



Weather and Fire in a Changing Climate

2025-10-14

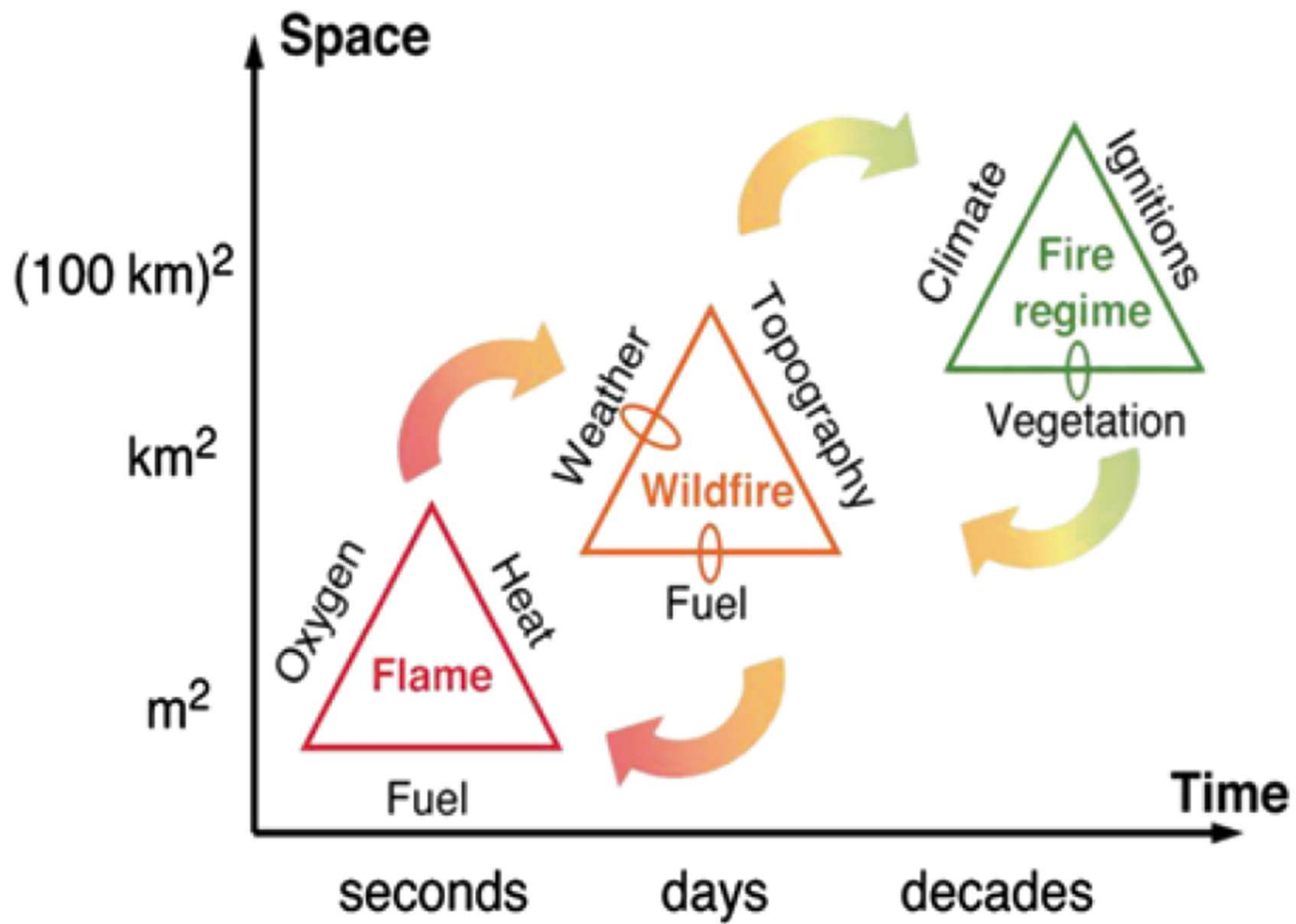
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Canada Wildfire

Who is here?

- Me
- You
 - Firefighters?
 - Planners and decision makers?
 - Just Interested?
- Who has family who are firefighters?
- Who has (heard) fire stories?

