Project Note
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FPInnovations
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Fuel load and surface fire behaviour differences between an eight-year-old forest fuel treatment and a natural stand.

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Background

To conduct our study on the effectiveness of an underburning treatment against crown fire, we chose to use an old test plot that had been created in 2005 by Dr. Martin E. Alexander at the Canadian Boreal FireSmart Community Project site near Fort Providence, NT. Dr. Alexander had constructed a 75 m x 75 m test plot, which he had divided into four sections (Figure 1). In the two treated sections, Dr. Alexander had the dead and down woody debris and the standing dead stems removed, and the flaky bark scrapped off the live stems up to a height of 2 m. He then subjected these two "cleaned" sections to a light surface burn. The two control sections had been left untouched.

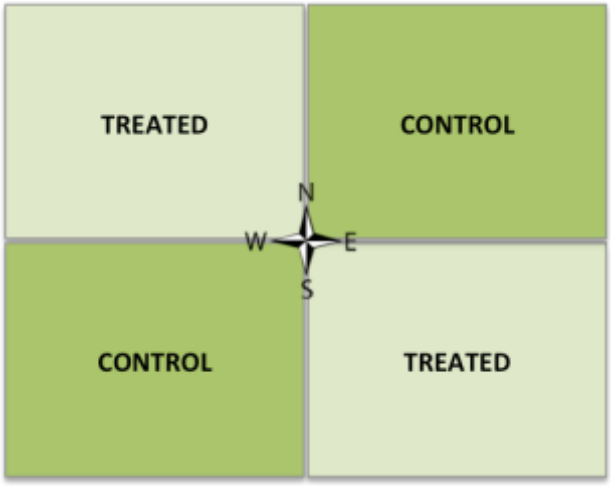

Figure 1. Dr. Alexander's 2005 test plot.

To prepare this old test plot for our 2013 study, we subjected all four sections to a light surface burn, i.e. an underburn treatment. During this prep work, we saw some obvious differences in fuel load and fire behaviour between the eight-year-old treatments and the controls. This paper summarizes those differences.

Fuel Load Differences

Upon our first visit to the test plot, we could clearly see a marked difference in the stand structure between the treated sections and the control sections (Figure 2). Using the line transect method, we calculated the surface fuel load in each section (Table 1). The site was flat and dominated by Jack Pine.

Figure 2. A treated section (left) and a control section (right).

Table 1. Fuel load data.

PLOT SECTION	T/HA
SE treated	2.91
NE control	6.76
SW control	10.65
NW treated	2.71

The data shows that even after eight years, the treated sections had much lower surface fuel loads than the control sections. Stand regeneration was minimal in the treated sections (an average of six Jack Pine seedlings less than 13 cm tall), and was non-existent in the control sections.

Fire Behaviour Differences

The plot sections were burned on June 21 and 22, 2013. The fire weather indices were very high (Table 2) so we used a handheld drip torch to ignite narrow strips. Ignition began at approximately 11:30 am both days. The temperature was already 29°C and the relative humidity was 23% from on site Kestrel readings.

Table 2. Fire weather parameters (from the Crownfire Weather Station for 1300h).

PARAMETER	JUN 21	JUN 22
FFMC	94	94
DMC	135	141
DC	443	452
BUI	153	159
ISI	12	11
FWI	41	39
TEMP (°C)	29.6	31
WIND (km/h)	10.4	7.6
RH (%)	26	26

We saw a distinct difference between the fire behaviour and in control efforts, between the control and treated sections. Figure 3 shows lightly burned surface litter in a treated section. The removal of the flaky bark from the live trees effectively prevented the fire from climbing the tree stems. Figure 4 shows more dramatic fire effects in a control section where the white ash indicates a hotter burn resulting from more surface fuel. Fire behaviour was gentle and easy to manage in the treated sections, whereas once burning began in the control sections, the fire crew had to constantly keep the fire from climbing the trees and dampen areas of intense fire. If left uncontrolled, the control sections would have produced problematic fire behaviour.

Figure 3. Underburn results in a treated section.

Figure 4. Underburn under way in a control section.

Summary

Our fuel load calculations and fire behaviour observations show that an eight-year-old stand-cleaning and underburning treatment can still reduce fire behaviour in a Jack Pine stand. These results suggest that in a boreal pine stand, a fuel treatment maintenance cycle of 10 years is reasonable.

Acknowledgements

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