Ontario. They estimated that the mean fire interval was 14 years for the period between 1721 and 1920 in the Ottawa Valley, 17 years for the period 1780 to 1940 in Algonquin Park (Guyette and Dey 1995) and only five years for the period 1741 to 1810 near Bracebridge (Guyette *et al.* 1995). The lack of fire scars on live trees indicated that the fires were of low-intensity and non-lethal. In the Temagami Region, mean interval of "hot" fires (those fires that were intense enough to leave behind fire scars), has changed from a historical 125 and 128 years to 13,488 and 1,233 years for red pine and white pine, respectively, because of fire suppression (Day and Carter 1990).

The absence of fire through modern fire suppression programs has significantly changed the composition and structure of understory vegetation. Natural regeneration of red pine and white

pine cannot be successful when other vegetation is abundant. Balsam fir and white spruce (*Picea glauca* [Moench] Voss), which cannot survive short fire intervals, often make up a major component of the mid-story vegetation in today's pine stands. Beaked hazel (*Corylus cornuta* Marsh.) and bracken fern (*pteridium aquilinum* [L.] Kuhn) can also be very abundant in the understory. Hardwoods, such as maple (*Acer* sp.) and poplar (*Populus* sp.), can also be serious competitors. Only on shallow and nutrient poor sites, where competition is poor, can natural pine regeneration still occur today.

UNDERSTORY PRESCRIBED FIRE

Because the ecological role of fire in the regeneration and perpetuation of red pine and white pine is well known, it makes sense to use understory prescribed fire to maintain the pine ecosystem. The prescribed burns are planned surface fires that are of low intensity ensuring that the pine trees are not killed. Prescribed burns are conducted in the spring of good crop years to take advantage of the natural seedfall in the autumn. The height of the individual mature trees and the bark thickness at ground level allow them to survive the fire. As a general rule, trees should be older than 80 years to have these characteristics (Van Wagner and Methven 1978). Details on planning and conducting an understory prescribed burn are available (M^{c}Rae *et al.* 1994; Van Wagner and Methven 1978). A key point for implementing the prescribed fire is the avoidance of all harvesting prior to burning to reduce the fuel buildup that would result in a high-intensity fire.

OBJECTIVES FOR AN UNDERSTORY PRESCRIBED BURN

The primary objective for conducting an understory prescribed burn is to control undesired vegetative competition from various shrubs, conifer, and hardwood species. Balsam fir with its thin bark, is often a major competitor with pine seedlings in the understory, and is easily girdled and killed by a single fire (Methven and Murray 1974). On the other hand, hardwood species, such as beaked hazel, will sprout after a fire. Control of these species can last 1-3 years depending on site and stand conditions. Often a second burn can be used to increase the duration of control (Van Wagner and Methven 1978). The first burn kills only the above-ground portion of the hardwood stem, but stimulates sprouting fed by root reserves stored over the winter. A second burn the following year can reduce the number and vigor of the sprouts because root reserves will be lower following the first burn. The vigor and size of bracken fern can be temporarily reduced for only one to two years after a single burn.

A second objective is to improve the seedbed by reducing the thickness of the L and F layers of the forest floor (duff). Although not as critical as on sun-exposed clearcuts due to the moderating effect of the shade from the overstory trees on the surface microclimate, seedbed reduction is important in summers if drought conditions persist. Retention of the lower forest floor material (i.e., the F and H layers) provides a rich nutrient base (Methven 1973), which is important for seedling development.

In protected areas (e.g., parks), a third objective for burning is to remove portions of the overstory to allow light to penetrate to the forest floor and encourage growth of any new post-fire seedlings (Van Wagner 1970). The size of the overstory openings should be larger for red pine,

which is less shade-tolerant than white pine. Standing live balsam fir or spruce will torch and trees downed by windthrow will produce higher intensity fires that will kill pine trees that overtop them. Therefore, managers should not panic when they see badly scorched trees as this is necessary for pine ecosystem survival. In managed red pine and white pine stands, lower intensity fires can be used and the canopy opening is provided through the use of the shelterwood silvicultural system.

TAKE-HOME POINTS

- Understory prescribed fire is a viable treatment for vegetation control and for promoting regeneration in the red pine and white pine ecosystems.

- Burns must be conducted prior to any harvesting to avoid increased fuel buildup to ensure that the fires remain low intensity.

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