

FUEL BREAK EFFECTIVENESS

CRUTWELL FIRE 2002

Fuel Break History

- In 1985, a Wildfire Action Plan for the Nisbet Provincial Forest was developed by The Forestry Service and Wildfire Management in Prince Albert. This plan included a proposal for a series of fuel breaks within the forest that would also serve to mitigate the spread of Jack Pine dwarf mistletoe.
- The North Cabin Fire (1989) in the MacDowall block of the Nisbet Provincial Forest consumed over 17,000 ha of forest, resulting in one individual's death, loss of private property, and forest resources. As a result of the North Cabin Fire, attention was focused on the immediate need for the construction of a series of fuel breaks across the northern portion of the Nisbet Forest.
- A revised fuel break schedule was developed in 1990 identifying twenty different areas for fuel breaks, totaling almost 90km in length. The Nisbet Fuel Break was completed in 1992.
- The plan called for brush disposal on each site and then the key fuel breaks planted to hardwoods. These fuel breaks were strategically located where they would provide the greatest protection to life and property.
- In 2002, at the time of the Crutwell Fire, The Nisbet Fuel Break was 800 meters wide and consisted of 0-1a grass fuel type with scattered immature deciduous shrubs.
- Today the Fuel Break has scattered jack pine regen as seen in picture below on the left.



The Crutwell Fire

- During the morning of June 28th 2002, a thunderstorm passed through the Prince Albert Forest Protection Area in central Saskatchewan resulting in multiple fire starts. Two of these fires, the Sam and Crutwell, would eventually join together to become the Crutwell Fire named after a small hamlet approximately 20 km west of Prince Albert close to where the fire originated.
- The Crutwell Fire was reported at 1423 hrs at a size of 0.01 hectares. It was a lightning caused fire where a white spruce tree was found with obvious lightning marks. The tree was situated on an old logging site where the area around it consisted of slash and dead woody material.
- The Crutwell Fire was reported and initially controlled in the early afternoon of June 28th; then escaped containment when embers from the fire jumped 130m outside of the containment line. This new ignition quickly developed into a full crown fire and rapidly spread toward the city of Prince Albert.
- Another start, named the Sam Fire, was reported 11 min after the Crutwell Fire, roughly 6km to the east of the Crutwell Fire, just south of the Village of Holbein.
- During the night of June 28th, shifting winds and changing fuel types reduced the fire behavior which allowed increased effectiveness for suppression activity. These fires joined together at 0100 hrs on June 29th as a result of burn out efforts.



Fuel Type

- The majority of the fuel consumed by the fire was mature jack pine with severe dwarf mistletoe infestation.
- The forest stands were also affected by severe drought which was evident across the landscape. It was observed that what used to be wetlands and ponds were dry, plantations in the area were dying and fields were emaciated.
- Two years prior to the Crutwell Fire, the area received high winds which caused significant blow down. Post burn analysis revealed that the dead and down trees were fully consumed, leaving ribbons of ash in their place. The duff layer was excessively dry and post burn results illustrate a thin layer of ash left on the sandy loam soil. It was also evident that former wetlands in the area were extremely dry as the fire burnt deep into the peat deposits.