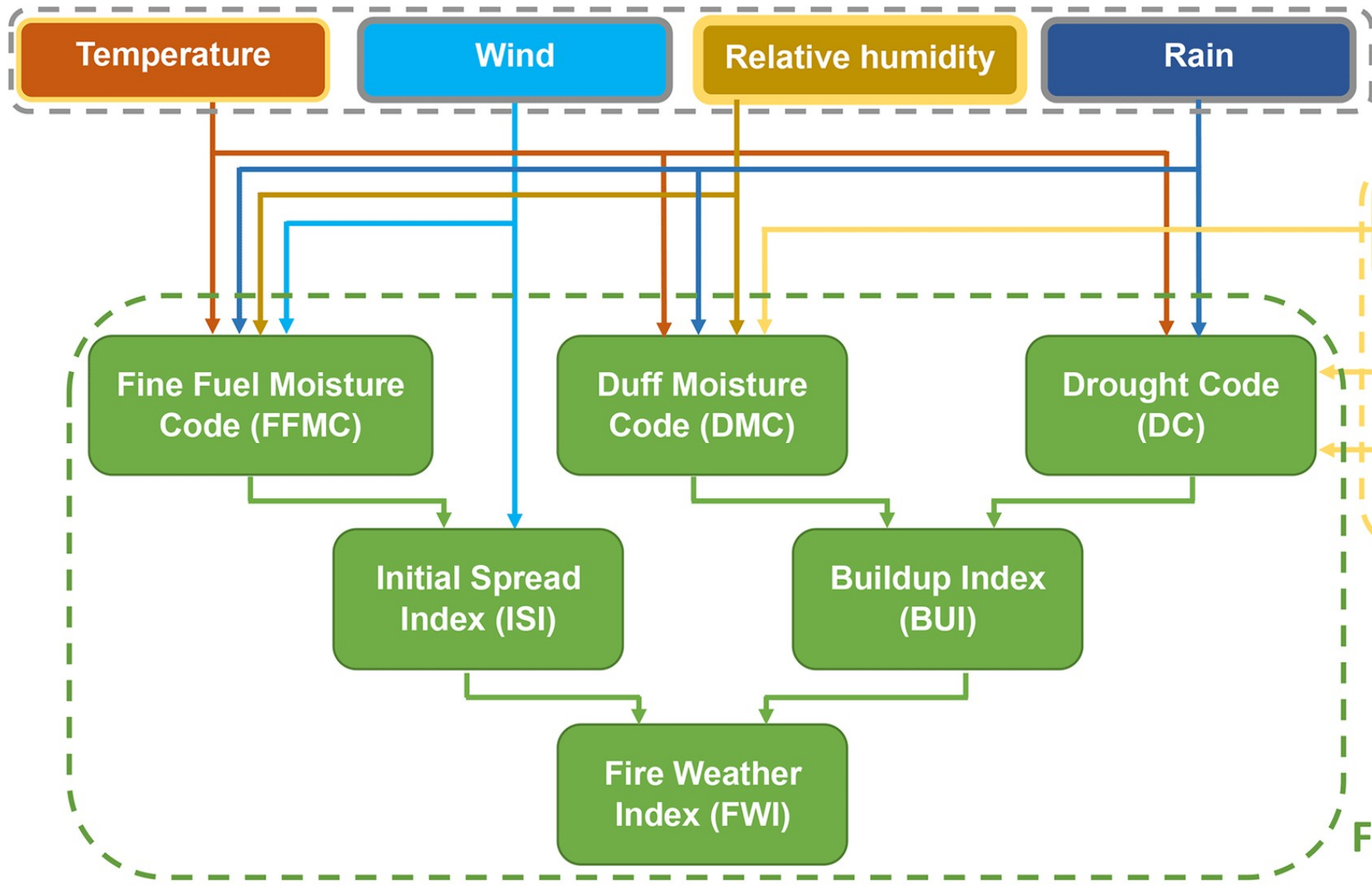


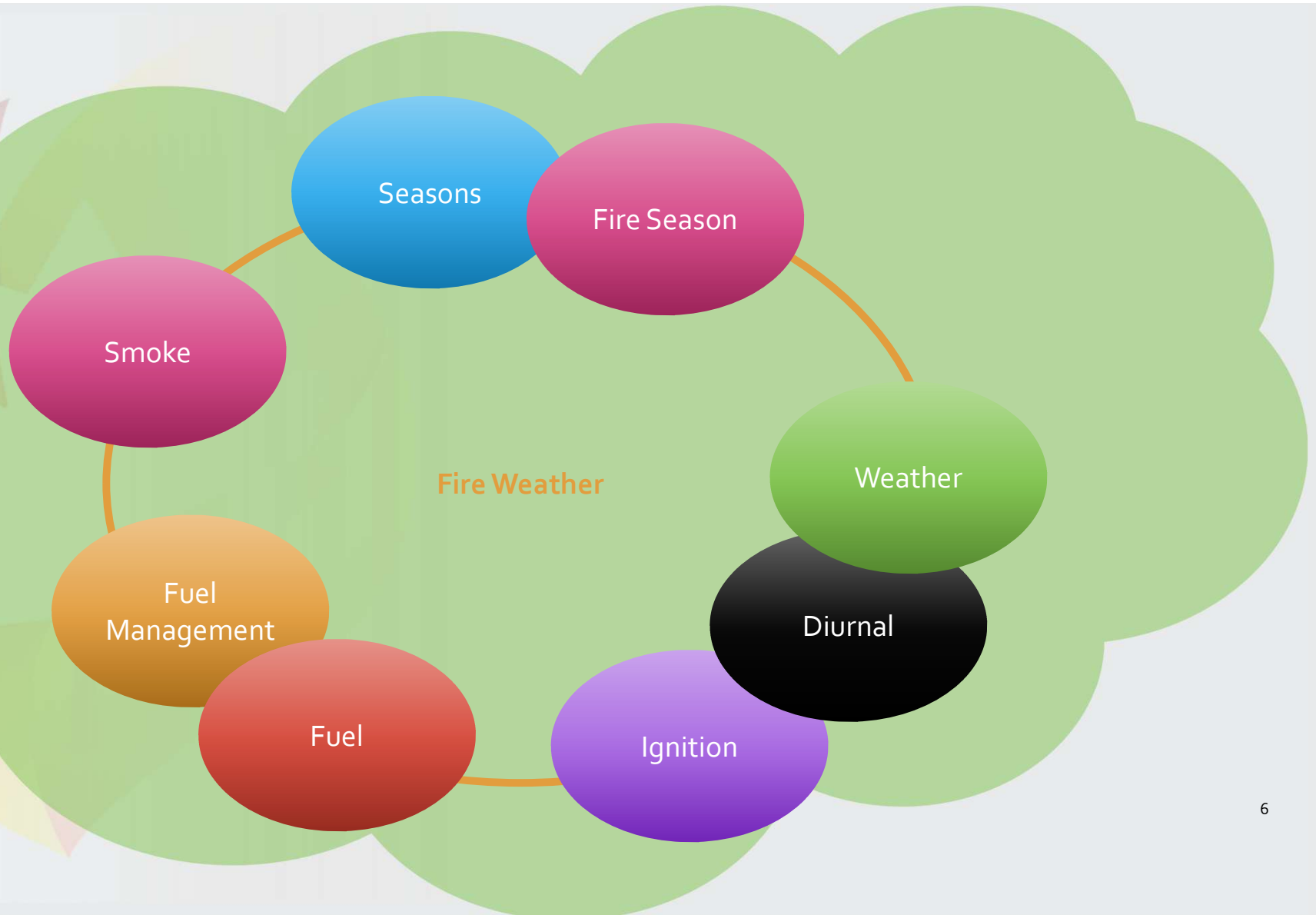


Fire Weather Index

- Fine Fuels Moisture Code (FFMC)
- Duff Moisture Code (DMC)
- Drought Code (DC)







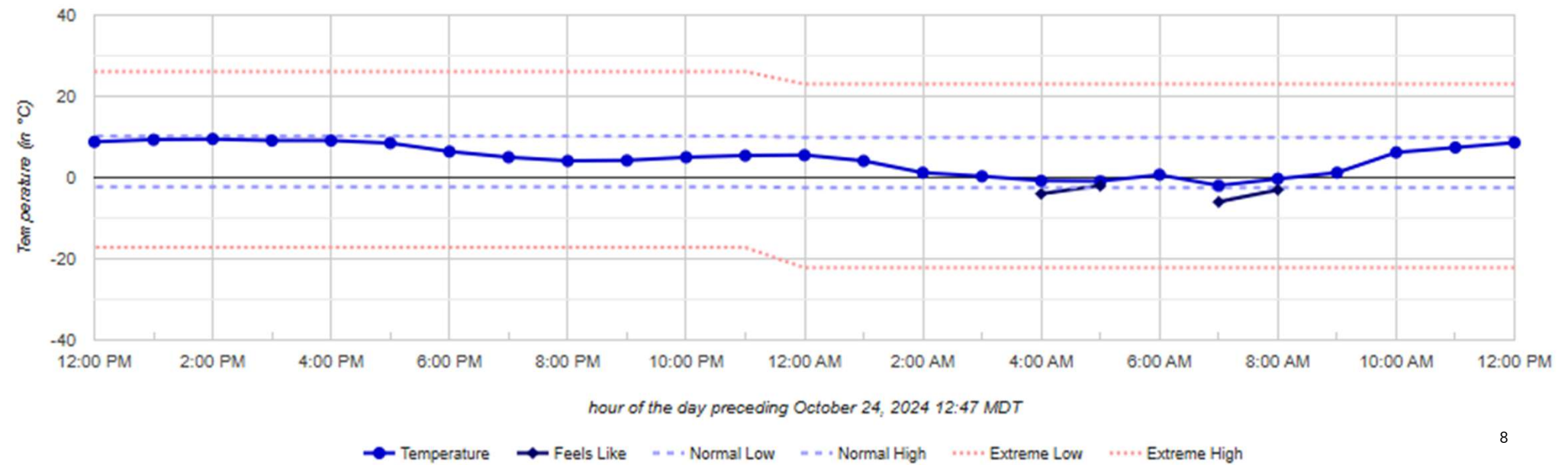
Weather vs Climate

- “Climate is what you expect; weather is what you get”
- “Not your grandparent’s weather”

