Canadian Wildland Fire & Smoke

NEWSLETTER

SPRING2019

CANADA'S BLUEPRINT FOR WILDLAND FIRE SCIENCE

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Following major wildfire disasters, professionals in the wildland fire community hope that we have reached a turning point when society will begin to take the problem seriously and do things differently. Sadly, we find all too often that this only lasts until the next major event in the news distracts most people; the disaster is forgotten, and the will to change things dwindles away. While fire scientists for decades have been warning of these trends in increasing fire danger, it has taken considerably more time for the concern to filter through to the general public and to the political level. Given recent fire events, however, it has become increasingly difficult for anyone to deny that the fire environment is getting more dangerous with far reaching impacts.

IN THIS ISSUE:

In Canada alone the list of major fire events is a lengthy one. 2017 set the record for the most area burned in British Columbia, but this record only stood a single year before it was broken in 2018. The Kenow Fire burned through Waterton Lakes National Park in the late summer of 2017 and, in the view of expert fire behaviour analysts, was one of the most intense mountain fires ever observed. In May of 2016, a fire tore through the city of Fort McMurray and caused incalculable damage that is still being repaired three years later. In 2014 there were extensive fires throughout the Northwest Territories and British Columbia. Parts of the town of Slave Lake, Alberta, were destroyed by wildfire in 2011. Quebec saw major fires around the city of La Tuque in 2010. In 2009, fire threatened the west side of Kelowna, which had seen homes on the southeast side burn in 2003 in the Okanagan Mountain Fire. Also in 2003, fires caused major damage to Barriere in BC, and came close to burning Blairmore in the Crowsnest Pass in Alberta. In 1998 Salmon Arm was nearly burned in a large wildfire, and in this same year there were major fires throughout western boreal Canada. These events are only a sampling of the fires we have seen over the past 25 years in Canada, and current trends suggest that this will continue, or even get worse. We only have to look to recent major fire events in the United States to see what damage these fires can potentially do to human communities and lives.

Wildfires are not only dangerous in terms of the potential of destroying homes, communities, and human infrastructure, but they interrupt economic activity, limit tourism, and smoke alone causes major health concerns across vast areas. For example, fires burning in British Columbia in 2018 choked out regions in Saskatchewan with smoke so thick that stars were not visible on clear nights, and visibility was so limited that a person could not even see across the South Saskatchewan River valley near Swift Current (personal observation) in mid-August. We also have to be concerned with numerous evacuations that occurred throughout western and northern Canada simply to get people away from the damaging effects of smoke. Some people have been evacuated multiple times over recent years. There is very real psychological trauma associated with evacuations.

In response to the 2003 Okanagan Mountain Fire, the Canadian Council of Forest Ministers signed the Canadian Wildland Fire Strategy (CWFS). While this document was originally signed in 2005, action to implement it was considerably slower. The CWFS was renewed again in 2016 following the Fort McMurray Wildfire. The CWFS seeks to increase wildland fire resiliency across the country through improved action and coordination on wildfire prevention, mitigation, preparedness, response and recovery. The 2016 CWFS identified a number of new priorities to help achieve those goals. Among these were recommendations to enhance horizontal collaboration and to increase investments into innovation. The "Blueprint for Wildland Fire Science in Canada" (the Blueprint) was developed in response to these two specific recommendations.

Developing the Blueprint

The Blueprint is a strategic plan of action focused on increasing Canada's capacity to conduct wildland fire research. It was developed by a national team of partners, representing provincial, territorial, Indigenous, academic, and non-government sectors, and led by Natural Resources Canada's Canadian Forest Service (CFS).

Over a period of 18 months, Blueprint organizers conducted workshops, surveys and one-on-one interviews, reaching out to more than 100 different individuals, communities and organizations. This included discussions with researchers, wildland fire management agencies, Indigenous communities and organizations, health care agencies, insurance providers, engineers, municipalities, forestry and energy companies, and emergency response agencies. The result is a national consensus view of the key research needed over the next 10 years.

The Blueprint puts forward six broad but strongly linked research themes. Individually, each of these

themes provides a high-level overview of existing knowledge gaps and areas for research priority. Taken together, they demonstrate the scope of the challenge ahead and the need for deliberate and collaborative efforts to answer the existing questions.

Theme 1: Understanding Fire in a Changing World: New and fundamental physical fire science as a foundation for improved decision making and to assist the development of new models and tools to enhance fire management.

Theme 2: Recognizing Indigenous Knowledge: Recognizing Indigenous knowledge as a compliment to western science and as a value path to understanding.

Theme 3: Building Resilient Communities and Infrastructure: Science to influence how, where, what, and why we build and to limit loss in the wildland urban interface.

Theme 4: Managing Ecosystems: Understanding the desirable and undesirable impact of fire on forest ecosystems and the complex interactions between wildland fire, landscapes and people.

Theme 5: Delivering Innovative Fire Management Solutions: Transforming fire management through research and innovation.

Theme 6: Reducing the Effects of Wildland Fire on Canadians: Science to address long-term physical, mental, social, and economic wellbeing of people living with wildland fire.

Blueprint Recommendations

The Blueprint makes 15 recommendations intended to guide science investments, attract new collaboration, and align national research efforts. These recommendations are broadly focused on:

1. Increasing national capacity for wildland fire research through new investments into academic programs, public sector science, and postsecondary networks;

2. Recognizing Indigenous knowledge as an equal and complementary way of knowing wildland fire, to inform future fire management policies and practices;

3. Creating new knowledge exchange mechanisms to improve the way science and technology is shared, understood and implemented;

4. Creating new multidisciplinary, multipartner, collaborative research opportunities; and

5. Improving national governance and coordination of science activities through development of a national research agenda and the creation of a national coordinating committee.

It is the sincere hope of all organizations and individuals involved in the creation of the Blueprint that it signifies a watershed moment in how we collectively choose to begin to better understand wildfire to enable more effective responses. The full Blueprint for Wildland Fire Science is available for free download at: http://cfs.nrcan.gc.ca/publications?id=39429

FLAMMAGENITUS?!

by Lynn Johnston[1], Alan Cantin[2], Joshua Johnston[3], Natasha Jurko[4], and Mike Flannigan[5]

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We have a multiple choice question for you:

What is flammagenitus?
a) a spell you learn at Hogwarts
b) a contagious disease prevalent amongst tree planters and on fire base camps
c) a new name for something that didn't need one
d) why should I care?

The correct answer is, d, but also perhaps c. While we were sleeping, likely dreaming about fire, the World Meteorological Organization (WMO) made up a new name for pyrocumulus or pyrocumulonimbus clouds. Lovingly referred to as pyroCb's in the wildfire world, these impressive products of rising convective heat are arguably one of the most interesting phenomenon in the fire world. Building from the heat of a wildfire, pyroCb's can quickly tower as high as 15 km and punch through to the lower stratosphere (Fromm et al. 2010, Dowdy et al. 2017, Kablick et al. 2018). They can be responsible for intercontinental smoke transport (Ansmann et al. 2018). They can create their own lightning, even starting new fires (Dowdy et al. 2017). They're pretty neat (Figure 1).

Figure 1. Some very neat looking pyroCb (aka flammagenitus) cloud formations. a) 2016 Horse River wildfire (Government of Alberta); b) 1986 Garibaldi prescribed burn (Mike Flannigan/Canadian Forest Service); c) 2010 Wawa18 wildfire (Jeremy Johnston/Ontario Ministry of Natural Resources & Forestry).

In 2017, the WMO updated their original 1986 definitions and have updated to an excellent online system (https://cloudatlas.wmo.int). The 2017 update included the addition of "special clouds" within their cloud naming system. So in naming a cloud, we take the cloud genera name (e.g. Cumulus or Cumulonimbus), add the name species name (e.g. congestus), optionally add the name of any relevant variety (e.g. opacus) or supplemental feature (e.g. incus), and finally add the special cloud name (e.g. flammagenitus) to form the full cloud name (WMO 2019). Following this standardized naming convention, the image in Figure 1a would be Cumulonimbus calvus flammagenitus, and the images in Figure 1b and c would be Cumulus congestus flammagenitus.

Flammagenitus is from Latin "flamma" (meaning fire) and "genitus" (meaning generated); so as with pyrocumulus ("pyr" from Greek, also meaning fire) the name is very rational. In addition to flammagenitus, there are now also special cloud names for man generated (homogenitus), waterfall generated (cataractagenitus), forest generated (silvagenitus), and man changed (homomutatus) clouds. Despite having this official naming convention, flammagenitus is largely an unknown term within the fire community (it seems flammagenitus is not

	Web of Science	Science Direct	Google Scholar	Google
flammagenitus	0	0	6	13300
pyrocumulus	14	24	484	67800
pyrocumulonimbus	24	10	598	14800

Table 1: Number of results found using a variety of fire-generated could names as internet search terms

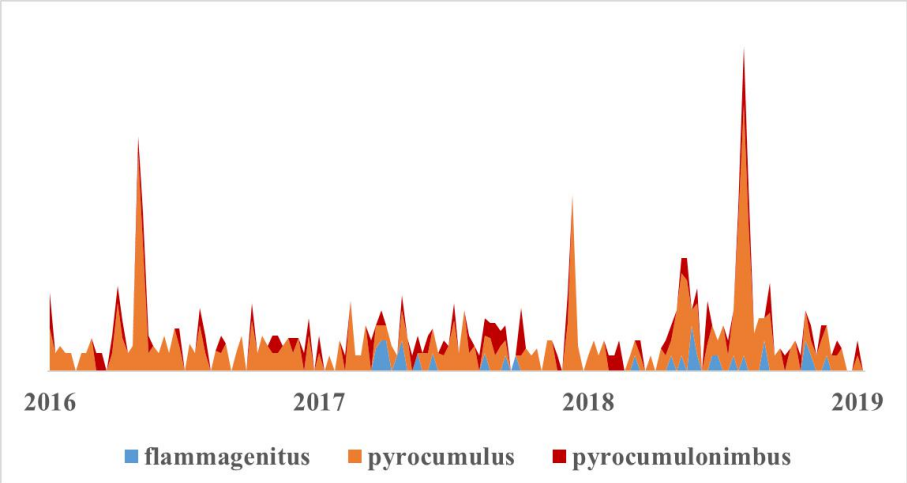

Figure 2. Relative search term popularity from Google from January 1, 2016 to January 10, 2019.

contagious?). We had never heard of it and only discovered it when Alan googled pyrocumulus, which popped up a Wikipedia article and the International Cloud Atlas website referencing it as flammagenitus. Googling the various terms shows that pyrocumulus returns the most results, but flammagenitus does have over 13,000 results (Table 1). Popularity of flammagenitus as a google search term only appears in early 2017 (when WMO's new International Cloud Atlas was released; Figure 2). We did a bit more digging and found that as of January 2019, both Web of Science and Science Direct contain no peer-reviewed publications referring to flammagenitus (Table 1). There were six Google Scholar results for flammagenitus, but one appears to be someone's blog, and three are from a brief mention of the new WMO definitions in national meteorological newsletters (from Spain, Russia, and France). One of the results is a Polish journal article discussing the new definitions (Matuszko and Soroka 2017), and one is a recent publication from Filkov et al. (2018) which does briefly mention the new name and provides a link to the International Cloud Atlas.