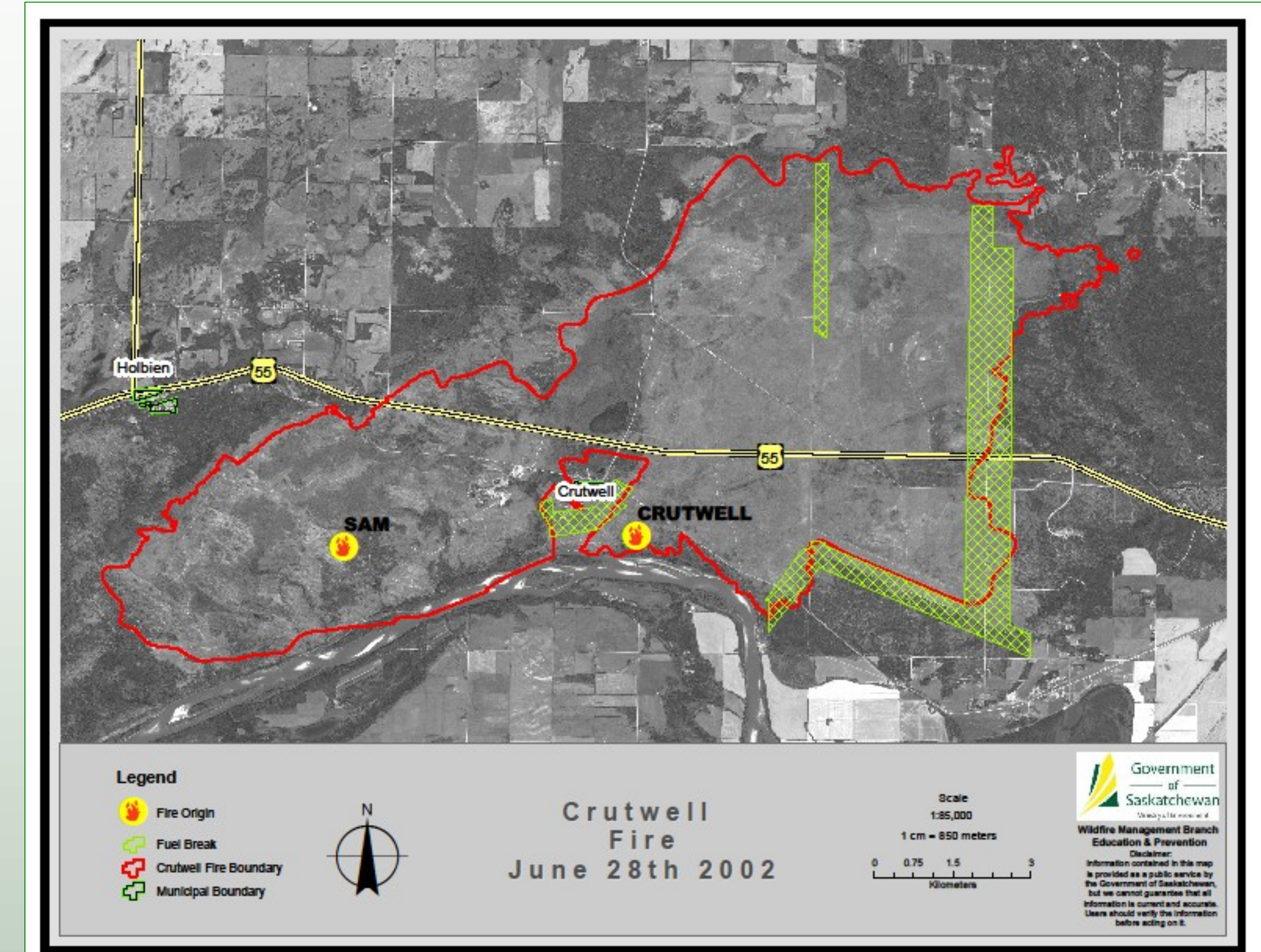
Fire Behaviour

June 27 2002—Noon Actuals										
Temp	RH	Wind Speed	Wind Dir	24 hr Rain	FFMC	DMC	DC	ISI	BUI	FWI
34	32	15	S	0	93	91	682	14	137	44
June 28 2002—Noon Actuals										
Temp	RH	Wind Speed	Wind Dir	24 hr Rain	FFMC	DMC	DC	ISI	BUI	FWI
29	46	7	SSW	0	92	96	690	8	142	30
June 29 2002—Noon Actuals										
Temp	RH	Wind Speed	Wind Dir	24 hr Rain	FFMC	DMC	DC	ISI	BUI	FWI
27	49	9	W	0	91	99	699	7	147	30
June 30 2002—Noon Actuals										
Temp	RH	Wind Speed	Wind Dir	24 hr Rain	FFMC	DMC	DC	ISI	BUI	FWI
22	45	50	W	11.7	77	53	621	11	87	32