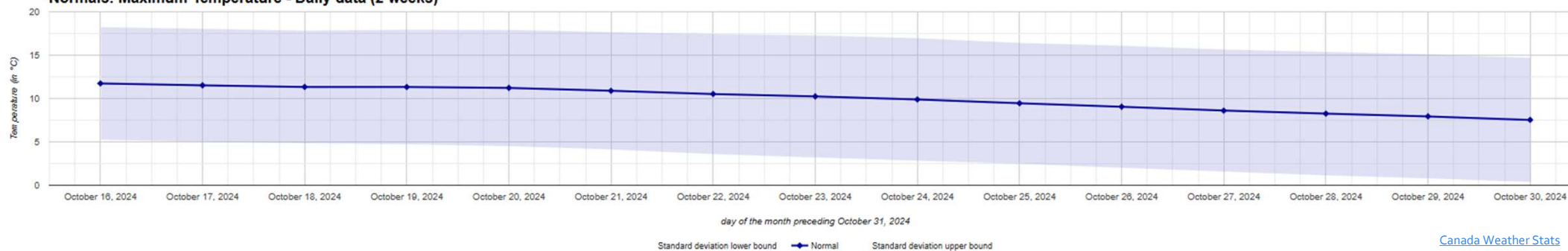


Average vs. Actual

Temperature - Hourly data (24 hours)

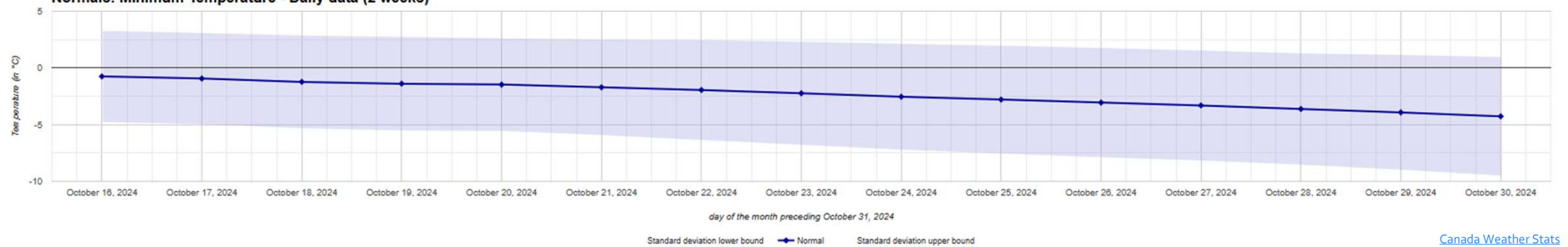


Normals: Maximum Temperature - Daily data (2 weeks)



[Canada Weather Stats](#)

Normals: Minimum Temperature - Daily data (2 weeks)



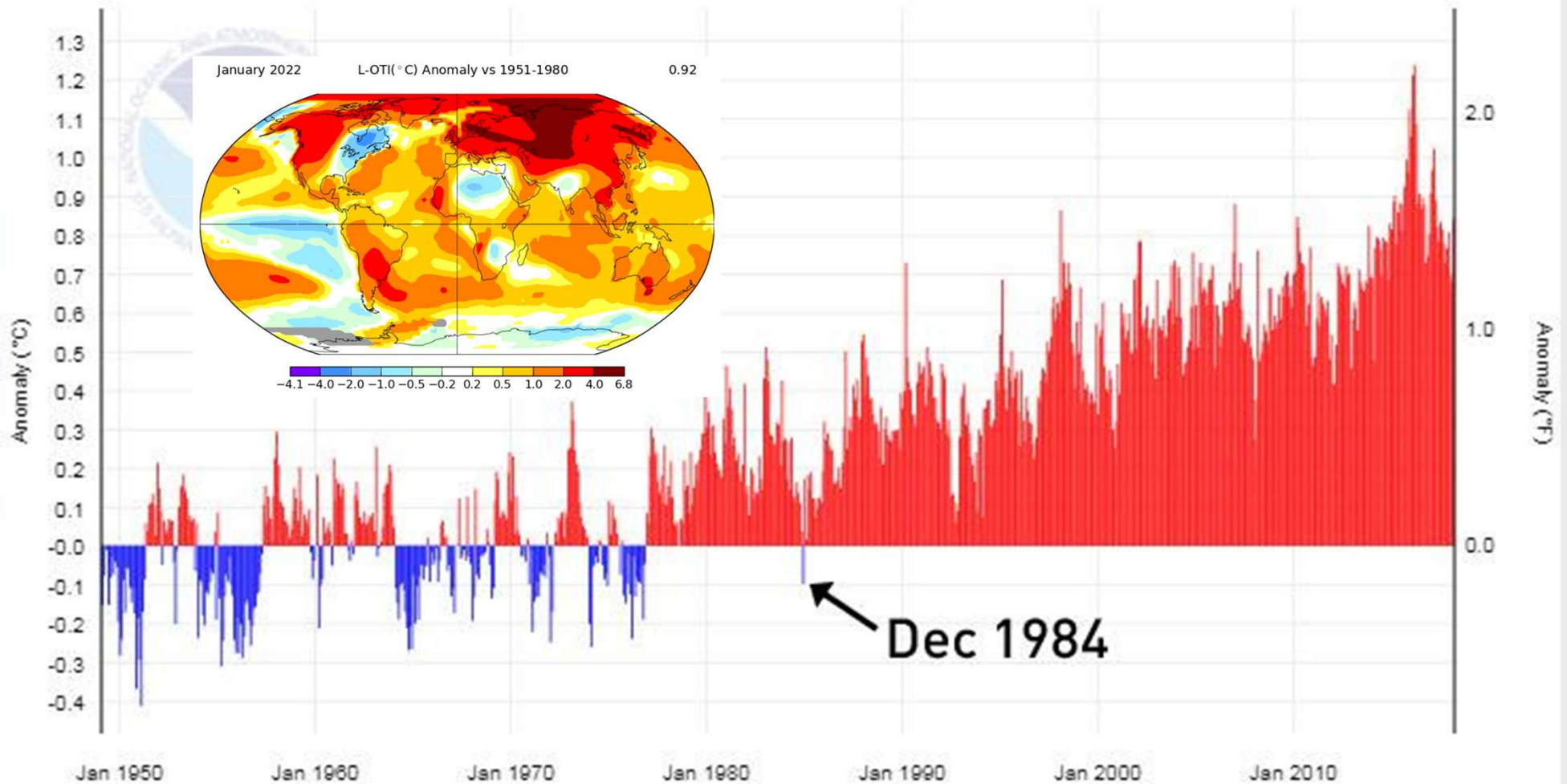
[Canada Weather Stats](#)

What does climate change look like?

