Fire Effects Monitoring in Quetico Provincial Park

2006_FOR54, Kashapiwi Lake Fire

Introduction

Fire effects monitoring data was collected in 2006, 2007, 2008 and 2011 in Quetico Provincial Park. Four prescribed fires and one prescribed burn were monitored between 1 and 6 years after the fires (Table 1). Additionally, in 2009, 2010 and 2012 a series of fire effects plots were monitored within Quetico`s fire management compartments before fires occurred, presumably with the hopes of recording stand composition in these areas pre-fire. With the exception of the 2006 Brent Lake monitoring, data was loosely collected according to the Quetico Provincial Park Fire Effects Monitoring Protocol (first draft 2008, updated in 2013).

Table 1: Fire effects monitoring locations in Quetico Provincial Park

Fire	Lake	Burn Area (ha)	Burn Year	Prescribed Burn?	Fire Compartment (as per 2009 Quetico Fire Management Plan)	Years Monitored	Number of Plots
2000_FOR01	Emerald		2000	yes	2	2008	31
2006_FOR54	Kashapiwi	91	2006	no	2	2007 2011	20 20
2005_FOR14	Brent	909	2005	no	2	2006 2008 2011	5 transects 12 8
2006_FOR52	Argo/Roland	264	2006	no	2	2008	9
2006_FOR63	Agnes	430	2006	no	2	2007 2011	15 13

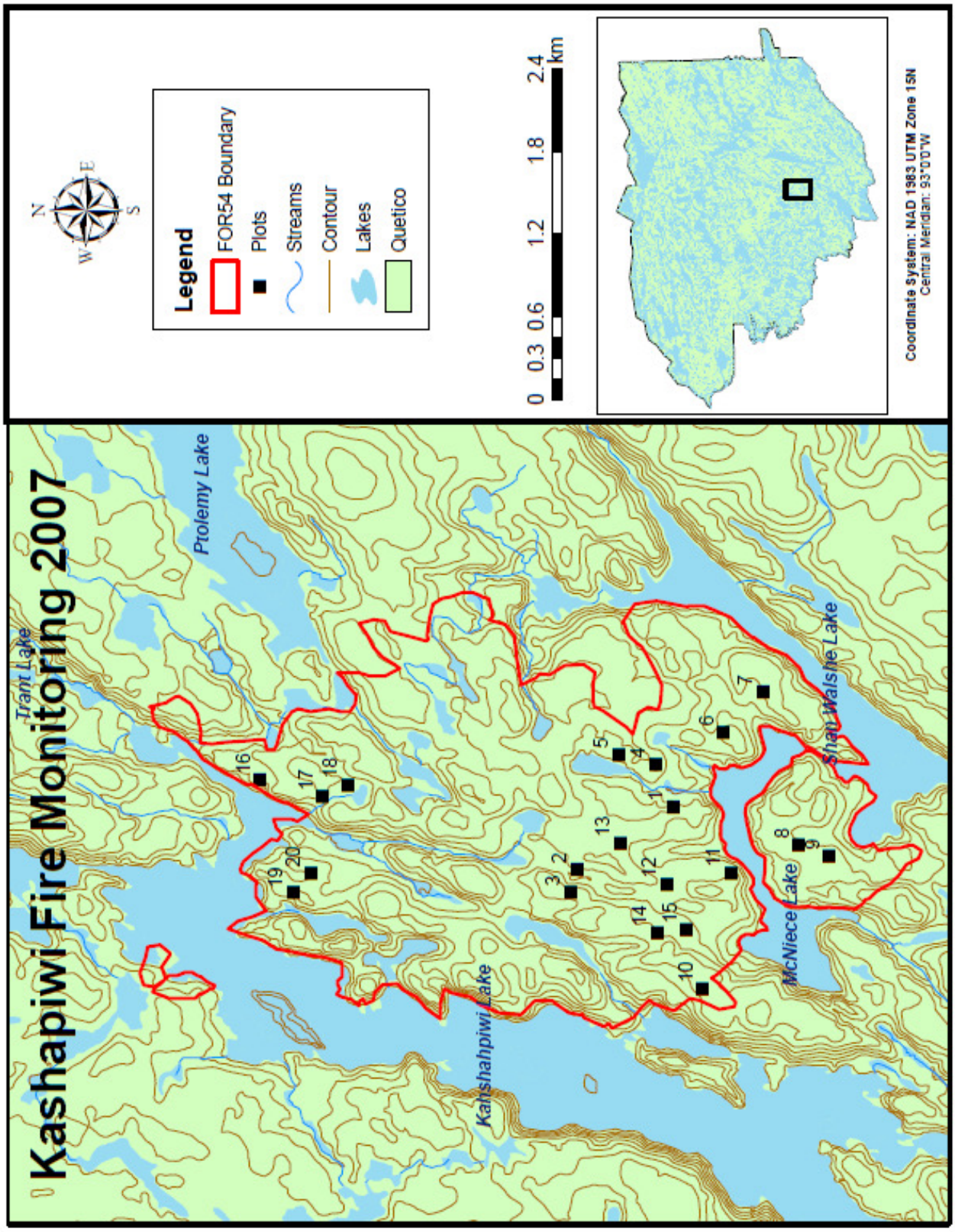
Kashapiwi Lake Fire (2006_FOR54)

