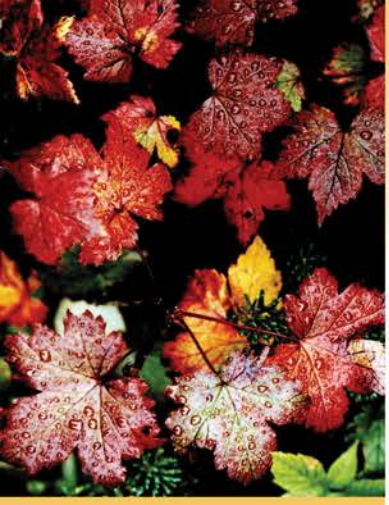

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Jack Pine Forests Face Struggle to Regenerate after Extreme Fires

The Richardson fire in northern Alberta (Photo: mcmurraymusings.com)

"Mega-fires" are large and extreme fires responsible for most of the forest area disturbed by fire in the boreal forest, with only 3% of these large fires accounting for 97% of the total area burned in Canada each year. These extreme events are expected to become even more common in the future with a changing climate. The general expectation after a fire in the northern boreal forest is that the forest will regenerate to approximately similar species composition and stem density as the pre-fire forest, known as the *direct regeneration hypothesis*.

Jack pine (*Pinus banksiana* Lamb.) is a species that is well adapted to fire. It regenerates well even after severe fires. The 2011 Richardson fire in northern Alberta was a mega-fire that burned 576,000 ha of boreal forest dominated by jack pine.

Immediately after the Richardson fire, researchers with the Canadian Forest Service (CFS) studied the effect of fire severity and stand characteristics on jack pine regeneration in the boreal forest of Alberta. Their goals were to determine how jack pine regeneration density was influenced by fire severity and stand age within individual stands; they also wanted to quantify, at the landscape level, the patterns of jack pine regeneration after fire.

"From a forest land management perspective," says Landscape Ecologist Dr. Brad Pinno, "this study will allow for a better understanding of the range of future forest conditions after a fire in pure jack pine forests."

Jack pine regenerates rapidly after a fire when seeds are dispersed from serotinous cones. Each mature tree may hold a supply of up to 10 years of closed cones, resulting in a large potential seed source. After a fire there is a very narrow window when seedlings germinate, with most seedlings becoming established immediately after the fire. Therefore, regeneration immediately after a fire gives a good indication of long-term stand composition.

Immediately after the Richardson fire, CFS researchers identified a great deal of variability in jack pine regeneration seemingly related to fire severity and pre-fire stand composition. "We found that jack pine regeneration density was greater in older stands (>60 years old) compared to younger stands (<30 years old). It was also greater in moderately severe burns compared to highly severe burns. In young stands with highly severe burns, jack pine regeneration averaged only 1164 seedlings per hectare, which is well

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Serotinous cones - jack pine (Pinus banksiana Lamb.) (Photo: NRCan (left); http://woodyplants.wikidot.com (right)

below current stand densities, indicating a potentially understocked future forest". Conversely, "moderately severe burns in old stands had on average 6819 seedlings per hectare."

Previously it was thought that jack pine could regenerate at a very young age and after many different types of fires. Dr. Pinno and his colleagues concluded, "We clearly demonstrated that jack pine post-fire regeneration is strongly influenced by the interaction of stand age and fire severity with particularly poor regeneration in young stands after highly severe burns. Given a changing climate, forest fires are expected to become more common and more severe, so these already climatically marginal forest lands may be prone to regime shifts from closed canopy forests to open canopy

Successful jack pine regeneration after a moderately severe burn (Photo: Fire Ecology.ca)

woodland ecosystems. Ultimately, jack pine in the western Canadian boreal forest may not be as resilient to extreme fire events as previously thought."

Jack pine is the most widely distributed pine in Canada, and a valuable timber crop species in the Canadian boreal forest. Species adapted to fire, such as jack pine, may have a more difficult time getting established if more intense, large and extreme fires become the norm; this might significantly reduce the number and size of

Poor jack pine regeneration after a highly severe burn (Photo: Up North Guides)

merchantable trees of this economically important timber crop species. Moreover, these pines play a critical role in maintaining the ecology and biodiversity in the boreal forest, as well as mitigating the effects of climate change. This poses a challenge for forest managers as they deal with an ever-increasing amount of uncertainty in planning for the future.

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