- Temperatures
- Precipitation
- Wind
- Seasons

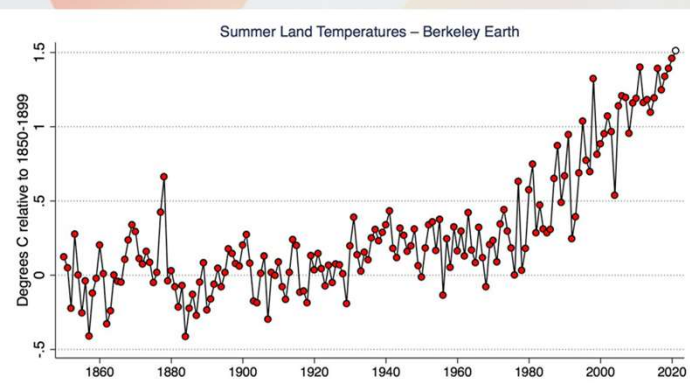


Global Land and Ocean Temperature Anomalies



Fire & Temperature

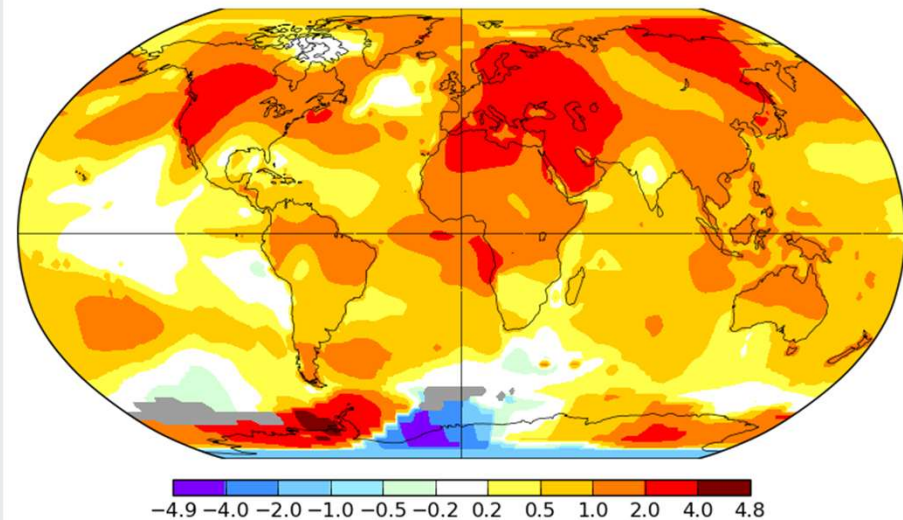
- Drier fuels
- Lightning
- Fire season



Jun-Jul-Aug 2021

L-OTI(°C) Anomaly vs 1951-1980

0.86



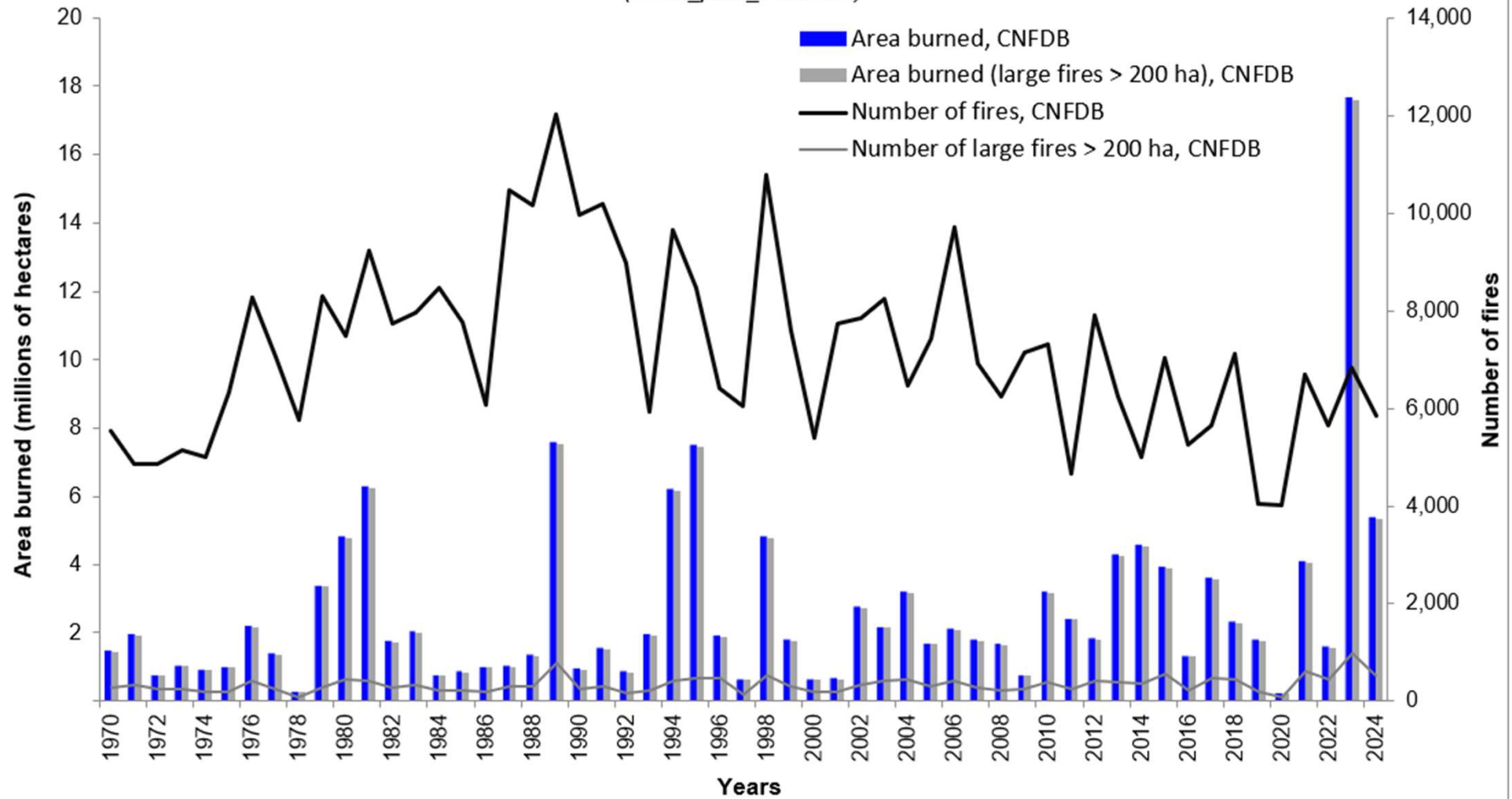
Fire Seasons



Number of Fires and Area Burned in Canada by Year

Source: Canadian National Fire database (CNFDB)

(NFDB_point_20250519)



Canada Average area burned

5 year	10 year	15 year	20 year	25 year
5,693,048	4,139,516	3,836,976	3,273,586	2,962,156