This report summarizes the data collected from the Kashapiwi Lake fire (2006_FOR54) in 2007 and 2011. Data from this fire is the most complete and consistent of all fires monitored.

The fire on Kashapiwi Lake burned from July 11 to October 26, 2006 reaching a total of 909 ha in size. This fire started from lightening and WEATHER, intensity?.

In 2007, one year after the fire, twenty fire effects monitoring plots were established within the burn area (see appendix for coordinates) (Figure 1). It is not known how plot locations were selected. All twenty plots were revisited in 2011.

Figure 1: Fire effects monitoring plot locations within the Kashapiwi Lake Fire (2006_FOR54)



Stand Change Over Time

Pre-burn stand composition

Pre burn stand composition for each plot was determined using 1968 Fire Resources Inventory data combined with fire effects monitoring data collected in 2007. The stand composition in 2006, immediately prior to the fire, was determined by adding the number of live trees, dead trees and coarse woody debris present in each plot during the first year of monitoring. Only coarse woody debris > 7 cm in diameter and with a decay class of 1 were included in an attempt to add only those trees that had fallen during or immediately before the fire (i.e. they represented the standing forest species composition pre-fire). This stand composition was then used to determine if the forest was conifer (≥80% conifer species), deciduous (≥80% deciduous species) or mixed (< 80% conifer and <80% deciduous). Plots 1, 3, 5, 7, 8, 9, 15, 17, 18, and 19 were classified as conifer and plots 2, 4, 6, 10, 14, 15, 19, and 20 as mixed (Figure 2).

Figure 2: Reconstructed stand composition for plots 1-20 for the Kashapiwi Lake (2006_FOR54) Prescribed Fire. Percentages are calculated based on the sum of live trees, dead trees, and coarse woody debris (>7cm diameter, decay class = 1) present one year after the burn.

