



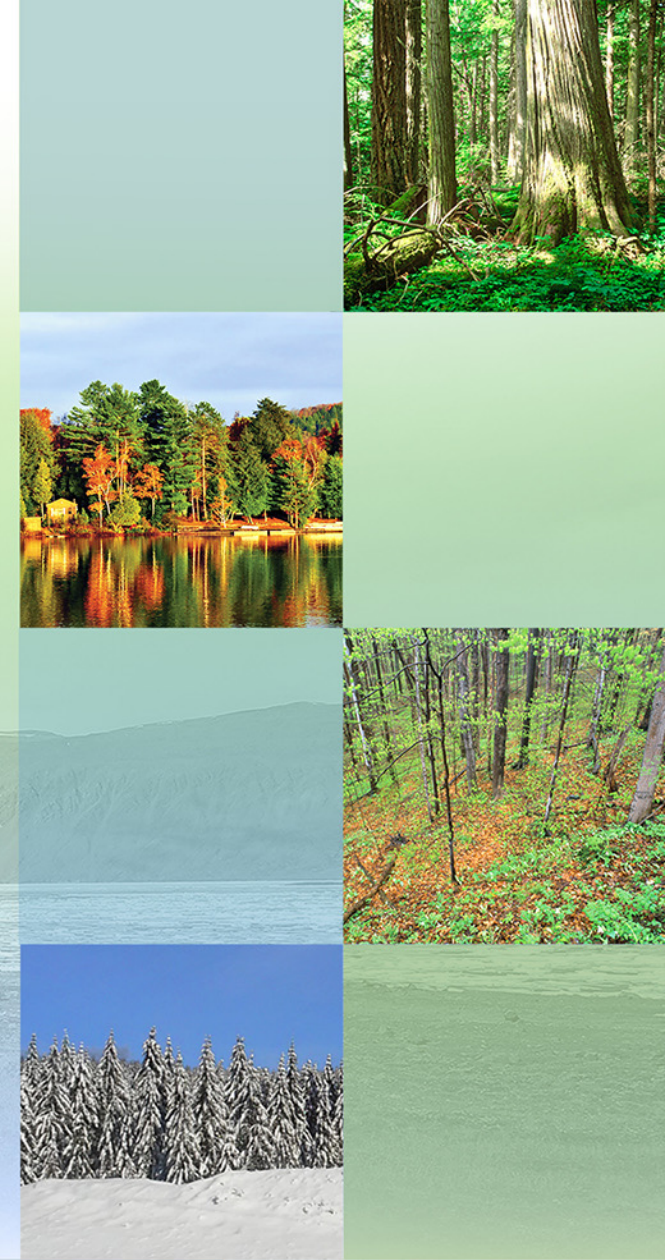
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The 2023 wildfire season in the North: A Tale of Two Extremes (Part One)