Fire Ignitions

Canada Wildfire



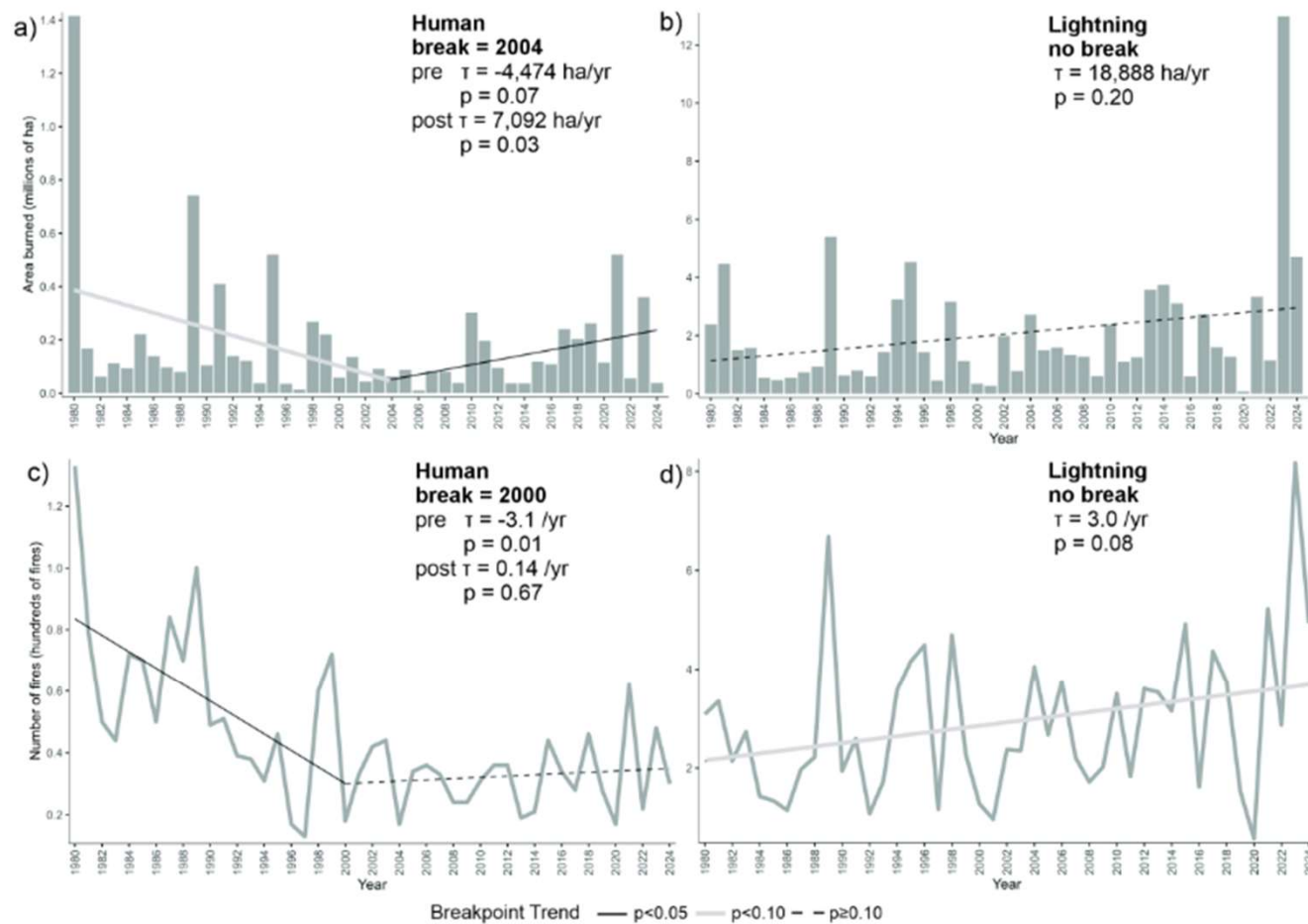


Figure 4. Annual area burned by a) human- and b) lightning-caused large fires 1980-2024. Number of large fires by c) human- and d) lightning-causes.

Diurnal Fire Behaviour





Kaiwei et al

- Drought conditions lead to more nighttime burning
- Most common in large fires
- 1 in 5 large fires (> 1000 ha) has overnight burning event