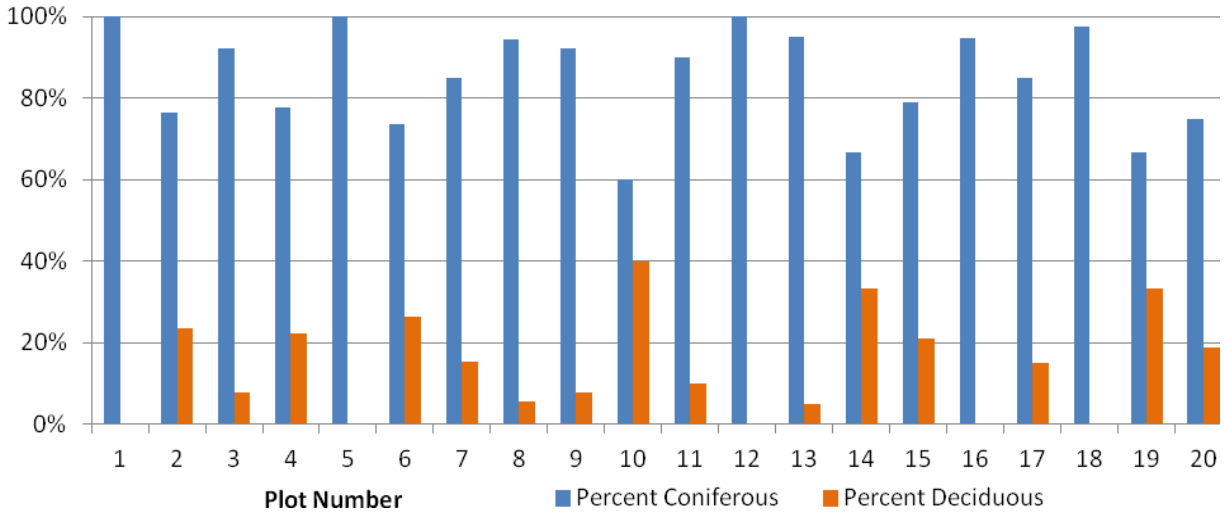


Table 2 shows that twelve of twenty plots (1, 2, 3, 4, 5, 10, 11, 12, 13, 14, 16, 19) maintained a similar stand composition between 1968 and 2006 (immediately prior to the fire). Seven of these plots (1, 2, 4, 5, 11, 12, 13), were white pine dominated in 1968, three of them (3, 10, 14) mostly white pine with some white birch and two (16, 19) mostly black spruce with a mixture of deciduous, pine and spruce species. The remaining 8 plots (6, 7, 8, 9, 15, 17, 18, 20) changed their stand composition. No jack pine was reported in the 1968 FRI data, however five plots (6, 7, 17, 18, 20) became jack pine dominated or mixed by 2006. These five plots were all less than 65 years old in 1968 with black spruce and trembling aspen as the main canopy species. This change indicates that despite jack pine preferring high-light growing conditions it may persist for decades in the understory before taking over the canopy from shorter lived colonizing species. Plots 8 and 9 were red pine dominated in 1968 however it appears that the small proportion of black spruce present expanded by 2006 to become the dominant species. Finally, plot 15 may have experienced a disturbance event because it changed from white pine dominated to a mixture of early successional balsam fir and white birch in 2006.

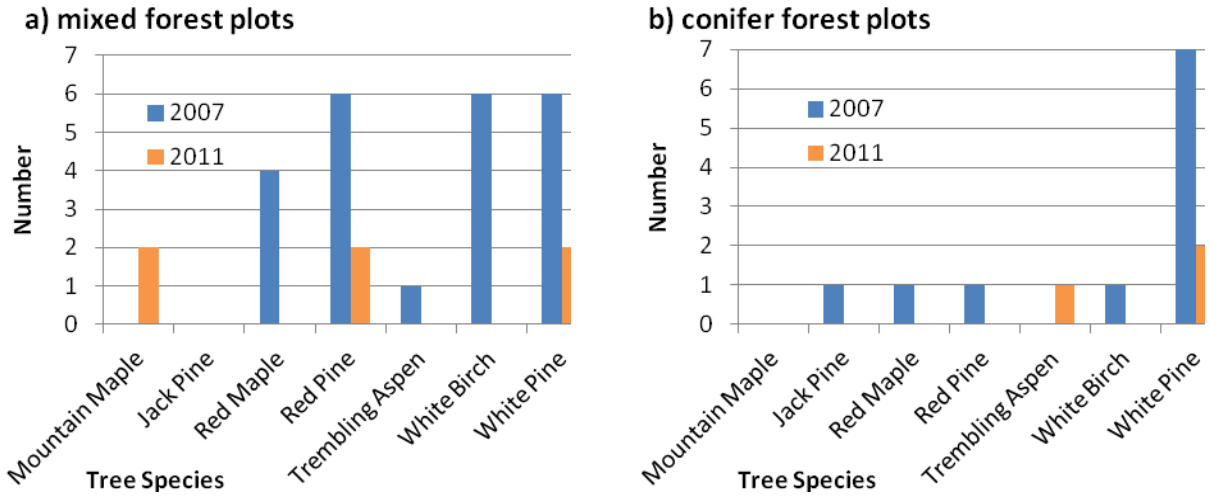
Table 2: stand composition for each fire effects monitoring plot in the Kashapiwi (2006_FOR54) Prescribed Fire. Reconstructed Forest Type is based on the number of live trees, dead trees and coarse woody debris (> 7 cm in diameter and decay class = 1) remaining in 2007. Plots with a Reconstructed Forest Type labelled as Conifer contained ≥80% conifer tree species. Plots with a Reconstructed Forest Type labelled as Mixed contained <80% conifer and <80% deciduous trees species. Plots highlighted in **orange** changed their stand composition between 1968 and 2006 before the fire.