So, why should you care? Well, if you're reading this you are likely a big enough fire and smoke nerd to care about the taxonomy of clouds. The name follows the established naming convention and is all very logical. But why are we only learning the name now? Should we all start using

flammagenitus? Let us know! We have a poll up on: www.flammagenitus.com. Maybe we should we start making shirts to get the word out (Figure 3).

Figure 3. Flammagenitus T-shirt mock up (not joking, this is happening).

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OUTSTANDING THESIS AWARD

Denyse Dawe received the Outstanding Thesis award for the Department of Renewable Resource at the University of Alberta. Her thesis titled Post-fire regeneration of endangered limber pine (*Pinus flexilis*) at the northern extent of its range can be viewed here.

New Partner

Founding partners

University of Alberta

Alberta Agriculture and Forestry

Canadian Forest Service (Northern Forestry Centre)

BC Wildfire Service joining

Canada Wildfire is pleased to announce a new partnership with the BC Wildfire Service. BC has had record breaking fire seasons in recent years, and has expanded research to help modernize their business. This partnership will expand our network and enhance wildfire research in Canada.

If your organization would like more information about joining,please contact us at wildfire@ualberta.ca

CARIBOU LAKE FIRE CASE STUDY: Focus on Weather

by Maria Sharpe

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Complete case study available HERE. This case study was written as a requirement of the Canada Wildifre, Fire Weather Course.

Smoke Column as a result of Aerial Ignition LWF-161-15, June 24, 2015 at 1930hrs.

Introduction

Wildfire Location and Significance

The Caribou Lake Wildfire (LWF-161) was ignited on June 24, 2015. The fire was discovered in North-eastern Alberta, within the Lac La Biche Forest Area (Figure 1). The fire was located 12 kilometres west of a major transmission line and 20 kilometres west of Highway 63; a major highway for movement of people and infrastructure to and from the Town of Fort McMurray to the city of Edmonton.

Date and Time	Time (hrs)	Size (ha)	Fire Status	% contained
2015/06/24	1914	80	OC	0
2015/06/25	1717	350	OC	0
2015/06/26	1655	600	OC	0
2015/06/27	2328	1200	OC	0
2015/06/28	1918	3500	OC	0
2015/06/29	1510	10000	OC	0
2015/06/30	n/a	n/a	OC	0
2015/07/04	0925	12000	OC	10
2015/07/19	1030	14000	OC	20
2015/07/13	2000	14000	BH	100
2015/07/26	2000	12900	UC	100

Status Change
Notable Fire Growth

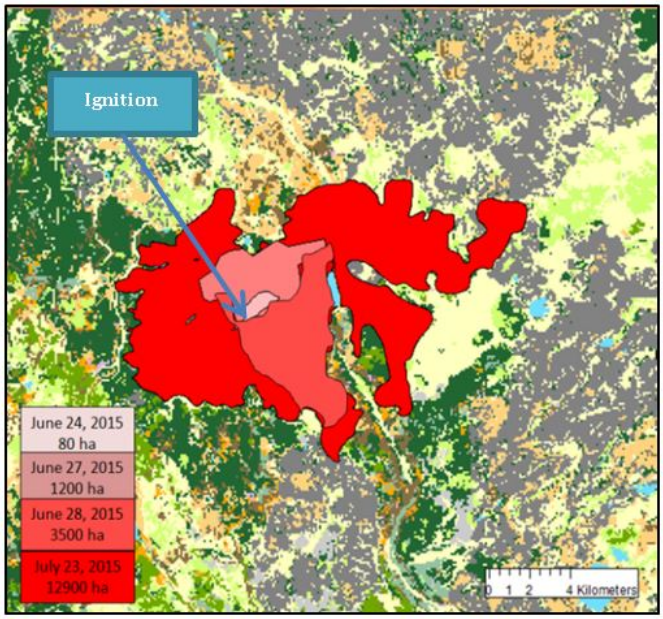


Figure 1. Chronology and growth of the Carbiou Lake Wildfire (LWF-161).

Context

The 2015 fire season was the busiest fire season we have experienced in Lac La Biche since the 2000s. Wildfire behaviour potential was high to extreme for much of May and June and precipitation commonly present in the month of June did not occur (locally known to wildfire staff as the "June Monsoon"). Because the drought and limited precipitation was experienced provincially, staff and resources were limited and many of the wildfires that occurred in the Lac La Biche Forest Area were set to patrol status.

Wildfire Chronology and growth

This case study will follow along the chronology of the Caribou Lake Wildfire (see Figure 1 for wildfire size and containment changes by date from detection to "under control" status). The wildfire was detected by May Wildfire Tower on June 24, 2015 at 1710hrs. The initial assessment was made just 20 minutes later at 1730hrs. The final wildfire size was 12,900 hectares, with the most significant growth from June 26-29.

The Wildfire Environment

Topography

The Caribou Lake Wildfire is situated at an elevation of 750 metres MSL (Figure 2). The majority of the landbase within the wildfire perimeter has 5-7% grade with exceptions near creeks and Caribou Lake where slopes exceed 20%. Due to the rolling topography and generally shallow slopes, it was deemed ground slope effect would be minimal.

Figure 2. Typical Topography at the Caribou Lake Wildfire site.

Forest Fuels

The area was dominated by continuous mature spruce, particularly during the first couple of days (FBP fuel type – C2). Vegetation established after the House River wildfire of 2002, was located to North and East of the wildfire. Fuels within the House River burn were typed as non-fuel on the fuel grid; however it was apparent that these fuels were closer to a S1 fuel type and behaved as such or hotter (Figure 3).

Figure 3. Presence of fuels at the Caribou River Wildfire.

Other vegetation observed in the area included:

• Open fens
• Wetlands
• Old burns

Wildfire Weather
Weather Stations
The two closest and most representative weather stations were located at May Tower (approx. 40 kilometres NW of the wildfire) and Roundhill Tower (approx. 30 kilometres SW of the wildfire). Because of the proximity of Round Hill tower to the wildfire and the lack of visibility due to smoke, the tower person was evacuated from the site. As such, for this case study, only May tower was used.
The closest weather station that was able to provide hourly weather was station L1 which contains a Remote Automated Weather Station (RAWS) unit. While highlights are taken from the hourly weather and reflected in the report, the raw data is available in the complete case study. Click HERE for full report.

Synoptic Weather Observations
*While June 24 and June 25 consisted of higher than average temperatures and low relative humidity, winds were light and steady from the SW.
• June 26: Wind speeds increase to 20G36 kph with wind shifts from SW to NW following the passage of a cold front over the wildfire area.
• June 27: An upper ridge was situated over the Province maintaining high temperatures and lower relative humidities
• June 28: The ridge of high pressure continued to build with shifting winds to NW.
• June 29: A trough of low pressure brought with it a S-SW flow.

Analysis of the Wildfire Environment (WEATHER)

The fire weather indices indicate a shift on June 26 from relatively high values to extreme. Specifically, the fine fuel moisture content (FFMC) reaches the threshold for spot fire potential and the initial spread index (ISI) exceeds 10, which is generally the threshold for crowning potential. In combination with climbing duff moisture code (DMC), drought code (DC) and build-up index (BUI), the wildfire had potential for crowning, spotting and deep burning into the soil – reflected in an extreme fire weather index value of 37 (Table 1). The values continued to climb June 24-June 29, likely due to the development of an upper ridge over Alberta. As indicated by June 30 values, fuel ignition potential begins to drop and continues to do so into July. Table 2 provides a summary of noon observations, things of note and fire observations for each day (from detection to end of fire growth).

Date (2015)	FFMC	DMC	DC	ISI	BUI	FWI
June 23	72	60	380	.7	86	3
June 24	88	65	388	5.9	91	21
June 25	89	70	396	4.2	97	17
June 26	90	74	404	12.5	102	37
June 27	92	79	412	6.4	107	24
June 28	93	84	421	11.5	112	37
June 29	93	89	429	10.5	117	35
June 30	90	93	437	6.7	121	26
July 23	80	8	255	1.6	15	2

Table 1. Fire weather indices for the Caribou Lake Wildfire from May Tower. High to extreme values in RED.

Noon Weather Observations – May Tower					Things of Note	Wildfire Observations		
Date 2015	Temp o	RH %	Wind Speed (kph)	Wind Dir. o		Size (ha)	Fire Status	% contained
24-Jun (Ignition)	24.3	34	12	SW	• Winds relatively light • Ground crews initiate direct attack and bucketing	80	OC	0
25-Jun	27.1	30	2	SW	• Variable Winds • Some direct attack by ground crews and bucketing	350		
26-Jun	24	37	20G36	W	• Cold Front Passage • Wind Shift at 900-1300hrs SW to NW • Indirect attack (dozers)	600		
27-Jun	25.3	30	3	SW	• Wind shifts SW-W-NW-SW at 1600-2200hrs • Wind gusts at 1800hrs • Indirect attack (dozers)	1200		
28-Jun	27.6	28	12	NW	• Wind Shift • Indirect attack (dozers)	3500		
29-Jun	26.6	33	10	S	• Wind Shift as trough of low pressure builds • Indirect attack (dozers)	10000		
30-Jun	25.1	52	9	SW	• Indirect attack, though things begin to recover as RH climb, temperatures drop and winds become light • Inversions begin to impact Round Hill town visibility	10000		

Table 2. Weather indices from May Tower in relation to the wildfire size, status and containment from June 24-29, 2015. RED - notable values.

