Frontline

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VEGETATION RECOVERY AFTER WILDFIRE IN OLD-GROWTH RED AND WHITE PINE

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INTRODUCTION

In August 1995, an Ontario wildfire (FOR-141) burned 25,000 ha on the southeast side of Quetico Provincial Park (Fig. 1). The area burned was about 5% of the total area of the park. This fire was the largest and most significant fire in the park since July 1936 when six fires burned more than 60,000 ha. The largest of these fires burned 30,000 ha in the northwest corner of the park which had been previously logged for red pine (*Pinus resinosa* Ait.) and white pine (*P. strobus* L.). In contrast, fire FOR-141 burned large stands of red and white pine that were 200-300 years old. Wildfires in red pine and white pine are not common in Ontario because little of the forest type still remains.

In October 1995, a reconnaissance of the burned area was carried out to assess the potential for carrying out long term ecological monitoring. The main interest was in the recovery of red pine and white pine. Based on this assessment, five vegetation and soil sample plots were established and assessed in the burned stands in the summer of 1996.

FIRST IMPRESSIONS

Six weeks after the fire, there were signs of extensive crown fire in all stand types, even in the poplar (*Populus* spp.) and white birch (*Betula papyrifera* Marsh.) stands, which are normally fireproof. The foliage was fully consumed in contiguous areas of burned crowns. In places, mature red pine and white pine trees had their roots completely exposed following total consumption of the organic soil layer (Fig. 2). In many places plates of rock were sheared off and left to crumble into pieces. This is common in high intensity wildfires that contain exposed bedrock, but was very noticeable in this fire because Quetico Provincial Park has a high amount of exposed bedrock (Heinselman 1996). The fire burned through many swamps, marshes, and lowland black spruce (*Picea mariana* [Mill.] B.S.P.) stands that would normally be considered fire breaks. Most of the beaked hazel (*Corylus cornuta* Marsh.) and willow (*Salix* spp.) shrubs burned down to 10-30 cm charred stubs. Moose maple (*Acer spicatum* Lam.), white birch and poplar shrubs were also killed.

Vegetation Recovery

Despite the fact that the fire occurred in late August, many tree and shrub species sprouted by October. Sprouting was identified from many of the stubs of hazel, birch, maple and willow. Some poplar stems that were killed, sprouted from lateral roots. Herb species such as Bunchberry (*Cornus canadensis* L.), Canada mayflower (*Maianthemum canadense* Desf.) and Big-leaf aster (*Aster macrophylus* L.) were also observed. The crowns of many poplar trees that were burned by the fire, also had patches (about 5% of the crown) of lime-green leaves that sprouted in the centre of the tree crowns.

Most white pine trees in the area of FOR-141 had little or no cone crop in 1995. Red pine trees had a meager cone crop but most trees had some cones. Many red pine trees had dropped aborted cones that showed signs of insect damage. These cones were hollow and were probably damaged before the fire since they were much smaller than any of the mature cones.

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A 34-year-old jack pine (*Pinus banksiana* Lamb.) stand within the fire boundary had abundant cones. The resin sealing the cones had melted but the cone bracts had not curled back or released any seed by October 1995. Black spruce trees had an abundant cone crop. With many of the spruce trees falling over due to residual burning and windthrow, there were ample cone clusters close to the ground and many cones were beginning to open.