Plot	1968 FRI Stand Composition	Age (yrs)	Reconstructed Forest Type	Most Common Species Conifer	Deciduous
1	PW8 SB2	130	Conifer	PW	
2	PW8 SB2	130	Mixed	PW	UNK
3	PW5 BW3 SB1 B1	109	Conifer	PW	
4	PW8 SB2	130	Mixed	PW	BW
5	PW100		Conifer	PW & SB	
6	PO4 PW4 SB2 SW1 PR1	60	Mixed	PJ	BW
7	PO4 PW4 SB2 SW1 PR1	60	Conifer	PJ	
8	PR6 PW3 SB1	100	Conifer	SB	
9	PR6 PW3 SB1	100	Conifer	SB	
10	PW5 BW3 SB1 B1	109	Mixed	PW	BW
11	PW8 SB2	130	Conifer	PW	
12	PW8 SB2	130	Conifer	PW	
13	PW8 SB2	130	Conifer	PW	
14	PW5 BW3 SB1 B1	109	Mixed	PW	BW & MR
15	PW8 SB2	130	Mixed	BF	BW
16	SB4 PO2 SW2 PW1 BW1	40	Conifer	SB	
17	SB4 PO2 SW2 PW1 BW1	40	Conifer	PJ	
18	SB4 PO2 SW2 PW1 BW1	40	Conifer	PJ	
19	SB6 B1 BW1 PO1 PJ1	61	Mixed	SB	BW
20	SB6 B1 BW1 PO1 PJ1	61	Mixed	PJ	BW

Live seed trees over time

Vegetation changes over time were determined for each reconstructed forest type by grouping all plots that were conifer dominated and all plots that were mixed. A total of 23 trees in mixed forest stands (8 plots) and 10 trees in conifer stands (12 plots) survived the fire (present when monitored in 2007). By 2011, 6 trees were living in the mixed forest plots and 3 in the conifer plots. Across both mixed and conifer plots all deciduous tree species present in 2007 died by 2011 (though two mountain maples and one trembling aspen grew into trees during this period). Two red pine and four white pine remained alive in 2011 (Figure 3).

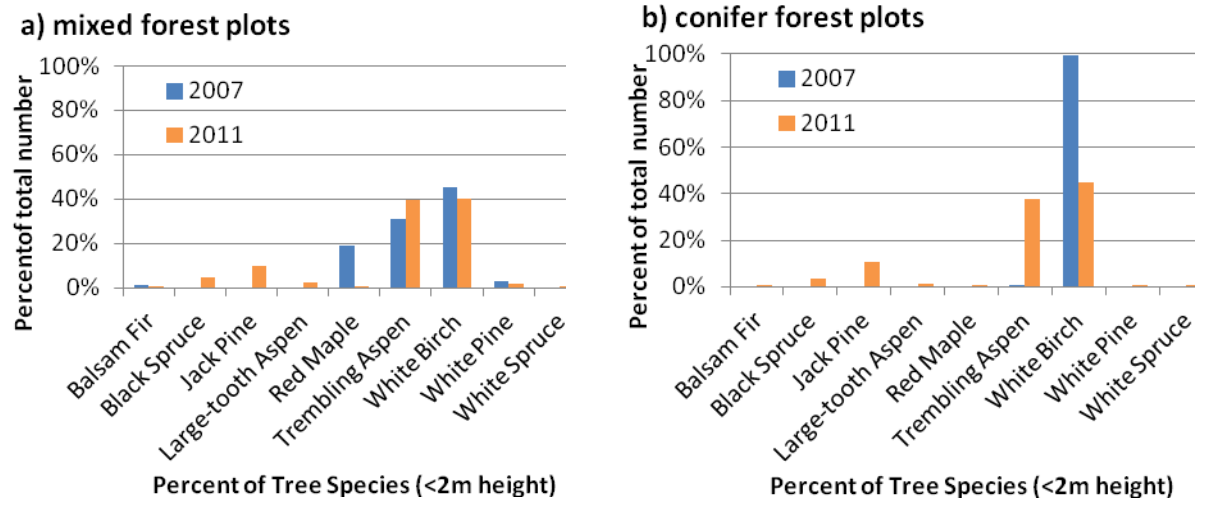
Figure 3: number of trees surviving in the Kashapiwi Lake (2006_FOR54) burn area post fire in a) mixed forest plots and b) conifer forest plots.



Regeneration over time - shrubs

Deciduous tree species, especially white birch (45% in mixed stands and 99% in conifer stands), were the most abundant species in both mixed and conifer plots immediately after the burn (present when monitored in 2007). By 2011, some jack pine, black spruce and white pine are present in the shrub layer (Figure 4).