How the weather influenced the wildfire:

JUNE 24

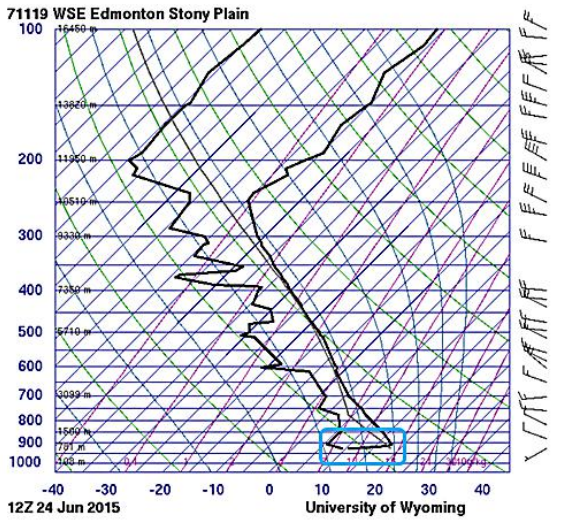
- Wildfire grew to the NE under light-moderate SW winds.
- Growth likely limited due to ignition time and moderate FWI (Table 1).
- FWI begins to build on this day, however, still unfavourable for aggressive fire growth.

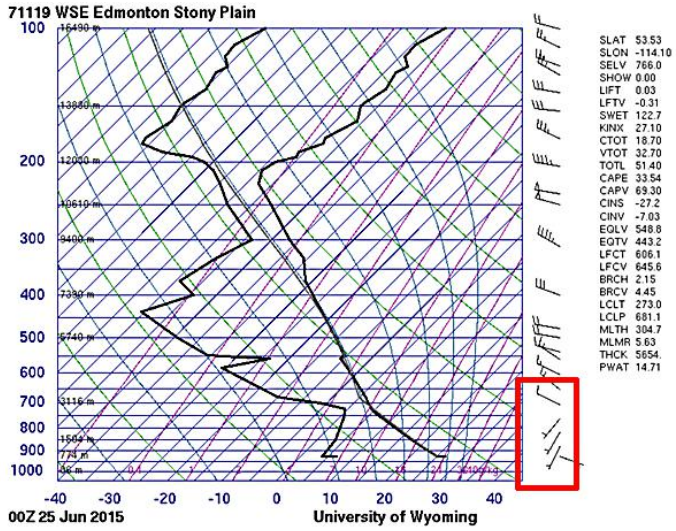
NOON WEATHER OBSERVATIONS MAY TOWER				WILDFIRE OBSERVATIONS		
Temp (o)	RH (%)	Wind Speed (kph)	Wind Dir	Size (ha)	Wildfire Status	% Contained
24.3	34	12	SW	80	OC	0
THINGS OF NOTE FROM THE FIRELINE						
Wildfire Detected						
Winds relatively light						
Ground crews initiate direct attack & Bucketing commenced						
Good Visibility						

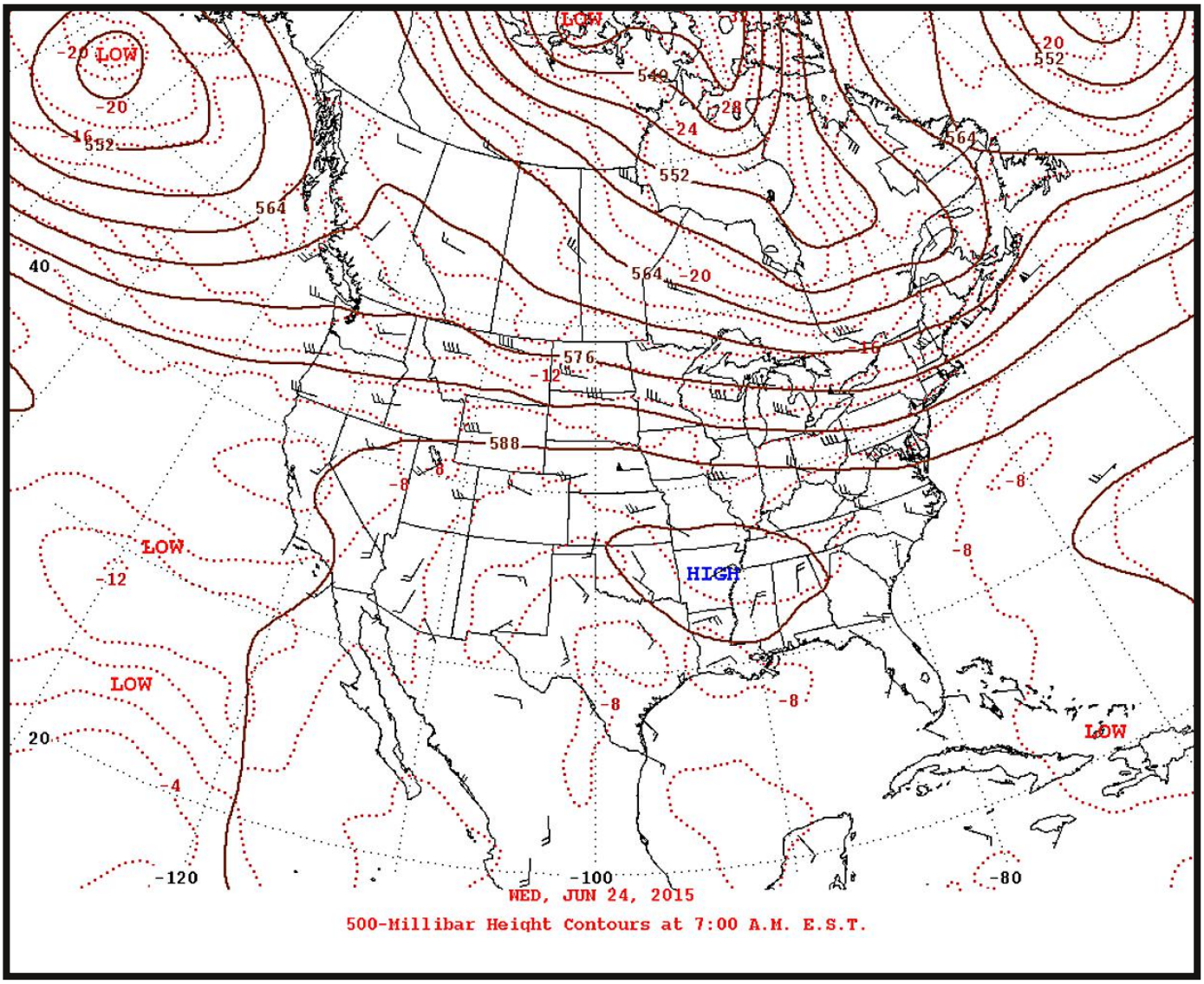
	Reasoning based on Sounding Data
Winds relatively light	Dew point (left line) and temperature (right line) spread indicate lack of cloud presence "Shallow" CAPE* indicates limited potential for deep convection or instability The wind barbs on the right indicate light surface winds (red) No indication of a low level jet
Good Visibility	Morning inversion appears to be strong but shallow (blue) – likely broke in the early morning providing for air (and smoke) to rise

*CAPE = conventive available potential energy

	Reasoning based on 500mb chart
Winds light-moderate	Contours appear to be neither in a trough nor ridge position, straight across horizontal. Ridge lines far away from each other indicate potential for light winds
Good Visibility	No indication of a low on the charts







JUNE 26

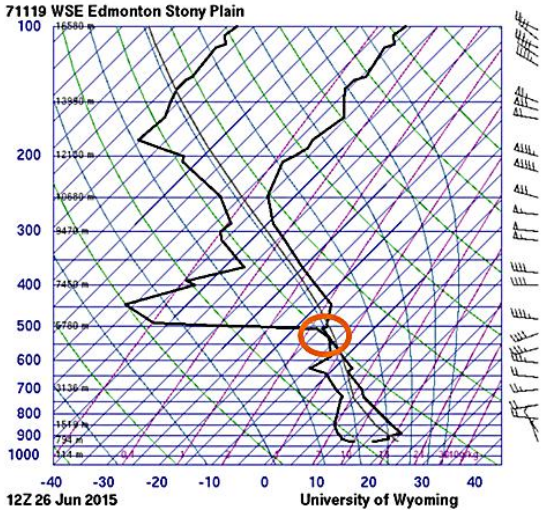
• High winds associated with the passage of the cold front contributed to the wildfire doubling in size.
• The wildfire grew predominately to the east due to high winds shifting from SW to NW.
• Crossover by 1400hrs contributed to uptrend in FWI (FFMC, BUI and elevated ISI) sending the indices into very high to extreme levels indicating an increase in available fuel (elevated ROS and growth).
• June 26 marks the start of crossover conditions.

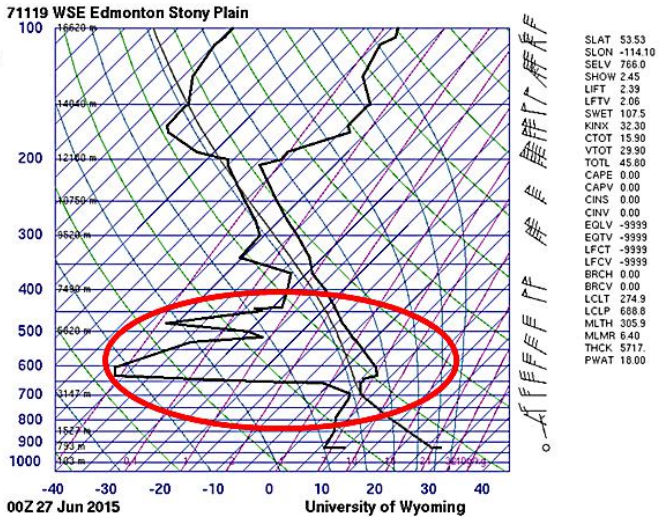
NOON WEATHER OBSERVATIONS – MAY TOWER				WILDFIRE OBSERVATIONS		
Temp (o)	RH (%)	Wind Speed (kph)	Wind Dir	Size (ha)	Wildfire Status	% Contained
24	37	20G36	W	600	OC	0
THINGS OF NOTE FROM THE FIRELINE						
Crossover at 1400hrs						
Wind shift at 0900-1300hrs SW to NW						
Wind 15km/hr gusting 35-40kph from 1100hrs – 1800hrs						
Wildfire doubled in size						
Indirect attack (dozers)						