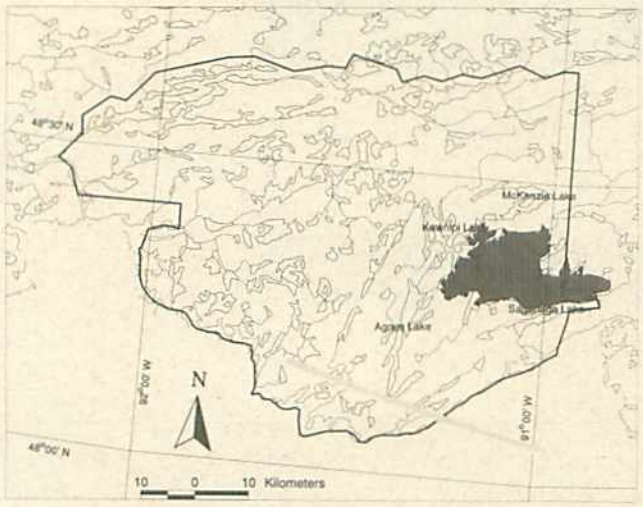

Figure 1. Map of Quetico Provincial Park showing the location of fire FOR-141, a 25,000 ha wildfire in 1995.

Wildlife

Ruffed grouse (*Bonasa umbellus*) and whiskey jacks (*Perisoreus canadensis*) were observed in one red and white pine stand. Even though there was a scarcity of food, the grouse were feeding on the tips of the new leaf sprouts of the willow, hazel and birch. They left most of the leaves intact by just nipping off the fresh leaf tips.

All of the burned marshes had grasses sprouting. At a mixedwood site there were fresh unidentified animal droppings at the edge of the water. The droppings were entirely green and appeared to be made up mostly of grass. These droppings were more typical of what one might find in the spring when animals feed on grasses before fresh green shoots appear on the shrubs. Moose (*Alces alces*) pellets were also common at all the sites. Squirrels (*Tamiasciurus hudsonicus*) had set up many caches of red pine cones in one burned mixedwood site.

SAMPLING ONE YEAR AFTER FIRE

A survey team visited the fire site in 1996 to characterize the effect of high intensity fire on soil and vegetation recovery in the mature red pine and white pine stands. The pre-fire overstory stand condition as well as the post-fire soil conditions and vegetation recovery by tree seedlings were recorded.

Figure 2. Intense fire has consumed the organic soil layer exposing roots of mature red pine and white pine.

Five separate survey transects were established along ridges. Four were located on Kawnipi Lake in the centre of the fire area. This area had burned intensely with high rates of spread. The fifth site was located at the south end of the fire, on Kenny Lake, which was a red pine/balsam fir/white pine ridge that burned as a low intensity surface fire. On this site there was very little red pine mortality, although all the balsam fir (*Abies balsamea* [L.] Mill.) trees were killed.

Two 100 m transects were installed at each site with sampling point centres every 10 m following the point-centered quarter method (Mueller-Dombois and Ellenberg 1974). The results (Table 1) give an estimate of the number of pre-fire overstory stems/ha by species as well as an estimate of the basal area by species. Regeneration was also tallied on 4 m^2 quadrats at the same sampling points to estimate conifer stocking and density (Table 1).

The 34-year-old jack pine stand was revisited in 1996 to make a qualitative assessment of the jack pine regeneration on the site.

RESULTS ONE YEAR AFTER FIRE

This was a high intensity crown fire that was estimated to have reached levels as high as 40,000 kW/m in some stands. Many areas had little or no organic soil remaining due to fuel consumption during passage of the initial fire front and residual burning after the fire front had passed. By the summer of 1996, any organic soil that might have been left on the ridge tops appeared to have been washed down the slope by water runoff. On most ridges tree mortality was 100 per cent. Sometimes the only surviving trees were found near the edge of the lakes or rivers where the fire backed down to the shore. Mature 100-300 year old red pine and white pine trees were left standing on bare rock after the organic soil was burned off around their roots. In the intensely burned areas, the balsam fir trees were reduced to charcoal stubs with little or no branches or crown structure remaining. On Kenny Lake, the low intensity fire burned through red pine, white pine and balsam fir. All the balsam fir were killed but their crowns, branches and some cones were intact.