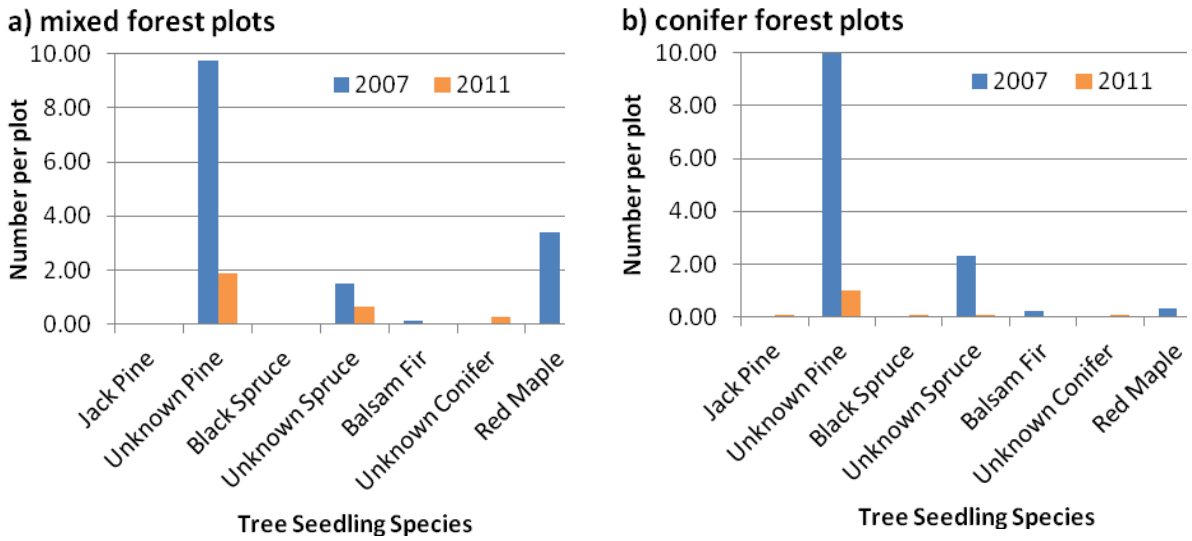
Figure 4: Percent composition of shrub-height (< 2m) tree species in the Kashapiwi Lake (2006_FOR54) burn area post fire in a) mixed forest plots and b) conifer forest plots.



Regeneration over time - seedlings

Though the fire effects monitoring protocol indicated that seedlings should be identified to species if possible, many were only identified to 'pine', or less specifically to 'conifer'. There appears to be little difference in seedling composition between mixed and conifer forest plots, though slightly more conifer seedlings were found in the conifer forest plots and slightly more deciduous species in the mixed forest plots. The number of seedlings across all plots decreased over time (Figure 5).

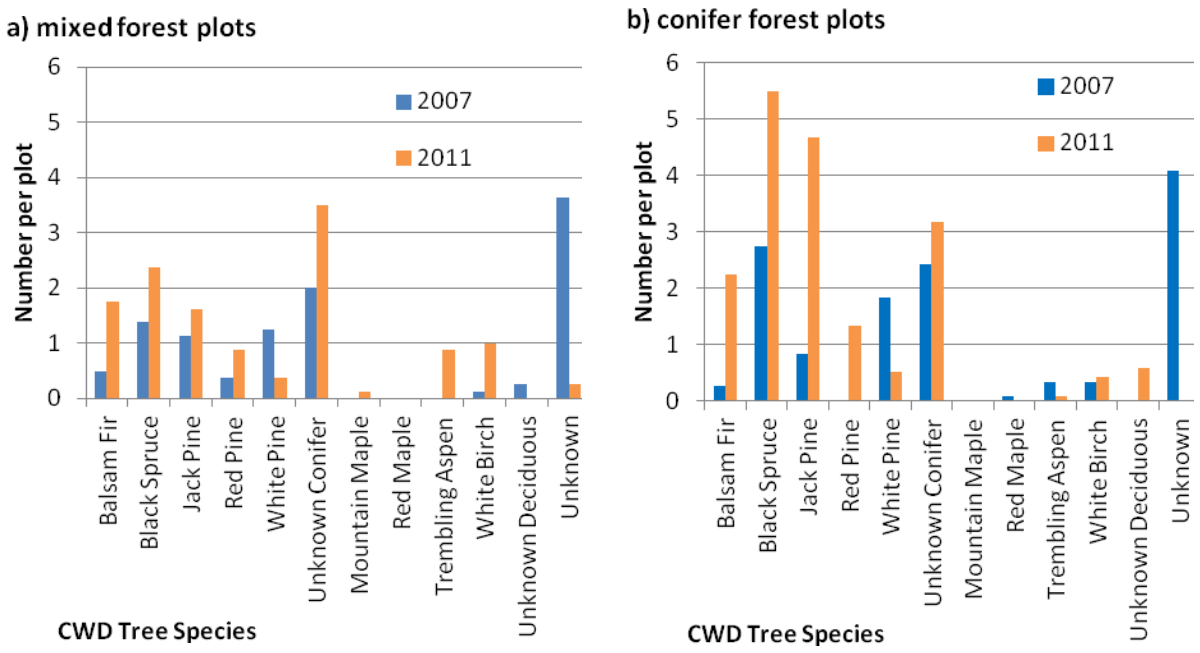
Figure 5: Number of tree seedlings present per plot in 2007 and 2011 for a) mixed forest plots and b) conifer forest plots in the Kashapiwi Lake (2006_FOR54) prescribed fire.