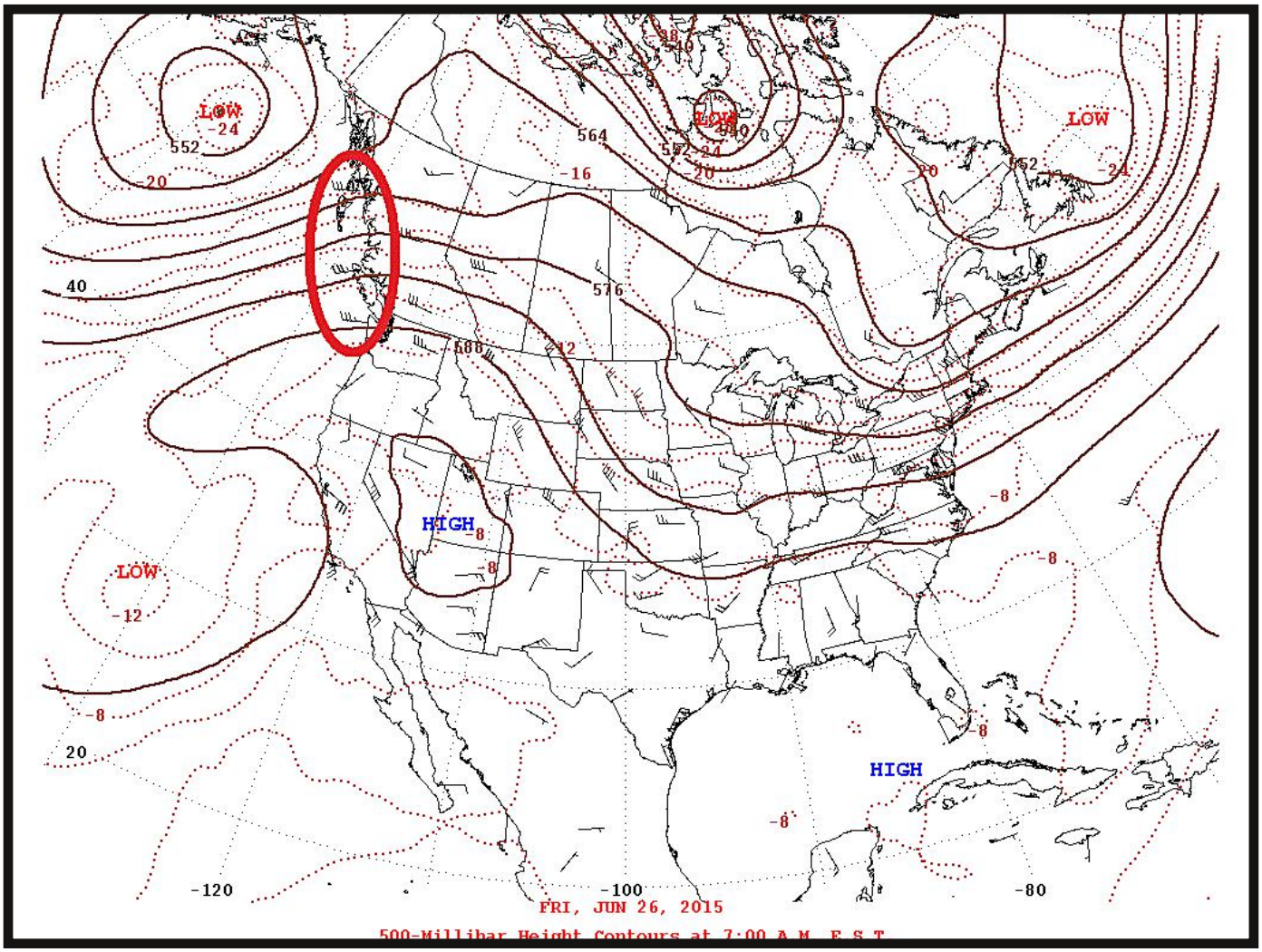
0900hrs

1700hrs

	Reasoning based on Sounding Data
Morning Wind Shift & Wind Gusts	AM sounding indicates a presence of clouds (orange); however they appear to be cleared by peak burn increasing temps and lowering RH. A dry air mass (red circle) appears to sink over the day due to subsidence causing potential for increased winds. No precipitation associated with the cold front due to subsidence occurring in the warm air due to adiabatic warming. Below orange circle, a weak low level jet is also present which may also have contributed to winds.
Crossover at 1400hrs	Given the movement of the clouds by peak burn, it is likely that in combination with the high winds, the area could have achieved crossover earlier than previous days. In addition, the AM sounding illustrates a weak inversion that likely broke early in the day. The large dry air mass (red) sinks over the day (subsidence) causing increased warming.





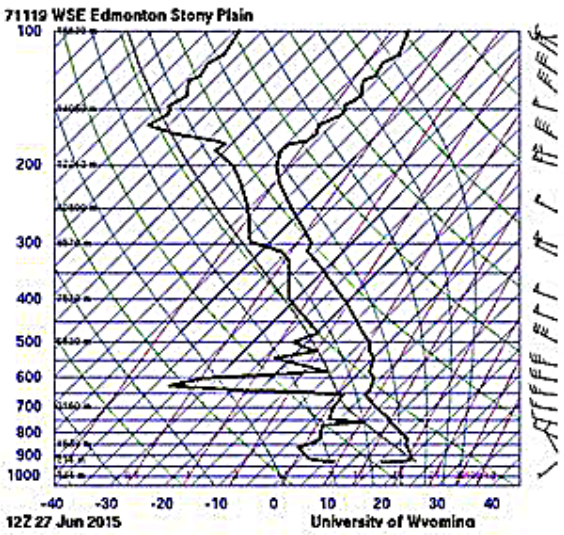


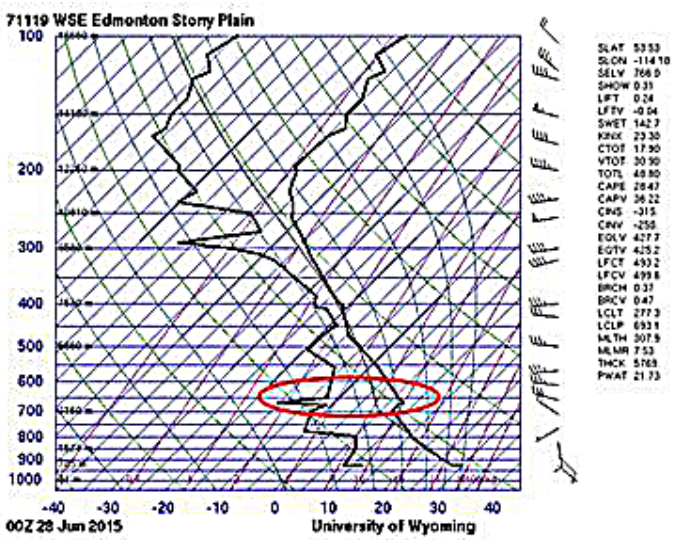
JUNE 27

- The wildfire doubled in size.
- Crossover was apparent by 1100hrs which indicates, despite 70% RH overnight, fuels were available to influence significant growth for a longer period of the day.
- Daytime heating and high winds aloft mixing to the surface contributed to fire spread.
- Presence of inversion in the morning likely prevented opportunity to apply sufficient suppression on the wildfire.

NOON WEATHER OBSERVATIONS – MAY TOWER				WILDFIRE OBSERVATIONS		
Temp (o)	RH (%)	Wind Speed (kph)	Wind Direction	Size (ha)	Wildfire Status	% Contained
25.3	30	3	SW	1200	OC	0
THINGS OF NOTE FROM THE FIRELINE						
Wind shifts SW-W-NW-SW at 1600-2200hrs						
Wind gusts at 1800hrs (24kph)						
Crossover 1100-2000hrs						
Indirect attack (dozers)						

	Reasoning based on Sounding Data
Wind shifts at peak burn	The low level jet weakens over the day, contributing to the mixing of air and shifting of winds
Wind gusts at peak burn	Presence of a weak low level jet could have potentially contributed to wind gusts
Crossover 1100-2000hrs	Wide spread between temp and dew point on the sounding indicates dry air mass





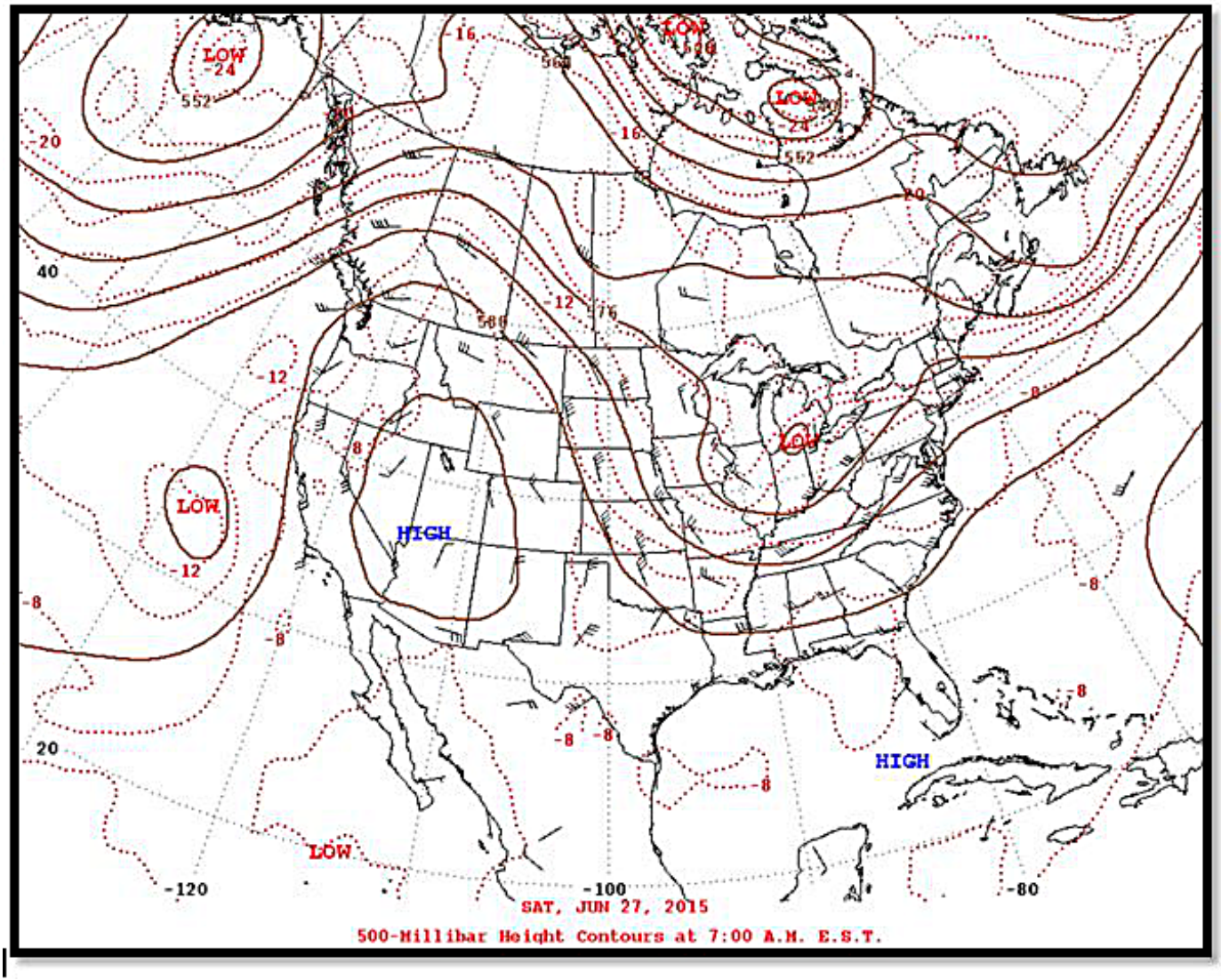
	Reasoning based on 500mb chart
Wind gusts @ peak burn	Bars indicate high winds
Crossover 1100-2000hrs	Strong upper ridge formed over the Province promoting drying conditions