Climate Change and Precipitation

- Heavy Rain and Flood





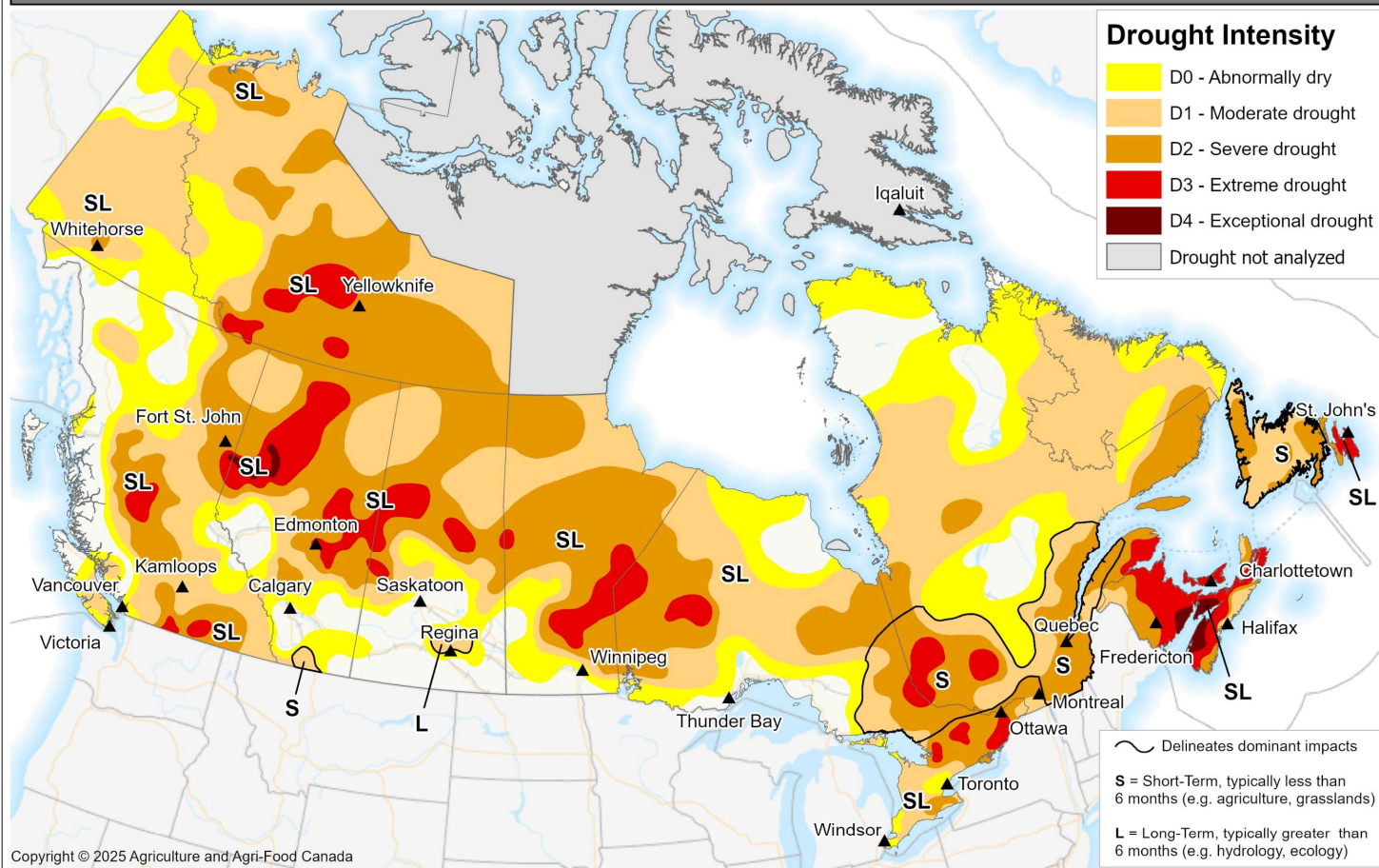
Agriculture and
Agri-Food Canada

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Agroalimentaire Canada

Canada

Canadian Drought Monitor

Conditions as of September 30, 2025

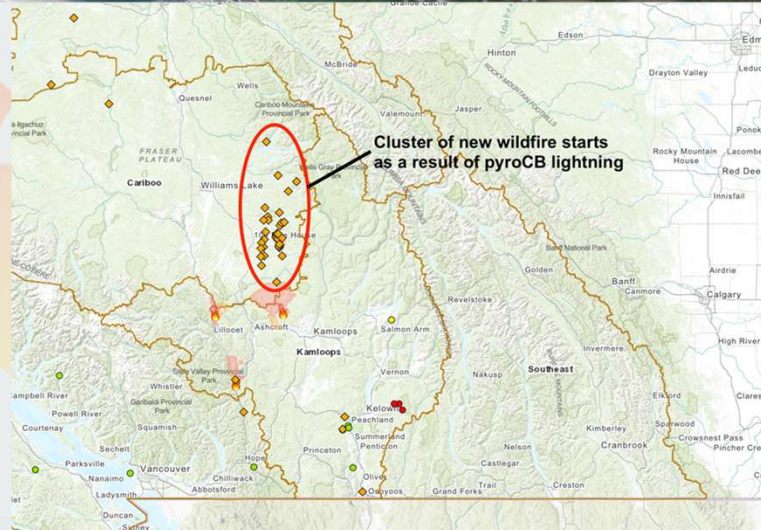


Prepared by Agriculture and Agri-Food Canada's National Agroclimate Information Service. We also acknowledge various provincial, territorial and non-government organizations whose reports and assessments are consulted. The Drought Monitor focuses on broad-scale conditions. Regions in northern Canada may not be as accurate as other regions due to limited information.

Created: 10/9/2025
www.agr.gc.ca/drought

Pyrocbs

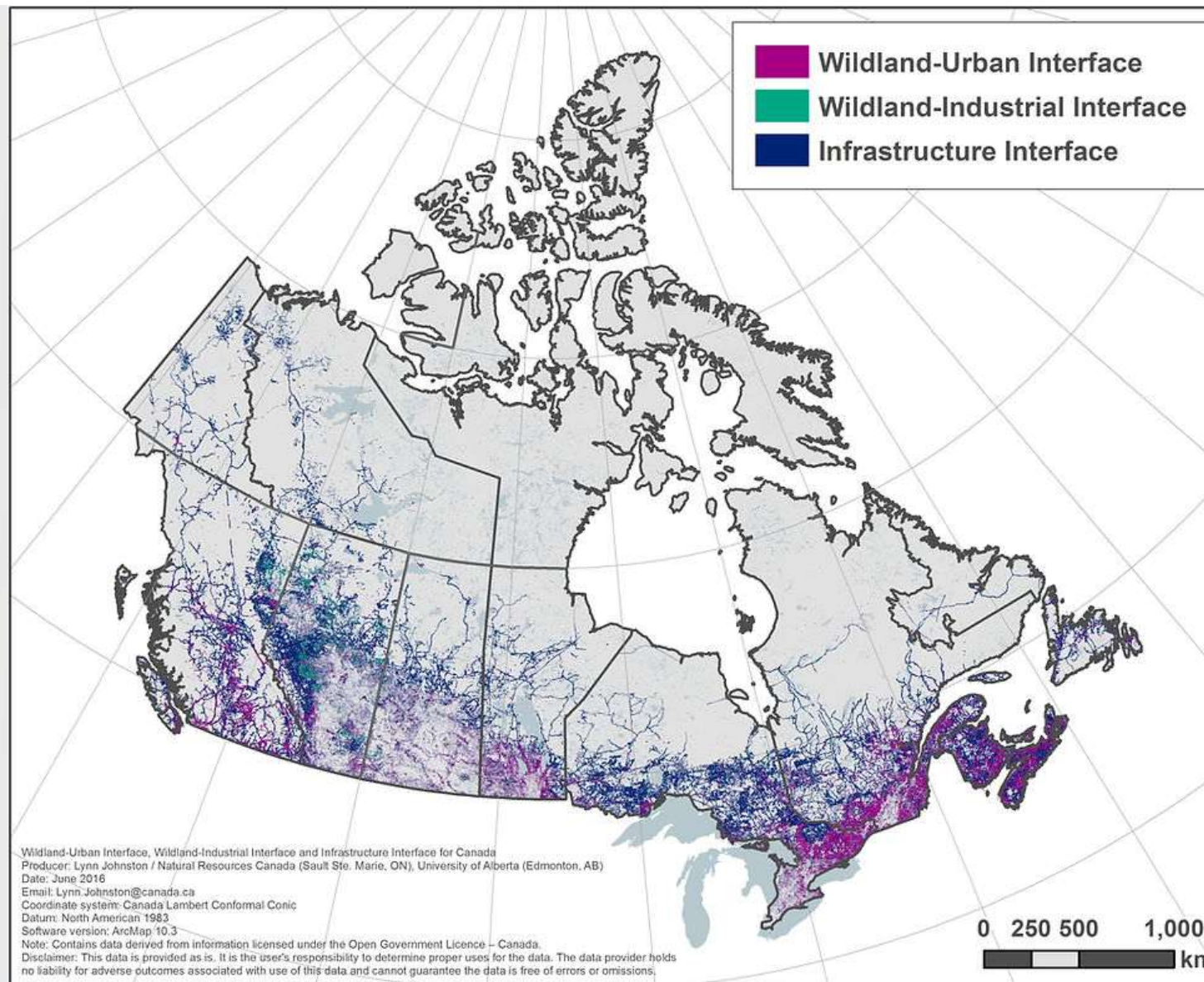
- June 30, 2021 massive pyrocumulonimbus generates thousands of lightning strikes that start tens of wildfire
- Are pyrocbs increasing in frequency and severity? Over 50 Pyrocbs in North America in 2021
- More night-time burning? Yes, warmer nights, lower RHs and/or more extreme daytime fire weather.