In unburned sections of the park surrounding the wildfire, 1996 was a good seed year for white pine. Red pine had a meager cone crop as in 1995. Table 1 shows that only one sample site in the high intensity fire had any white pine regeneration in 1996. Some red pine seedlings were found throughout the study area and jack pine were common because parent trees were often found adjacent to the transects. Balsam fir seedlings were found only on the red pine/balsam fir/white pine site that was burned by the low intensity fire. Seedling counts on this site suggested that the stand was regenerating to red pine with a white pine and balsam fir component. This reflects a species composition similar to the pre-fire stand.

The pine ridges that burned intensely showed very little pine regeneration in 1996. The absence of white pine seedlings was probably because the parent trees were killed in a year when there was little or no seed available. When the fire occurred in 1995, many white pine trees were one year away from producing a mature cone crop. Most of the developing cones were killed by the fire. Based on this survey, it is unlikely that white pine will be a major component of these stands in future unless other mechanisms that favour white pine regeneration occur.

Red pine seedlings were fewer in number on the high intensity burn sites compared to the low intensity burn site at Kenny lake. The fire favoured regeneration of red pine and jack pine over white pine on sites that burned intensely. Red pine regrowth was favoured on the low intensity burn but white pine and balsam fir were also prominent.

Table 1. Survey site locations with tree and conifer seedling species found on fire FOR-141.

Sampling Site	Pre-fire		Post-fire	
	Live stems/ha	Total live stems/ha	Conifer seedlings/ha	Total seedlings/ha
South shore of Kawa Bay (Kawnipi Lake)	Bf_{243} Pr_{81} Pw_{76} Sw_{47} Bw_{20} Ce_{14} Ma_{14} Po_{6}	501	Pw_{125}	125
South' shore of Kawa Bay (Kawnipi Lake)	Sw_{303} Pr_{121} Ce_{97} Pw_{86} Bf_{65} Po_{54} Bw_{43}	769	Pr_{375} Pj_{125}	500
North' shore of Kawa Bay (Kawnipi Lake)	Pw_{286} Sw_{122} Pr_{59} Bw_{30} Po_{15}	512	Pj_{875}	875
East' side of Kawnipi Lake north of Kennebas Falls	Bf_{659} Bw_{86} Ma_{73} Pw_{49} Pr_{37} Po_{37}	941	Pj_{13875} Pr_{125}	14000
South side of Kenny Lake above Canyon Falls	Pr_{638} Bf_{170} Pw_{128} Ce_{128} Sb_{85} Sw_{64}	1213	Pr_{2000} Pw_{667} Bf_{667}	3334

' Even though jack pine trees were not found in the transect, parent trees were present in the surrounding area

There was abundant jack pine regeneration in all parts of the 34-year-old jack pine stand. Seeds were likely released sometime after early October 1995. Most of the seed probably survived the winter mixed in the snow that covered the site by late October.

DISCUSSION

This investigation focused on the combination of a high intensity wildfire in mature red pine and white pine stands, coupled with a poor seed year for those species. Red pine seedlings were present on the sampled sites one year after the fire. White pine regeneration was rare. Balsam fir has been temporarily eliminated from these stands. Because of the low rate of pine regeneration in many of these stands, the stands may be understocked to pine or become dominated by poplar, birch, and balsam fir.

The red pine/balsam fir/white pine stand that burned with a low intensity fire appears to be regenerating back to a stand of red pine, white pine, and balsam fir, possibly leading to a stand that will be similar to the pre-fire stand. Most of the parent pine trees in this stand were not killed by the fire. Because 1996 was a good seed year for white pine, it is likely that the number of white pine seedlings will increase in this stand over time.

Future investigations on these sites over the next 5-10 years will document the pattern of recovery of red pine and white pine in the burned stands. The fate of white pine is of particular interest, because the pre-fire stands had a prominent mature white pine component, while the post-fire stands had few white pine seedlings in 1996. It remains to be determined whether there is some additional mechanism that might favour re-establishment of white pine on these sites. Otherwise, this high intensity fire may result in red pine and jack pine being favored over white pine.

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