FireSmart

Wildfire Exposure Assessment

A planning tool for identifying values at risk and prioritizing mitigation effort.

Learn about the steps taken to complete the assessment and the meaning of the results. You may be a homeowner, a municipal or government employee, a FireSmart consultant, or part of the many other organizations involved in protecting communities from wildfire. If you are concerned about protecting your home, neighbourhood or other values from wildland fire, the findings of a Wildfire Exposure Assessment can help you take action – and this guide explains how it all works. CLICK HERE for information



JUNE 28

• Marks the biggest wildfire growth day. The Wildfire was able to burn all day on the 28 and into early afternoon on the 29.

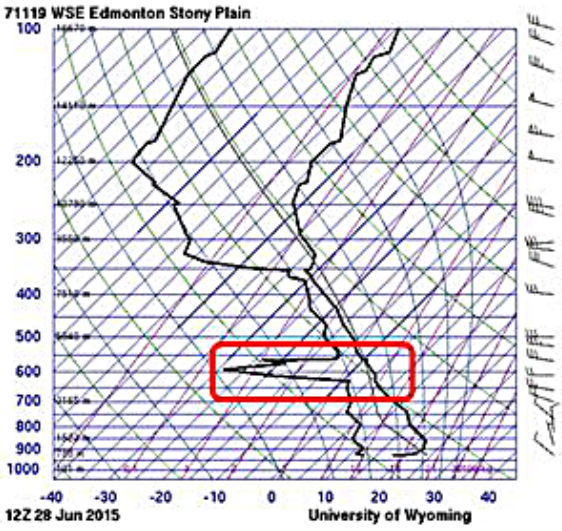
• Early in the morning, winds shifted to a N-NW flow which contributing to fire growth to the S-SE.

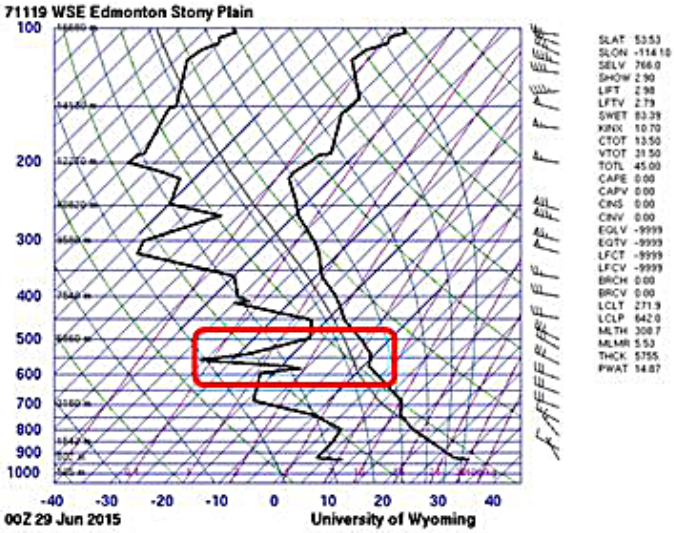
• High temps and low RH were present due to a persisting upper ridge over Alberta which contributed to further drying of the fuels – all FWI were at extreme – spotting potential was high (FFMC > 92).

• Daytime heating may have contributed to the increased winds, because it was indicated that winds dropped off during the evening.

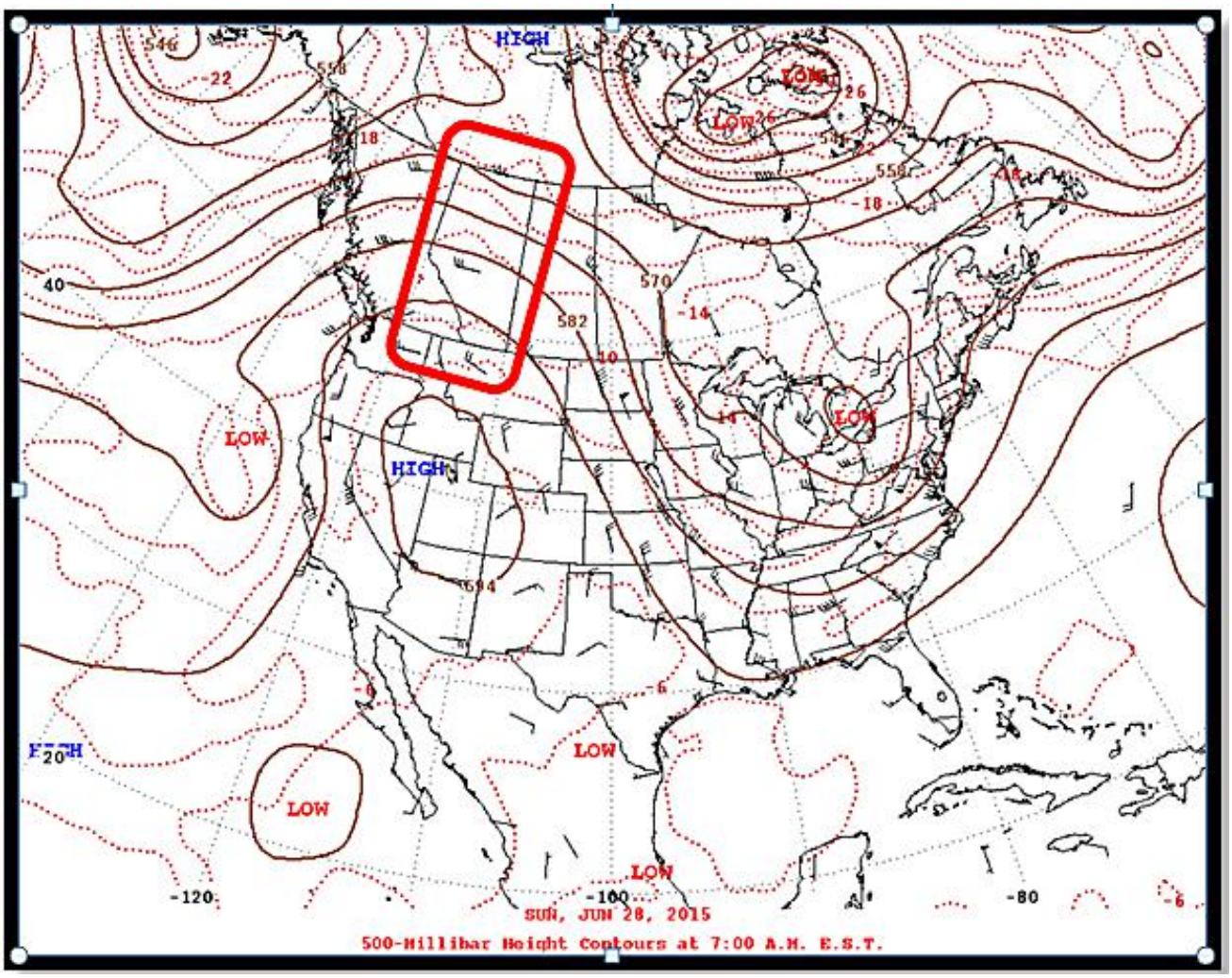
NOON WEATHER OBSERVATIONS – MAY TOWER				WILDFIRE OBSERVATIONS		
Temp (o)	RH (%)	Wind Speed (kph)	Wind Direction	Size (ha)	Wildfire Status	% Contained
27.6	28	12	NW	3500	OC	0
THINGS OF NOTE FROM THE FIRELINE						
Wind Gusts (30 kph)						
Indirect attack (dozers)						
Overnight, light winds and high RH recovery in the 70s with presence of inversion						

	Reasoning based on Sounding Data
"High" crossover	Peak burn sounding illustrates a wide spread between dew point and temp indicating dry air
Wind Gusts (30 kph)	A mid-level dry slot is present (red) which contributes to evaporative cooling and instability. Low level directional wind shear is also present in the barbs to the right.





