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Canadian Forest Service, Great Lakes Forestry Centre

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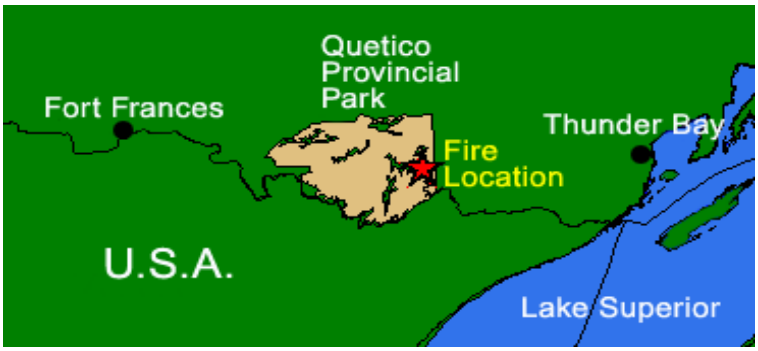
VEGETATION RECOVERY AFTER WILDFIRE IN OLD-GROWTH RED AND WHITE PINE

INTRODUCTION:

In 1995, a 25,000-hectare (ha) wildfire burned in the southeast part of Quetico Provincial Park in northwestern Ontario. This fire, known as Fire 141, burned some of the oldest forest in the Park. Fire 141 was unusual because it burned large stands of 150 to 300 year-old red and white pine. These tall pines are relatively rare in Ontario due to logging in the 1800s, but Quetico Park was only partially logged and therefore had some large remnant stands of pine. These pines can usually resist fire because of their tall stature and thick bark, but because Fire 141 was a crown fire it caused heavy mortality in the pines as well as in aspen, birch and other hardwood stands. In some stands of red and white pine there were no survivors for 500 m from the burned edges of the stand. About 90% of the organic soil layer was consumed leaving large patches of mineral soil or bald rock. The roots of mature red and white pine were completely exposed where the fire burned off the organic soil.



Map showing the location of Fire 141 (star) in Quetico Provincial Park.

LOCATION/SITE:

Quetico Provincial Park is located 200 km west of Thunder Bay, Ontario. It is made up of both Great Lakes-St. Lawrence and Boreal forest types. Fire 141 burned 25, 000 ha on the southeast side of the Park, approximately 5% of the total area of the Park.

RESEARCH RESULTS:

Field research has revealed that the biggest changes in the forest were most evident the year after the fire. In fire-affected stands, most of the mature jack pine trees were killed by the fire, but in 1996, there was an explosion of jack pine regeneration leaving thousands of seedlings to dominate the new stands. Red and white pine stands that burned deeply were taken over by regenerating birch and aspen seedlings along with fireweed and bigleaf aster. Pine ridges that burned intensely showed very little white pine regeneration in 1996. When the fire occurred in 1995, the white pine trees were one year away from producing a mature cone crop. The fire killed most of those cones, which may explain the lack of white pine regeneration in 1996.

Beginning in 1997, two years after the fire, Quetico Park experienced a severe drought that lasted into 1999. This drought caused high mortality of the aspen and birch saplings, and the fireweed. The mortality created more openings on the mineral seedbed and provided an opportunity for white pine seedlings to take root. The protection from drought offered by the aspen, fireweed and other ground cover (e.g., fringed bindweed and aster), coupled with the added release of pine seeds, allowed the number of white pine seedlings to increase from a few hundred per hectare in 1996, to a few thousand per hectare in 2000.

A 150-year-old red and white pine stand located near Kenny Lake burned as a low intensity fire. This stand had almost no mortality in the overstory parent pine trees. However, the burn did kill the balsam fir understory by girdling the trees. 1995 was not a good seed year for red or white pine. By 1996, there were only about 2500 pine seedlings per hectare on this site. In 1997, the year after the heavy cone crop matured, the number of seedlings jumped to 15,000 seedling per hectare. Drought killed many of the seedlings by the end of 1997, but another good cone crop in 1998 caused the number of seedlings to jump to 45,000 in 1999. In 1999 there was a blowdown, that helped to open the canopy and provide light. By 2000, there were about 50,000 red and white pine seedlings per hectare on the low intensity burn site along with some balsam fir seedlings that invaded the site. The low intensity burn on this site has the potential to cause a repeat of the forest stand structure that existed before Fire 141 occurred.

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CONCLUSIONS:

Red and white pine expend most of their energy on root development in the first five years after germination. Both pines germinate under low (30%) levels of light but require higher levels of sunlight (60%) to survive and grow into mature trees. A large number of early red and white pine germinants does not necessarily translate into lots of surviving saplings or trees. Unless the light levels increase, the seedlings may stagnate or die. The fact that both pines can germinate under low light means they have a survival advantage over plants that require higher levels of sunlight. It also means they can get started on burned sites even when aspen, birch, fireweed, and aster first dominate the site. The aspen and birch will be thinned naturally and the fireweed and aster will disappear completely after a few years. While the pines are putting down roots under low light levels, they are poised to grow when more light starts to reach them as the other plants die off. The well-developed root systems of the pine will also help them to survive during years of drought.

On the site that burned as a low intensity fire, the pine will probably survive and grow as the stand opens up to provide more light. In 2000 the stand had low levels of sunlight, but enough to allow pine regeneration. The 1999 blowdown in the stand knocked down some of the parent trees, which has increased the amount of natural light reaching the forest floor. If the blowdown had not occurred, light conditions in the stand would have favoured the white pine because it requires less light (50-55% of full sunlight) than red pine (65-70% of full sunlight) to grow during the sapling stage.

High intensity fire in Quetico Provincial Park consumed 100% of the organic soil layer, exposing the roots of mature red pine and white pine trees

MANAGEMENT IMPLICATIONS:

Low intensity fires in mature red and white pine stands appear to favour abundant pine regeneration because of a ready source of pine seeds from parent trees that are not killed by the fire. However, the success of pine regeneration in red and white pine stands where all the parent trees are killed by fire, seems to depend on the availability of seeds from adjacent, unburned pine stands. It remains to be determined whether there is some additional mechanism that might favour re-establishment of pine on these sites that burned with high intensity fire.

The timing of drought and other natural disturbances such as blowdown, probably play an important role in the survival and development of red and white pine seedlings after fire. Drought caused little or no mortality on high intensity fire sites, where the pine seedlings were protected by a dense, low layer of regenerating birch, aspen, fireweed, and bigleaf aster. On low intensity fire sites, where there was almost no ground cover, mortality of pine seedlings was common; however, that mortality was offset by continuous recruitment due to repeated good seed years in the overstory trees. Post-fire blowdown on the low intensity fire site has probably improved the chances of the survival and development of the red pine seedlings due to the increased light level reaching the forest floor.

SOURCES OF RELEVANT INFORMATION:

Heinselman, M.L. 1996. The boundary waters wilderness ecosystem. Univ.of Minnesota Press, Minneapolis. 334p.

Mueller-Dombois, D.; Ellenberg, H. 1974. Aims and methods of vegetation ecology. John Wiley and Sons, N.Y. 547 p.

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