Not just climate changes

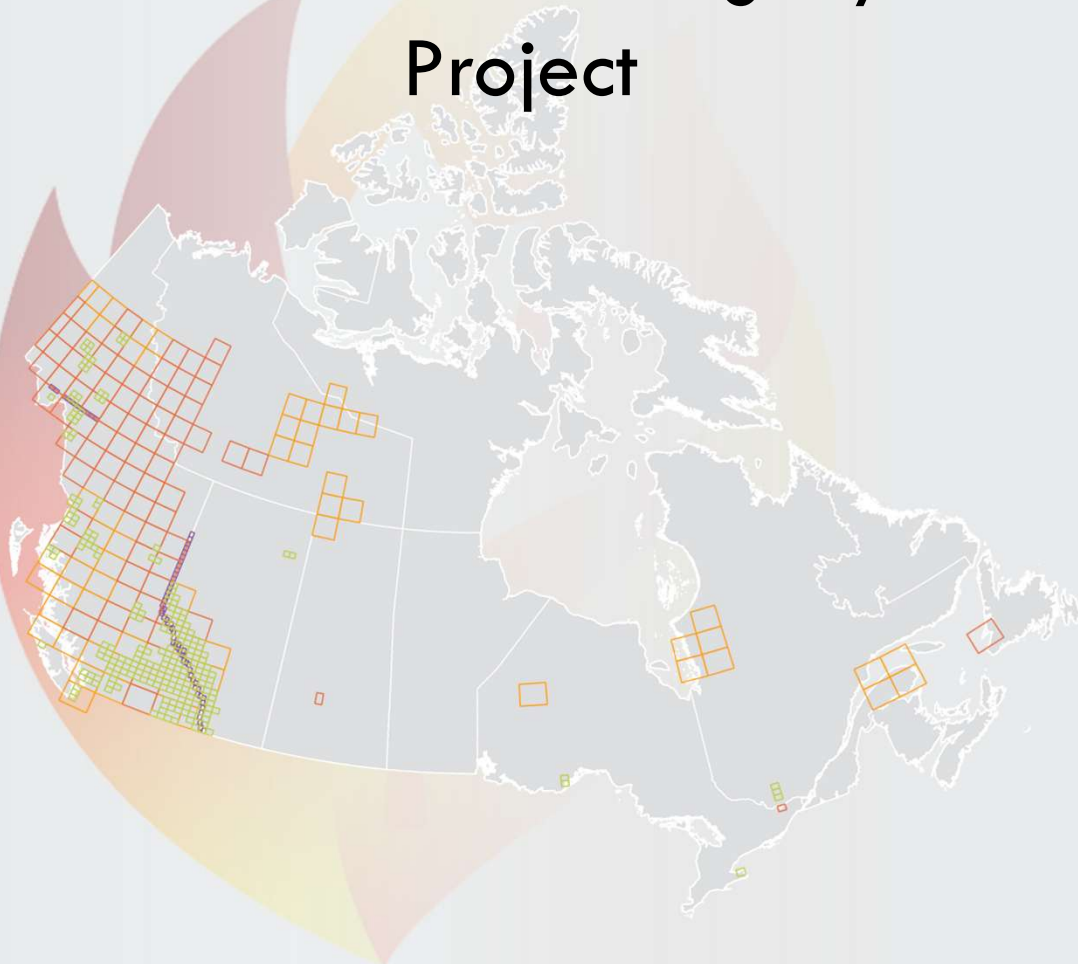
Canada Wildfire



Fuel Load and condition

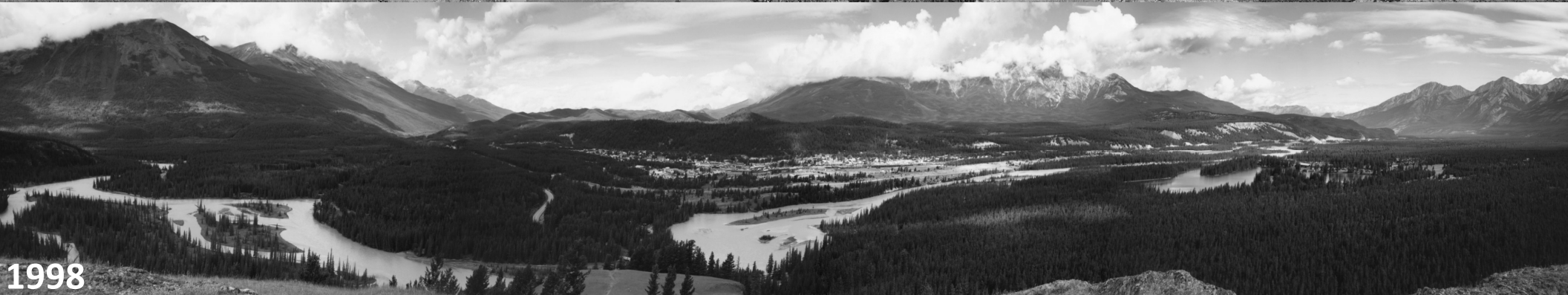
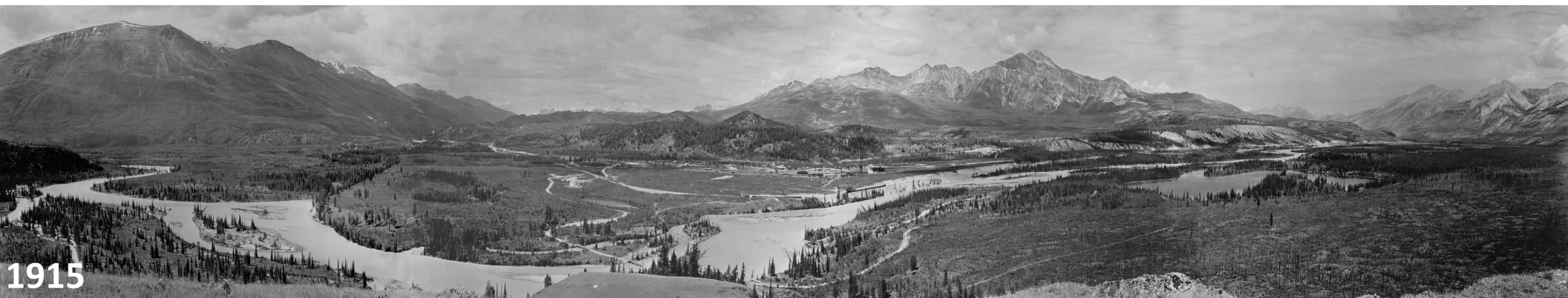