	Reasoning based on 500mb chart
"High" crossover	Upper ridge persists as indicated by the shape of the contours (red)
Wind Gusts (30 kph)	Contours tighten (red) indicating the potential for higher winds

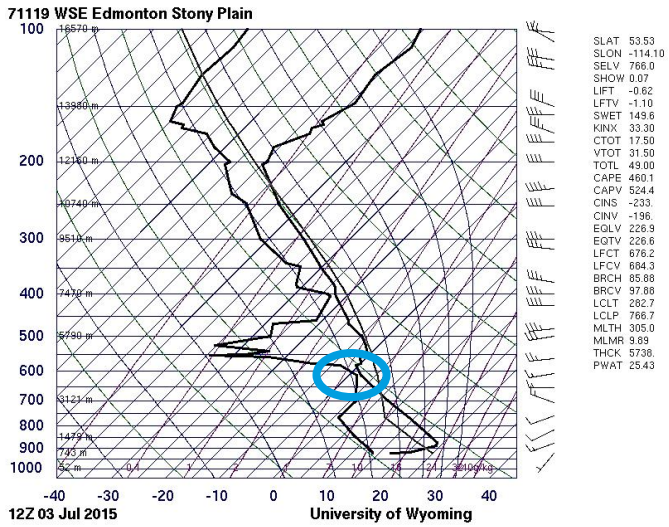


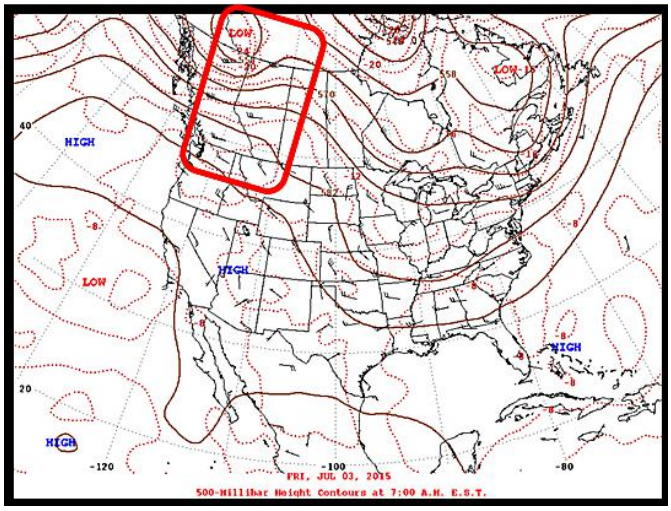
JULY 3-4

• Wildfire growth was reduced due to the weakening of the upper ridge and development of cloud cover leading to the lowering of temperatures and increasing in RH (no crossover).
• Winds subsided over the day providing an opportunity for successful direct attack and further reduction in growth.
• No real significant growth occurred past this day due to successful direct attack (and weather providing the opportunity to do so) and due to the presence of a trough moving in from the west which was fully established by July 4th.

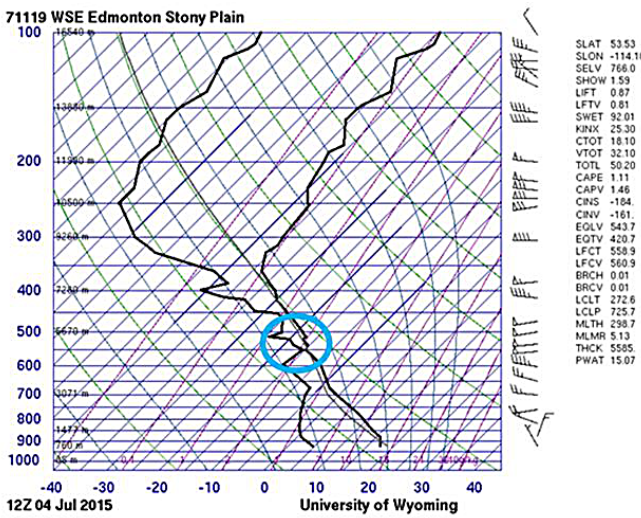
Weather Tool	Feature
500mb	Upper Ridge Breakdown begins on the morning of July 3rd (red). A trough is present by July 4th dampening the potential wildfire behaviour by increasing the RH and lowering temperatures.
Sounding	Presence of cloud (blue) on July 3-4 (indicated by dew point = temperature) likely attributed to light winds, low temps and high RH which helped to dampen growth and aggressive wildfire behaviour. As such, the wildfire was 10% contained on July 4th.

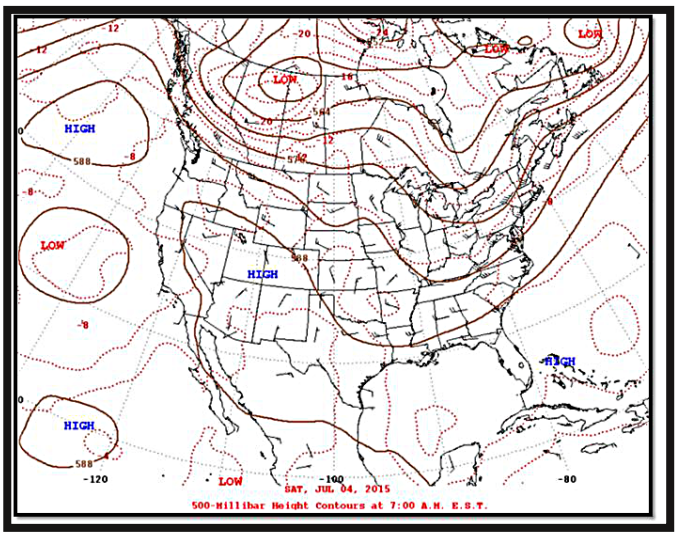
July 3 @0600





July 4 @0600



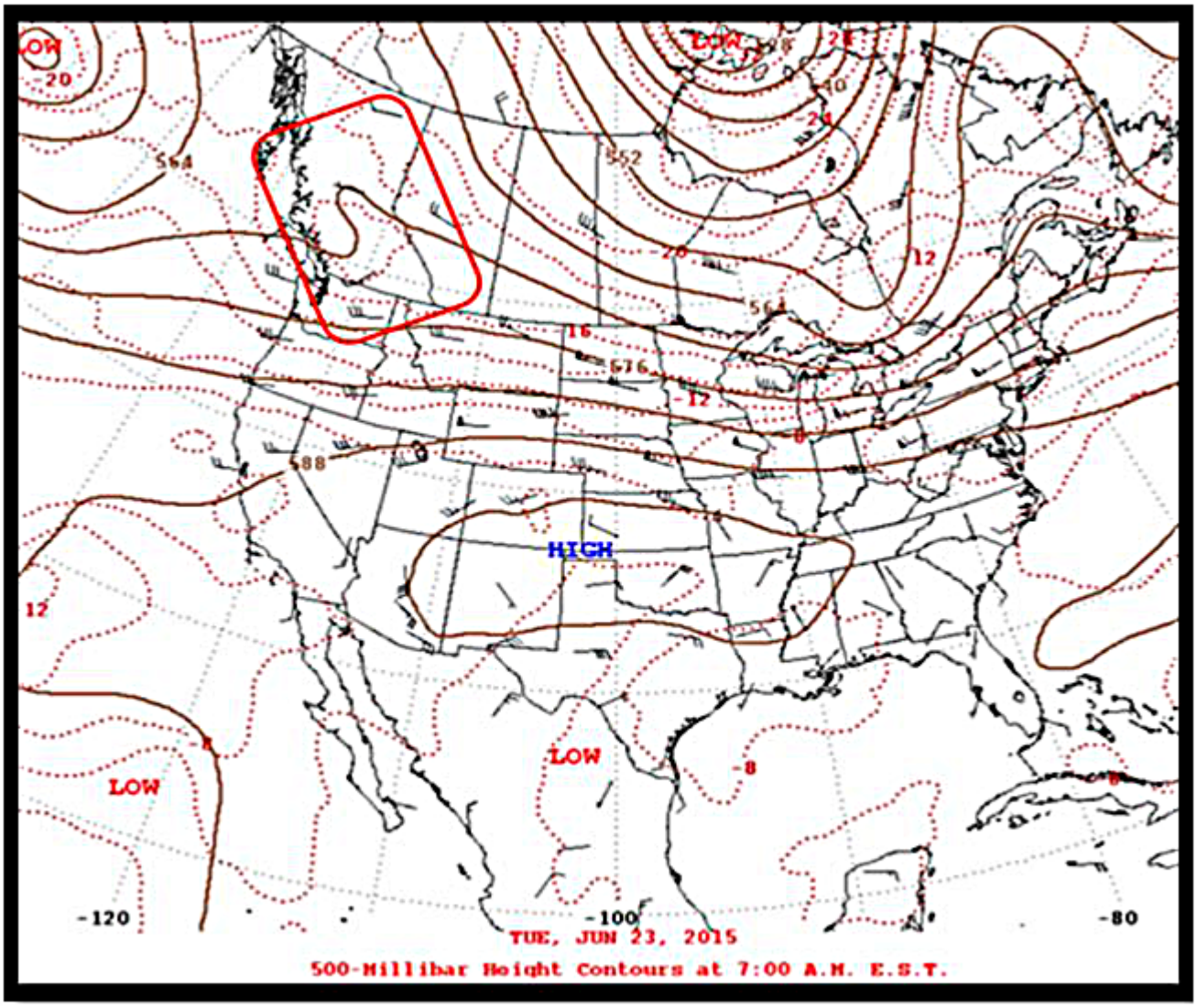


Summary

The wildfire was detected on June 24, 2015 which was the start of an FWI uptrend for the area for that year. Fine fuels, which are the main driver for ignition in spring in Lac La Biche, were essentially unavailable for ignition on June 23, indicated by a FFMC value of 72 and inability for sustained combustion as indicated by a FWI of 3.

You can see from the 500mb chart (below) that the ridge is beginning to build the day prior to ignition (June 23), however not enough to support the conditions required for combustion and growth. On the day of ignition, we see temperatures beginning to climb and RH lower in conjunction with the building of the ridge of high pressure, but really just at the bottom end of FWI's indication of potential growth (FFMC 88). Crossover conditions are first seen on June 26 and as such, we see the start of significant fire growth. June 28 saw the highest growth due to the wind shift from SW to NW that persisted with high winds through the day. Significant growth continued until June 29 with the end of crossover due to development of clouds, increase in short wave upper troughs and weakening of the upper ridge.

During the early phase of growth of the Caribou Wildfire, the dominant weather features experienced on the fireline were easily explained through the use of various weather tools. These tools include upper air soundings, radar, surface maps and the 500mb maps; among others. This case study provided an opportunity to utilize the tools in order to better understand their function and use.



WILDFIRESAT:
A new Canadian wildfire monitoring satellite system on the horizon

by Joshua Johnston[1], and Helena van Mierlo[2]

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[2] WildFireSat Mission Manager, Canadian Space Agency, helena.vanmierlo@canada.ca

The Canadian Space Agency (CSA) has initiated the development of a satellite system called WildFireSat with the purpose of monitoring active wildfires. The initiative responds to a need identified by Natural Resources Canada (NRCan)'s Canadian Forest Service (CFS), Environment and Climate Change Canada (ECCC) and academia, to increase Canada's ability to monitor wildland fires within Canada.