Piyush Jain

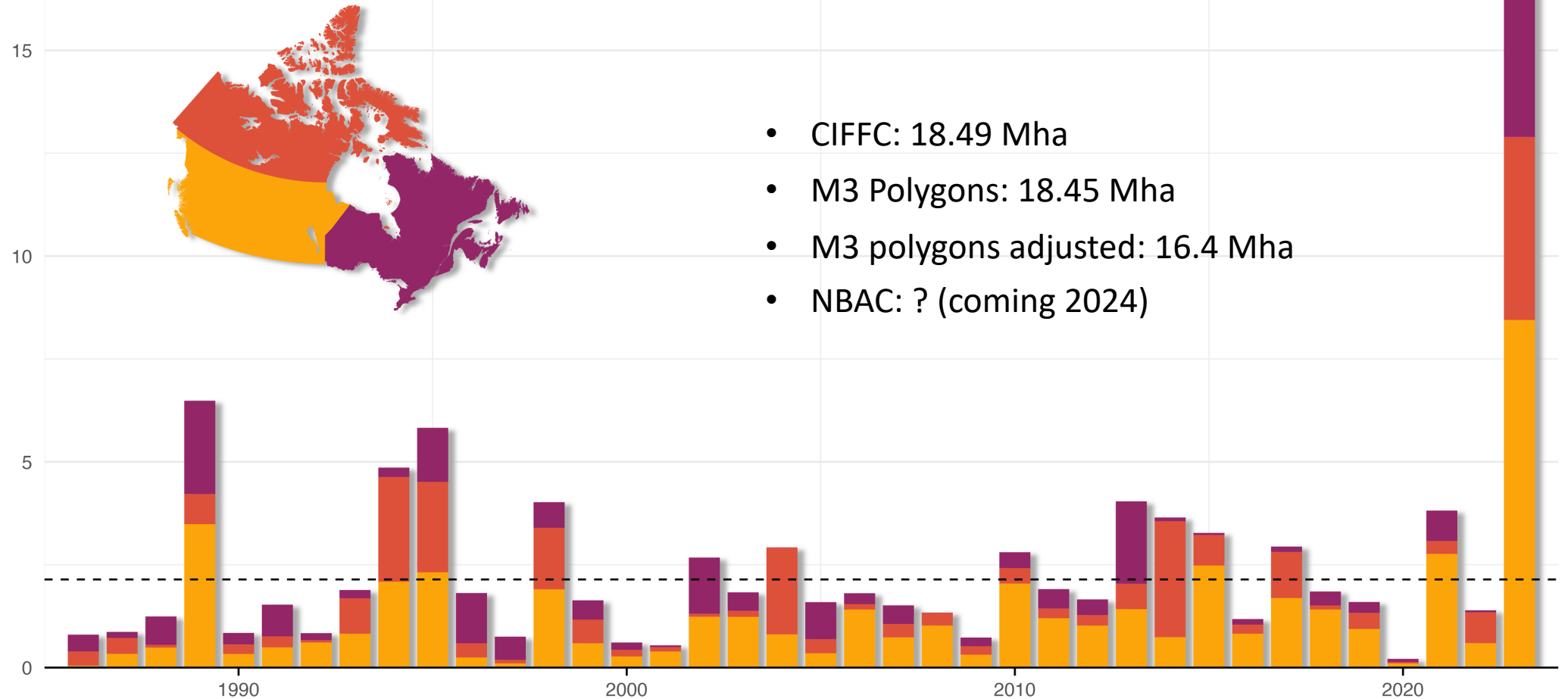
The Canadian Forest Service



What happened?



Over 18 million hectares burned*



- CIFFC: 18.49 Mha
- M3 Polygons: 18.45 Mha
- M3 polygons adjusted: 16.4 Mha
- NBAC: ? (coming 2024)

Canadian Interagency Forest Fire Centre (CIFFC) - <https://ciffc.net/summary>

Canadian Wildland Fire Information System (CWFIS) M3 hotspots - <https://cwfis.cfs.nrcan.gc.ca/maps/fm3>

National Burned Area Composite (NBAC) - <https://cwfis.cfs.nrcan.gc.ca/datamart/metadata/nbac>