CWD over time

Coarse woody debris (CWD) was defined as horizontal trees > 7 cm in diameter. More conifer species per plot were found in the conifer forest stands while more deciduous species per plot were found in mixed stand. This reflects pre-fire forest composition. Between 2007 and 2011 the amount of CWD per plot increased for most species (Figure 6). This is as expected because trees that survive fires may be stressed or exposed to changed environmental conditions (warmer, windier, drier) that could cause mortality. White pine CWD was the only species that decreased between years in both forest types. It is possible that some of these trees rotted away completely between 2007 and 2011, however all of the recorded white pine CWD in 2007 was classified as decay class 1 or 2 (see appendix for decay classes). Therefore these trees were freshly fallen or only beginning to decay and should have been present in 2011. The large number of unidentified trees in both plots in 2007 might account for this discrepancy.

Figure 6: Number of coarse woody debris trees species (> 7cm diameter) per plot in c) mixed forest plots and b) conifer forest plots in the Kashapiwi (2006_FOR54) prescribed fire.



Additional Data Collected

Data collected at each monitoring plot is extensive, however there is some variation in the type of information collected and methods of collection between years and between fires. Data presented above was collected very consistently across plots, fires and years. Other information that is more sporadically available includes: soil surveys (available for Kashapiwi in the appendix), understory composition, tree height, diameter, decay, age, amount of char, and amount of crown scorch, shrub height, diameter and amount of char, CWD decomposition class and diameter, and fine woody debris counts by diameter class.

Conclusions

Overall we see slightly different patterns of regeneration between mixed forest plots and conifer forest plots monitored within the Kashapiwi Lake fire (2006_FOR54).

In mixed forest plots more live trees were initially present post-burn, especially trembling aspen, white birch and red maple. However these deciduous species survived less than 5 years post fire. Similarly, young shrubs present in the mixed forest plots were primarily trembling aspen, white birch and red maple with some spruce and pine seedlings reaching the shrub layer by year 5 after the burn. The seedling composition in the mixed forest consisted of mostly spruce and pine with some red maple. The number of shrubs and seedlings decreased over time. More deciduous CWD was present in the mixed forest plots compared to the conifer forest plots with the amount of CWD increasing over time due to the surviving trees dieing within 5 years after the burn.

In conifer forest plots there were fewer total surviving trees however these were mostly conifer and survived longer after the fire. White birch was by far the most common shrub species during the first year of monitoring, and like the mixed forest plots some spruce and pine shrubs grew up to

the shrub layer by the fifth year after the burn. Seedling composition was very similar to mixed forest plots, consisting mostly of spruce and pine. More conifer CWD was present in the conifer forest plots compared to mixed forest plots. The data also shows that it can become challenging to identify CWD as they decay, leading to a high number of unknown species.

The Kashapiwi Lake fire (2006_FOR54) was monitored one and fire years after it burnt. Fire effects monitoring in Quetico Provincial Park has currently monitored fire sites up to 8 years after the fire. These preliminary datasets provide an assessment of stand composition pre fire and the very early stages of vegetation change following a fire. To understand the type of forests that are returning post fire it will be necessary to monitor vegetation changes during mid succession (6-20 years post fire) and late succession (20-30 years post fire) and combine this with long term changes in mature forest stand composition such as that available through the Forest Resources Inventory.