On April 24 the CSA issued a Phase-A request for proposals that would award up to two contracts to execute the "System Definition Phase" during which the system conceptual design, the System Requirements, and the Operations Requirements are developed for this wildfire monitoring satellite dubbed WildFireSat (WFS).

Back in 2013, the Canadian Wildland Fire Monitoring System (CWFMS) (now referred to as WildFireSat) was proposed as one of five microsatellite missions to undergo a feasibility study which was carried out in 2014-2016. Several Space Technology Development Program (STDP) activities have been carried out since to increase the maturity of the proposed mission enabling instrument technology.

WildFireSat intends to provide:

- Near real-time information in support of wildland fire management and research;
- Emission measurements in support of international requirements for carbon reporting;
- Improved smoke and air quality forecasting.

WildFireSat will cover the whole of Canada on a daily basis, with an overpass late afternoon, during peak burning time (Figure 1). In contrast to most other polar orbiting missions which typically have a data latency of three hours or more, WildFireSat intends to deliver its data to its users within 30 minutes. It should be emphasized that WFS represents a wildfire monitoring capability. A key mission objective of

Do you take amazing photographs? If so, we'd like to consider one of your images for a new book tentatively titled: The Past and Future History of Wildfire. Written by Ed Struzik, and the introduction by Mike Flannigan. It will be published in fall 2020 by McGill-Queen's University Press.

The publisher is currently looking for extraordinary photographs that relate to indigenous burning, prescribed burning, evacuations, lighting, and wildfire, pyro-cbs, wildlife, and fire, as well as any photo that really stands out and could be used for the cover.

Please send your submissions to edwstr@telus.net Submission deadline is October 31,2019.

Photos must be digital and may be submitted at a lower resolution for initial consideration. If your photo is selected for our long list you will be contacted and asked to submit a high definition digital version of your photo.You may submit more than one photograph, but please no more than five. If your photo is chosen for our book, we'll present you with a signed copy of the finished book, and of course you will be identified as the photographer in the photo caption. Compensation for the cover photo will be discussed once chosen.

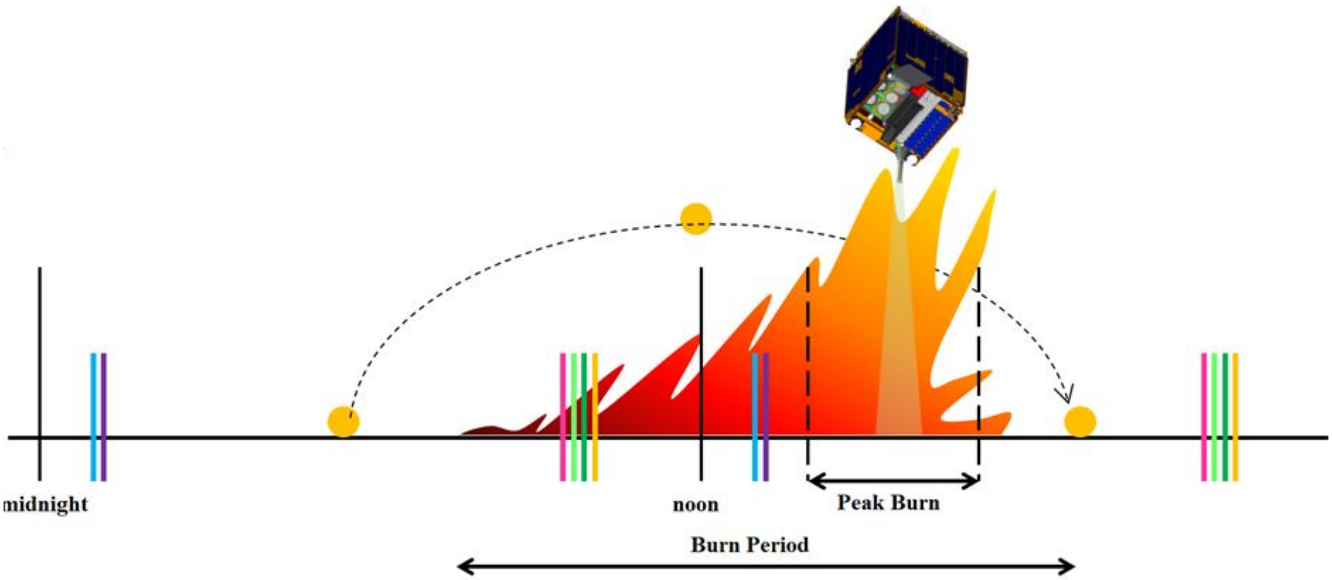


Figure 1 – Distribution of polar-orbiting satellite overpasses within the diurnal fire cycle. Coloured bars approximate the overpass times of MODIS Terra (dark green) and Aqua (blue), VIIRS Suomi-NPP (purple), SLSTR Sentinel 3-a,b (light green), Sentinel-2 (orange) and Landsat-8 (pink). WildFireSat aims to fill a crucial gap in peak burn fire monitoring, and to be used in conjunction with existing systems.

WFS is to monitor accurately the radiated power from wildfires to infer their characteristics and be able to improve fire management practices and report on carbon emission. The mission would confirm that the current selection of spectral bands and algorithms is adequate to retrieve fire characteristics with the desired accuracy.

As such, the WFS mission will serve as a stepping stone to accomplish the long-term objective of establishing a new, potentially commercial, fully operational 24/7 service in the future. WFS could help prepare the user community in Canada and possibly abroad, and thus create the customer-base that would be needed for a future global operational data service to be commercially viable.

NSERC CONNECT: Building a Wildfire Management Network

by Mike Flannigan
Director, Canada Wildfire, flanniga@ualberta.ca

Recently, we have seen catastrophic and deadly wildfires around the world. In Canada, recent examples of such events include the Fort McMurray wildfire (the costliest natural disaster in Canadian history) and a record breaking year for area burned in British Columbia in 2017 and 2018. Wildfires have contributed to a drop in National GDP and significant evacuations of communities across Canada. On average, 7,000 wildland fires burn about 2.5 million ha (about half the size of Nova Scotia) every year. The area burned has more than doubled since the 1970s primarily due to human-caused climate change. Impacts from wildfires are rising due to increasing wildfire activity along with increasing societal values on the landscape. Canadian wildfire management agencies currently spend an average of $800 million every year protecting Canadians and these expenditures are steadily growing. The need for research to address wildfire management research is pressing and will only grow more urgent with climate change.

The wildfire management research community is fairly small in Canada so working together and coordinating our research efforts is a logical approach. The NSERC Connect programme provided an opportunity to bring together the wildfire community. Representatives from the BC Wildfire Service, Yukon Wildland Fire Management, Department of Environment and Natural Resources, Alberta Agriculture and Forestry, Northwest Territories Department of Environment and Natural Resources, University of BC, University of Alberta, McMaster University, University of Toronto, Canadian Forest Service (CFS), Canadian Interagency Forest Fire Centre (CIFFC), NSERC, and ICLR attended the workshop in Victoria on April 16-17. Discussions included looking at other fire research networks around the world, research strategies and activities, funding opportunities, network objectives and how we get from where we are to where we want to be. This was a first step and we hope to have another workshop in the fall and winter to build on what was started with this augural workshop.

PODCASTS COMING 2019

Join Amy Christianson and Matt Kristoff with various guests from all over the world to discuss Good Fire: Stories of Indigenous fire stewardship, follow @CanadaWildfire for updates.

TO LEAVE OR NOT TO LEAVE: Understanding indigenous experience of evacuation in Canada

by Tara McGee

Professor, Department of Earth and Atmospheric Sciences, University of Alberta, tmcgee@ualberta.ca

Professor Tara McGee in the Department of Earth and Atmospheric Sciences is taking a closer look at the experiences of indigenous communities during wildfire evacuations—and how these findings can aid in policy development for future evacuation needs. Photo credit: John Ulan

For members of indigenous communities, the question of abandoning home during mandatory wildfire evacuations is a complicated one, according to new research by a researcher in the University of Alberta's human geography program.

The research—examining the experiences of Mishkeegogamang Ojibway Nation in Ontario during a mandatory wildfire evacuation in 2011—is the first to examine the reasons behind why indigenous people did or did not want to leave their communities during mandatory wildfire evacuations.

While some residents wanted to leave, others were reticent until being encouraged by fellow community members or directed to leave by law enforcement, explained Tara McGee, professor in the Department of Earth and Atmospheric Sciences and lead author on the study.

"People also wanted to stay within their community and traditional territory, because that is home," said McGee. "In some cases, people had never left their traditional territory before, and the idea of going to a town where they had never been was extremely unfamiliar during an already traumatic time. As a result, quite a few people either wanted to stay or actually did stay behind."

Evacuation in the event of wildfires generally brings evacuees to large municipal centres, with resources and housing already in place in towns or cities. But for indigenous communities, this may not be the best way forward.

"We need to investigate the option of, when faced with a fire or a threat, allowing people to stay within their traditional territory safely, if there are the resources to do that," said McGee. "Alternatively, evacuating to another indigenous community. That way, access to appropriate supports and language barriers would not present issues the same way as when people are evacuated to large, unfamiliar towns and cities."

McGee hopes that future research will take her to other provinces and territories in Canada to understand how other indigenous communities respond to evacuation notices. She hopes these findings will aid in federal, provincial, and regional policy development for future evacuation needs.

This publication is part of the First Nations Wildfire Evacuation Partnership. The paper, "Residents' wildfire evacuation actions in Mishkeegogamang Ojibway Nation, Ontario, Canada," in the International Journal of Disaster Risk Reduction (doi: 10.1016/j.ijdrr.2018.10.012).