- The Prince Albert area was under a ridge of high pressure for several days prior to the fire starts. During the morning of June 28th, a low pressure system moved across the province creating a cold front over Prince Albert at 0600 hrs. Dry thunder storms associated with the cold front produced lightning that was recorded from 0556 to 1104 hrs.
- Wind shifts were recorded from southwest at 0700 hrs to west south west at 1200 hrs and then changed direction again to northwest at 0100 hrs. The Prince Albert airport weather station recorded cross over conditions from 1500 to 2200 hrs on June 28th, extreme burning conditions resulted with the FFMC reaching the maximum value of 94.5 at 2100 hrs with a Head Fire Intensity of 12,948 kW/m.
- The fire was reported to be burning at a Rank 5 with a 30-45 meter flame height burning everything in its path.
- The hourly variation in relative humidity did not follow the typical pattern built into the FWI system, which strongly affects the FFMC values. In this case, the highest FFMC value occurred at 2200 hrs, not at the "standard" time of 1600 hrs. The Crutwell and Sam fires burned under cross-over conditions that lasted seven hours that day where the relative humidity values were less than the temperature.

In order to compare the observed rates of spread with rates of spread for the pine models within the Canadian Forest Fire Behavior system, the time intervals and corresponding ISI values needed to be calculated and matched with the time intervals applicable to the observed rates of spread. Time intervals of 15 min were chosen between 1700 and 1830 hrs and the corresponding ISI values were calculated from the hourly record using a linear interpolation method. Using the same technique, rates of spread based on the observations were calculated and assigned to each of the 15 min time periods. The table below shows the results of the adjusted ISI values and the adjusted observed rate of spread for mature jack or lodgepole pine and immature jack or lodgepole pine. The results show that the C-4 model best matches the observed rates of spread. (taken from *The Crutwell Fire Run of June 28-29 2002*; Rick Lanoville)

Time	ISI	ROS ₀	ROS ₁	ROS ₂
17:00	17.3	30.9	19.1	30.2
17:15	19.0	35.1	22.9	33.6
17:30	20.8	39.3	27.2	37.1
17:45	22.6	43.5	31.5	40.6
18:00	24.3	47.8	35.6	43.8
18:15	23.5	41.4	33.7	42.3
18:30	22.8	35.0	32.0	41.0



Fuel Break Effectiveness

"Without this substantial break in fuels on the East side of the fire, I believe our chances of being successful would have been significantly reduced to the point of 5-10% probability of containment" — Eric Braaten, Air Attack Officer.

- Air Attack Officers reported trying to use a 30m roadway as a fuel break reinforced with retardant. The fire was far too aggressive and quickly burnt over the roadway.
- The main highway was closed and tankers began reinforcing the 75-100 meter wide highway right of way, but because of the aggressive rates of spread, control lines could not be established.
- Long range spotting occurred over the highway, leaving only the Nisbet Fuel Break as the last defense point between the fire and the outlying subdivisions west of Prince Albert.
- The 800m wide fuel break was a significant determining factor in securing the east flank. Using the fuel break as an anchor point, an aerial ignition backfire operation was conducted at 1900hrs on June 28th along the east flank of the fire which was successful in dropping the fire to the surface.
- Because of low visibility and the hazards of flying on June 29th, active fire suppression could not take place at the head of the fire when it reached the fuel break. The fire could have spread across the fuel break and into heavy fuels again if it was any narrower.
- Once the fire reached the fuel break, air support was unable to directly action the fire due to low visibility. Air tankers were still able to drop on the eastern edge of the fuel break while the visibility was reduced in the western portion of the fuel break.
- After the smoke had lifted, retardant was placed directly on and in front of the fire as it was burning across the fuel break.
- The openness of the fuel break and grass fuel type made retardant drops extremely effective as there was no canopy retention to intercept the retardant.

Acknowledgements

Information for this document was compiled from the following:
Crutwell Fire and Fuel Break Effectiveness; Eric Braaten
The Crutwell Fire Runs of June 28th-29th 2002; Rick Lanoville
Crutwell Fire Aerial Ignition Report; Kelly Sawchuk
Crutwell Fire Report