The Mountain Legacy Project



Canada Wildfire
James Tricker and Claire Wright | University of Victoria

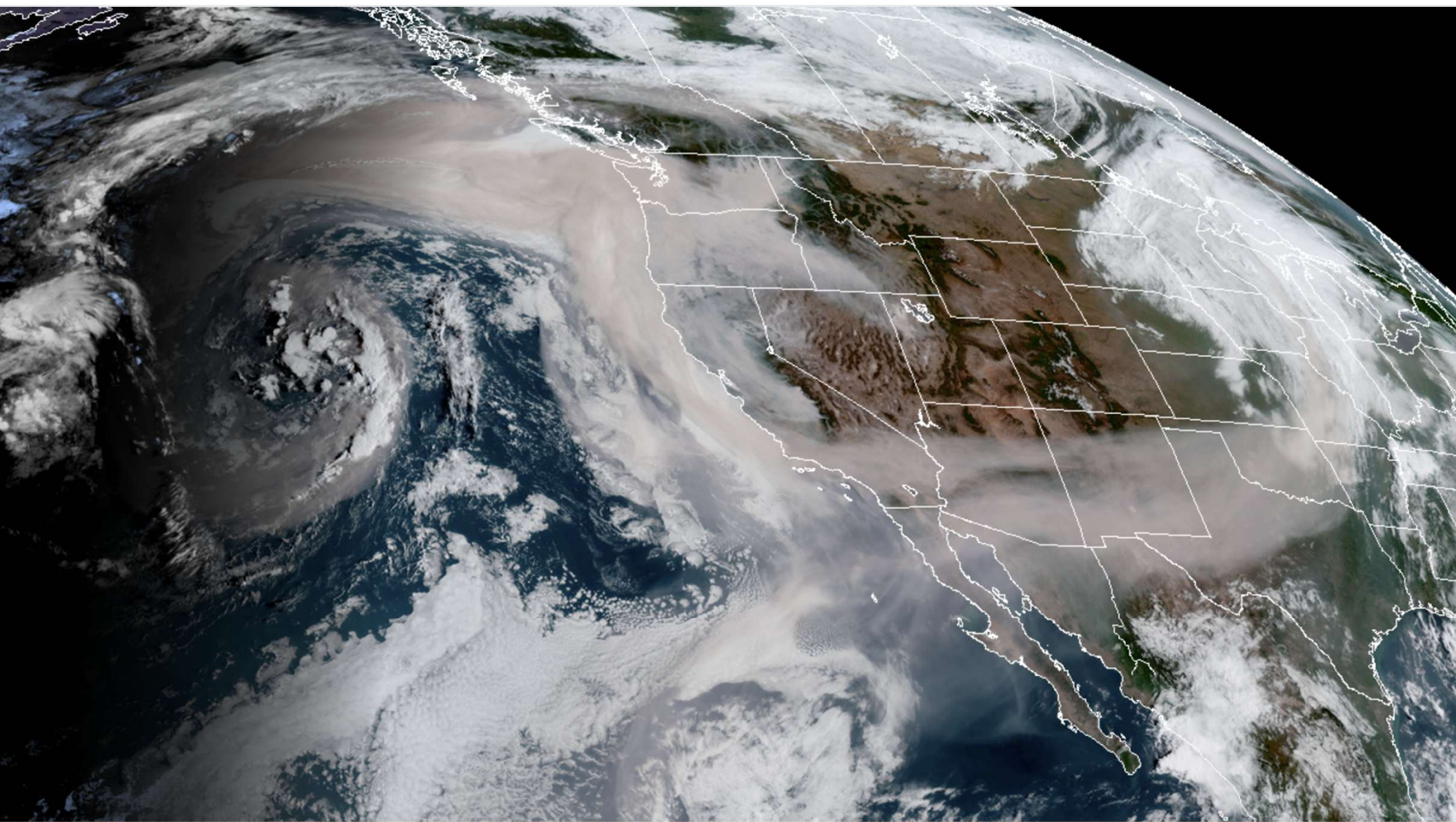




Smoke



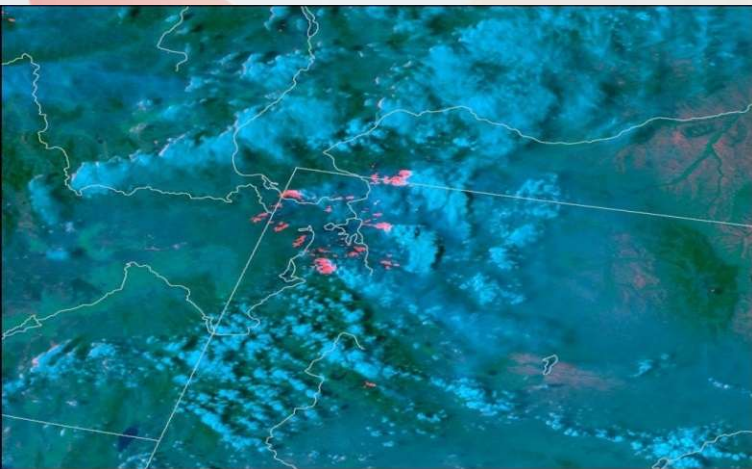
cbc.ca



Low Intensity or High Intensity fire

- Good fire?





Forest Fires – 3 Ingredients

- Fuel – type, loading, moisture, structure etc.
- Ignition - human and lightning
- Weather – extreme weather, temperature, precipitation atmospheric moisture and wind; upper atmospheric conditions (blocking ridges) sunshine



Fires -Key Factors Part 2



Canada Wildfire

- Weather is a component in all 3 natural factors – fuel, ignitions (Lightning) -.
- Options -Weather – we can't control; only options are fuel and human-caused fire ignitions
- Prevention – education, restricted fire zones, reduce or eliminate industrial activity during periods of high fire danger, enforcement
- Fuel – modifications – fuel break, reduce fuel load or change fuel type either at the landscape level (strategically) or areas of high value (e.g., communities)

Fire – Weather Interactions - 2

- Fire Spread
- Wind is the most important except in cases with spotting from an intense convection dominated fire
- Wind shifts can be critical as the fire flank can change to the fire head – fronts, troughs, thunderstorms, sea breezes, valley and slope winds
- Spread events are often just for short periods of time that are tied to strong winds
- Some have found thresholds in CFFDRS components and fire spread days – FWI 19 and ISI 8.5



Fire – Weather Interactions



- Two types of wildland fires – wind driven and convection driven
- Combustion – flaming and smouldering
- Three phases – Ignition, spread and extinguishment
- Fires can be ground fires (peat), surface fires and crown fires
- Ignition requires the fine fuels and/or the duff layer (FFMC and/or DMC) to have dried out sufficiently so combustion can occur
- Fuel moisture codes are derived from 1200 LST weather – temperature, relative humidity, wind speed and 24-hr precipitation
- Period of dry weather is required
- Unstable airmass for thunderstorm development for lightning-caused fires

Fire front is 3 kilometers long, 6,200 hectares already gone and 10,000 people have been evacuated.

A63 motorway on fire.



Canada Wildfire
Rodur, J. and Wotton, B.M. 2010. Will climate change overwhelm fire management capacity? Ecological modelling. 21: 1301-1309.

Escaped Fires....

- Increased fire intensity may lead to more escapes
- Extended attack simulation showed that projected intensity increases resulted in very substantial increases in burned area
 - Driven by the change in frequency of being above suppression intensity thresholds

Wotton, B.M., Flannigan, M.D. and Marshall, G. 2017. Potential climate change impacts on fire intensity and key wildfire suppression thresholds in Canada. Environmental Research Letters. 12 (2017) 095003, <https://doi.org/10.1088/1748-9326/aa7e6e>.

So what now.

- Lil'th Nation
- Strong Firesmart programs
- Forest industry is starting to listen
- Growing recognition that fire needs to be back on the land
- Fire conferences are later in the autumn...





Thank you

Resources:

mountainlegacy.ca

Climatedata.ca

cwfis.cfs.nrcan.gc.ca

Slides 11,12,21,22 and 31 to 35 provided by Mike Flannigan

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Canadawildfire.org