Go to www.ibama.gov.br/wildfire2019-eng for more information

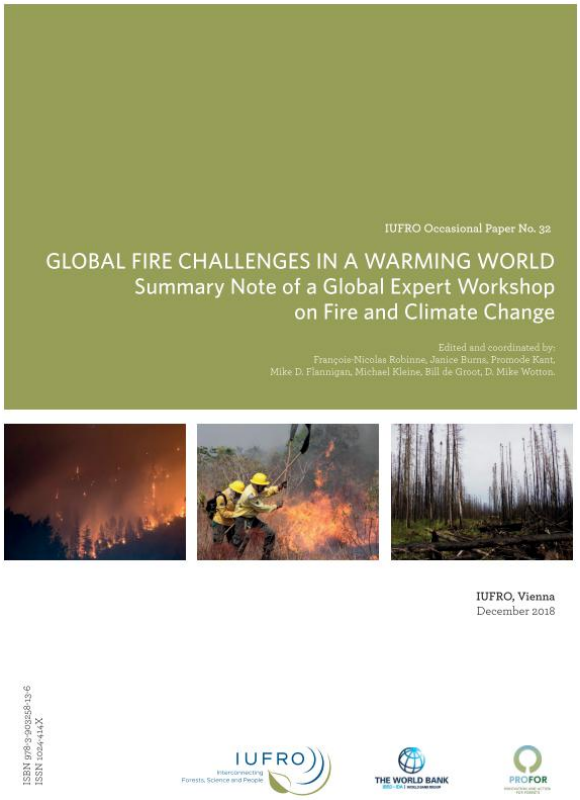
OCTOBER 28-NOVEMBER 1
IWF Conference provides a forum for wildland fire managers, leaders, politicians, professionals, researchers and practitioners from around the globe to discuss and work on critical fire issues affecting people, communities, resources and ecosystems in a cooperative way aiming the consolidation of the Global Wildland Fire Management Strategy.

GLOBAL FIRE CHALLENGES IN A WARMING WORLD

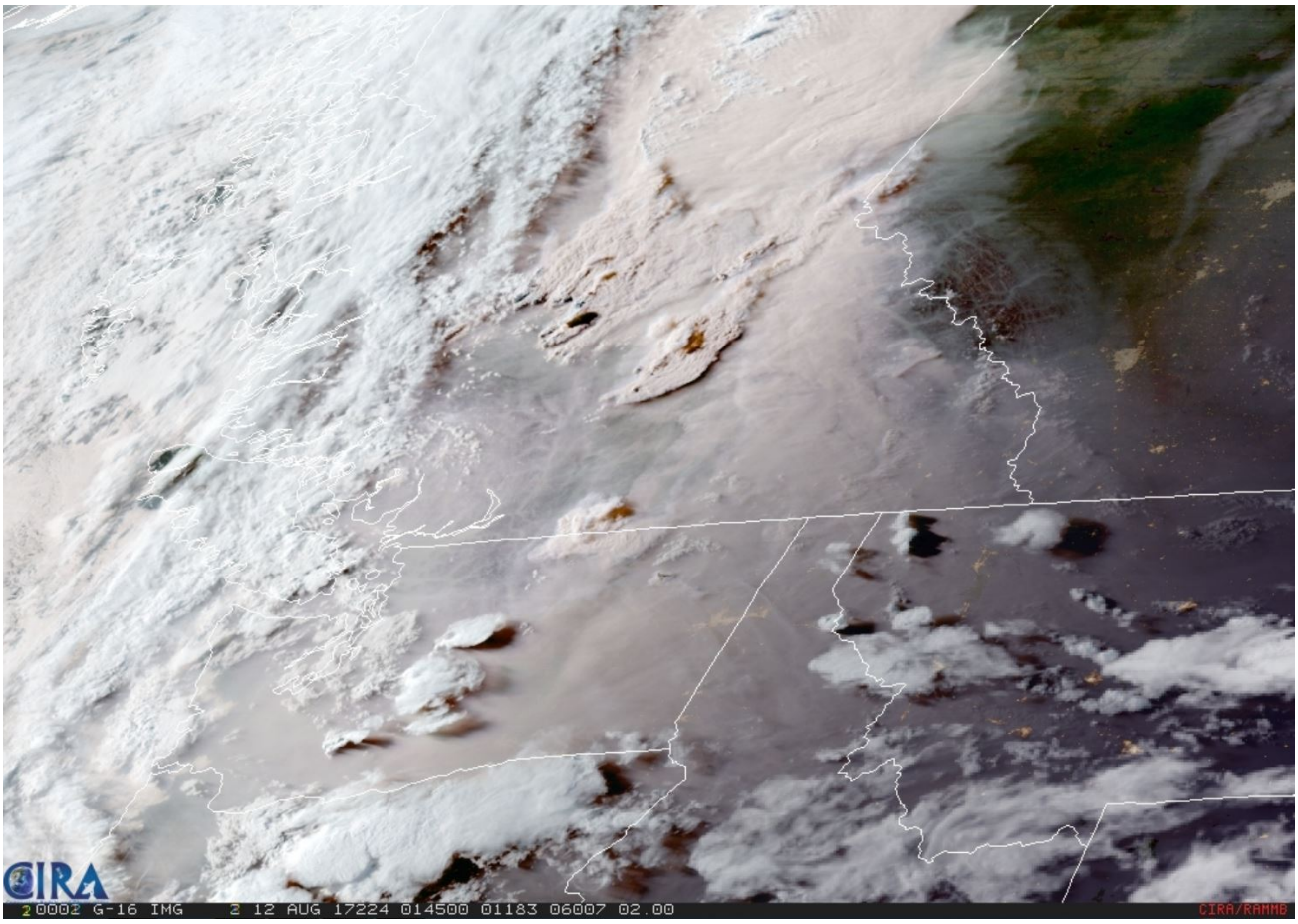
by François-Nicolas Robinne
Postdoctoral Fellow, Global water futures & Canada Wildfire, robinne@ualberta.ca

Today, catastrophic wildfires are increasingly common across the globe. Recent disasters have attracted media attention and strengthened the perception of wildfires as "bad" events, a financial nightmare for insurers, basically a plague worsened by climate change that has yet to be eradicated. Although it is true that fire has a destructive potential, the reality of global fire activity depicts a much more complex picture in which fire can be a useful, if not necessary, tool for food security and the preservation of cultural landscapes, as well as a necessary process promoting the healthy functioning of many natural ecosystems and the services they provide.

In view of this, the International Union of Forest Research Organizations (IUFRO) in association with the World Bank's Program on Forests (PROFOR) jointly convened a Global Expert Workshop on Fire and Climate Change with the aim of improving the understanding of the complex interrelations between wildfire, climate, and land management, and of identifying urgently required response strategies and actions to be undertaken at an international level.



The 3-day workshop resulted in the publication of a summary note edited by Canada Wildfire's team members. This document is the product of a large collaborative effort by fire scientists and practitioners who believe that learning to co-exist with changing fire activity is not only possible but necessary if we, as a global society, are to adapt to climate change and keep our natural and cultural landscapes healthy, resilient, and safe for the next generations. The work presented hereafter was developed during, and as follow-up to, the Global Expert Workshop on Fire and Climate Change hosted in Vienna, Austria, in July 2018. It stresses the diversity and the complexity of the global fire situation, a situation that is evolving, positively or negatively, in unknown proportions due to global environmental changes — with climate change being the most acknowledged manifestation.
The full paper is available on IUFRO's website, here.



NATIONAL SMOKE FORUM - Ottawa, November 2019

by Ginny Marshall
Wildfire Analyst, Canadian Forest Service, ginny.marshall@canada.ca

Wildland fire smoke is an increasing concern for not only for the public, but for firefighters and other emergency personnel. Over the last 60 years, Canada has seen a steady rise in the number of large fires, area burned, and length of the fire season (Hanes et al., 2019). Similarly, the number of evacuations related to fire and smoke has increased nationally since 1980 (Natural Resources Canada, 2019). Looking forward, we expect a further increase in extreme conditions conducive to wildland fire with changing climate (Wotton et al., 2017; Wang et al., 2017), which translates to increased fire and smoke, and consequently, a potential rise in evacuations and negative smoke-related health impacts. As a result, there is a growing need to better predict wildland fire smoke, effectively communicate the risks, and better assess and manage the related health effects.

To address the growing wildland fire smoke issues, and to bring the wildland fire smoke community together to share ideas, research, best practices, and recommendations, the first Canadian National Smoke Forum was held in Halifax, in October 2014 immediately following the Wildland Fire Canada Conference. Two years later, the second National Smoke Forum was held in Kelowna, BC, also collocated with the Wildland Fire Canada Conference. Presentation and discussion topics at both forums included research and case studies related to smoke prediction, health impacts, emergency management, preparedness, and individual experiences. Both events were recognized as valuable and were well attended.

In an effort to foster communications and encourage new relationships, and in partnership with the Wildland Fire Canada Conference, we are proud to announce the integration of the National Smoke Forum

within the conference as a new partner theme. This merger supports the combined goals of the National Smoke Forum, communicating and improving understanding of smoke impacts, as well as this year's Wildland Fire Canada Conference theme, New Paths, New Partnerships.

We encourage interested persons to submit abstracts for talks or posters related to smoke through the main conference website: www.wildlandfire2019.ca. Our focus for this conference will be to examine strategies and tools used to assess and manage the impact of wildland fire smoke on firefighters and the general population. Topics can include advancing science on health impacts, development of smoke modelling tools and improving communications to protect health.

Smoke management is not any single organizational responsibility and it requires a multidisciplinary cooperation of municipal, provincial and federal agencies. These agencies include, but are not limited to, emergency management, health, environmental, meteorological, fire management, and community leaders. Furthermore, since smoke and fire are intrinsically linked, emerging issues cannot be separated into individual fields, and it is necessary to ensure open and frequent communication between all parties.
We hope to see you in Ottawa this November!

National Smoke Forum Organizing Committee:
• Didier Davignon, National Coordinator, Health Related Environmental Forecast Products, Environment and Climate Change Canada
•Jeff Eyamie, Air Quality and Health Specialist, Health Canada
• Sarah Henderson, Senior Scientist, BC Centre for Disease Control
• Ginny Marshall, Wildfire Analyst, Canadian Forest Service
• Brian Simpson, Wildland Fire Manager, Canadian Forest Service
• Cindy Walsh, Air Quality Science Specialist, BC Ministry of Environment & Climate Change Strategy
**Article photo is a screenshot of an image loop from RAMMB available click here

NOTE: This informal newsletter is produced on behalf of the wildland fire and smoke communities. Articles from government, industry and academia, whether Canadian or international, are welcome. Please visit our website or send an email to wildfire@ualberta.ca for author guidelines. Views and comments in these articles are those of the authors or the organizations they represent, and do not necessarily reflect the views of the Canadian Wildland Fire and Smoke Newsletter.