Appendix

Plot Locations

Plot	Easting	Northing
1	614688	5343801
2	614233	5344501
3	614068	5344541
4	615000	5343933
5	615069	5344201
6	615234	5343436
7	615527	5343147
8	614417	5342890
9	614333	5342668
10	613367	5343585
11	614211	5343379
12	614127	5343850
13	614425	5344185
14	613778	5343915
15	613799	5343703
16	614884	5346796
17	614765	5346343
18	614851	5346160
19	614071	5346555
20	614207	5346429

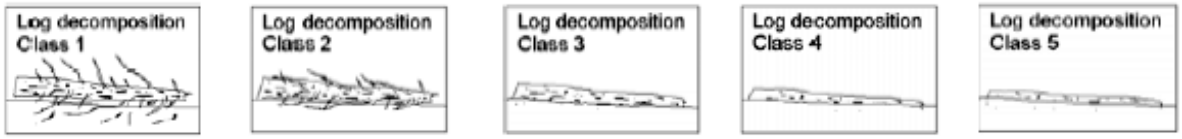
Soil Survey

2007 Soil				
Plot	**Texture**	**Depth (cm)**	**Drainage**	**Moisture Regime**
1	LOAMY medium SAND	49	very rapid	dry
2	SILTY medium SAND	42	well	moderately dry
3		11	well	moderately dry
4	SILTY medium SAND	26	well	moderately dry
5	SILTY medium SAND	23	well	moderately dry
6	SILTY medium SAND	16	well	moderately dry
7	SILTY medium SAND	14	well	moderately dry
8	SILTY LOAM	32	well	moderately fresh
9	SILTY very fine SAND	18	well	moderately dry
10	SILTY LOAM	45	well	moderately fresh
11	SILTY medium SAND	7	well	moderately dry
12	SILTY LOAM	28	well	moderately dry
13	SILTY fine SAND	18	well	moderately dry
14	SILTY fine SAND	48	well	moderately dry
15	SILTY fine SAND	6.2	well	moderately dry
16	SILTY fine SAND	16.5	well	moderately dry
17	SILTY medium SAND	14.2	well	moderately dry
18	SILTY medium SAND	33	well	moderately dry
19	SILTY medium SAND	12	well	moderately dry
20	fine SILT	12	well	moderately dry

2011 Soil				
Plot	**Texture**	**Depth (cm)**	**Drainage**	**Moisture Regime**
1		18	very poor	moist
2	silt loam	30	moderately well	very fresh
3				
4	silty sand	31	moderately well	moderately fresh
5	silty sand	23	moderately well	moderately dry
6	sandy clay loam	44	well	moderately fresh
7	loam	28	well	moderately dry
8	loam	28	very poor	moderately dry
9	loam	35	well	moderately fresh
10	silty sand	21	very poor	moist
11	silt loam	36	well	moderately fresh
12	silty clay	34	moderately well	moderately fresh
13	silty sand	26	well	fresh
14	silty sand	38	moderately well	moderately fresh
15	loamy sand	68	rapid	moderately wet
16	loamy sand	21	very rapid	fresh
17	loamy sand	31	rapid	moderately fresh
18	silt loam	24	well	moderately dry
19	silt loam	37	well	moderately fresh
20	clay loam	26	well	moderately dry

Decay Classes

Dead Woody Debris Decomposition Class	**CLASS 1**	**CLASS 2**	**CLASS 3**	**CLASS 4**	**CLASS 5**
Wood texture	intact, hard	intact, hard to partly decaying	hard, large pieces, partly decaying	small, blocky pieces	many small pieces, soft portions
Portion on ground	elevated on support points	elevated but sagging slightly	sagging near ground, or broken	all of log on ground, sinking	all of log on ground, partly sunken
Twigs < 3 cm (if originally present)	twigs present	no twigs	no twigs	no twigs	no twigs
Bark (do not use this criteria with birch)	bark intact	intact or partly missing	trace bark	no bark	no bark
Shape	round	round	round	round to oval	oval
Invading roots	none	none	in sapwood	in heartwood	in heartwood



CLASS 1 **CLASS 2** **CLASS 3** **CLASS 4** **CLASS 5**