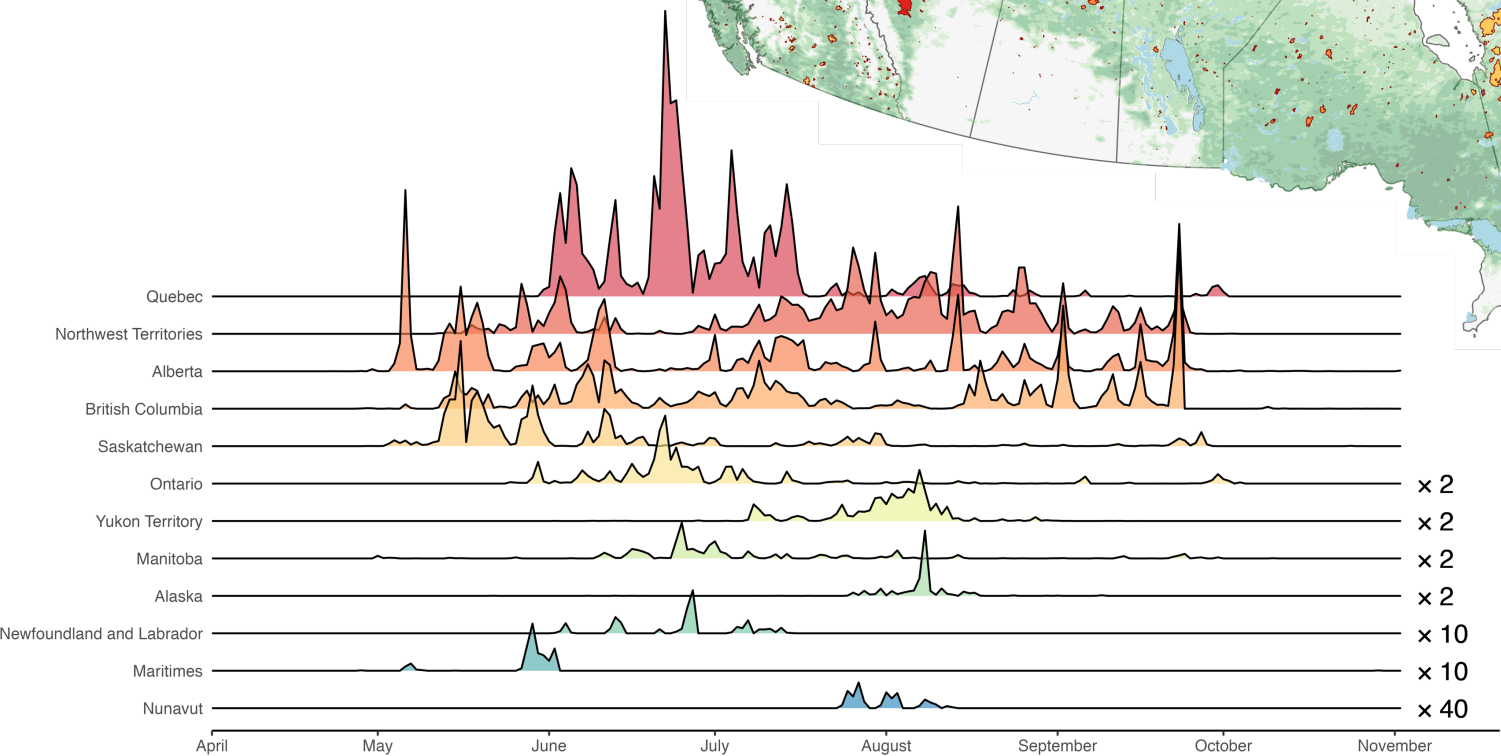
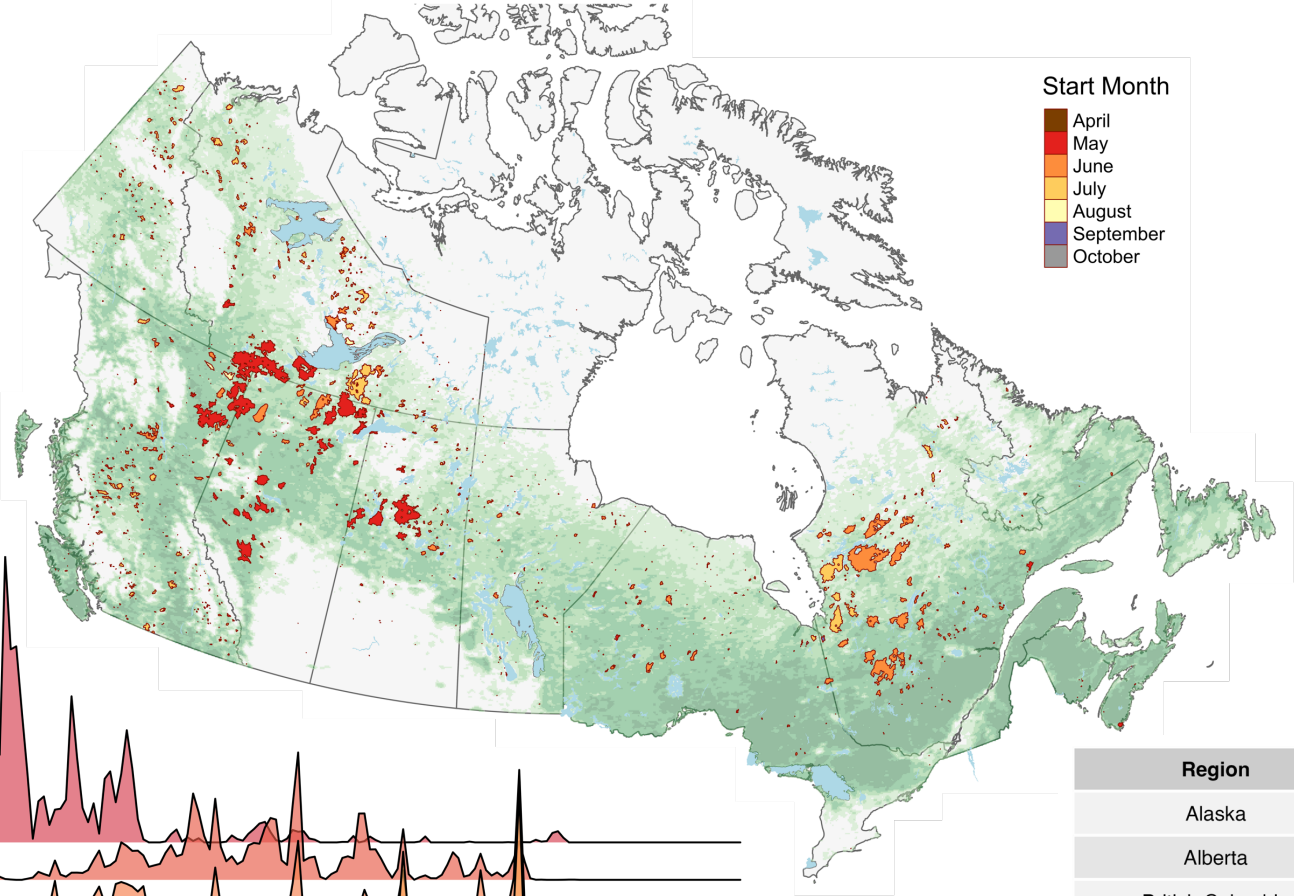


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Where and when?*

CWFIS M3 hotspots

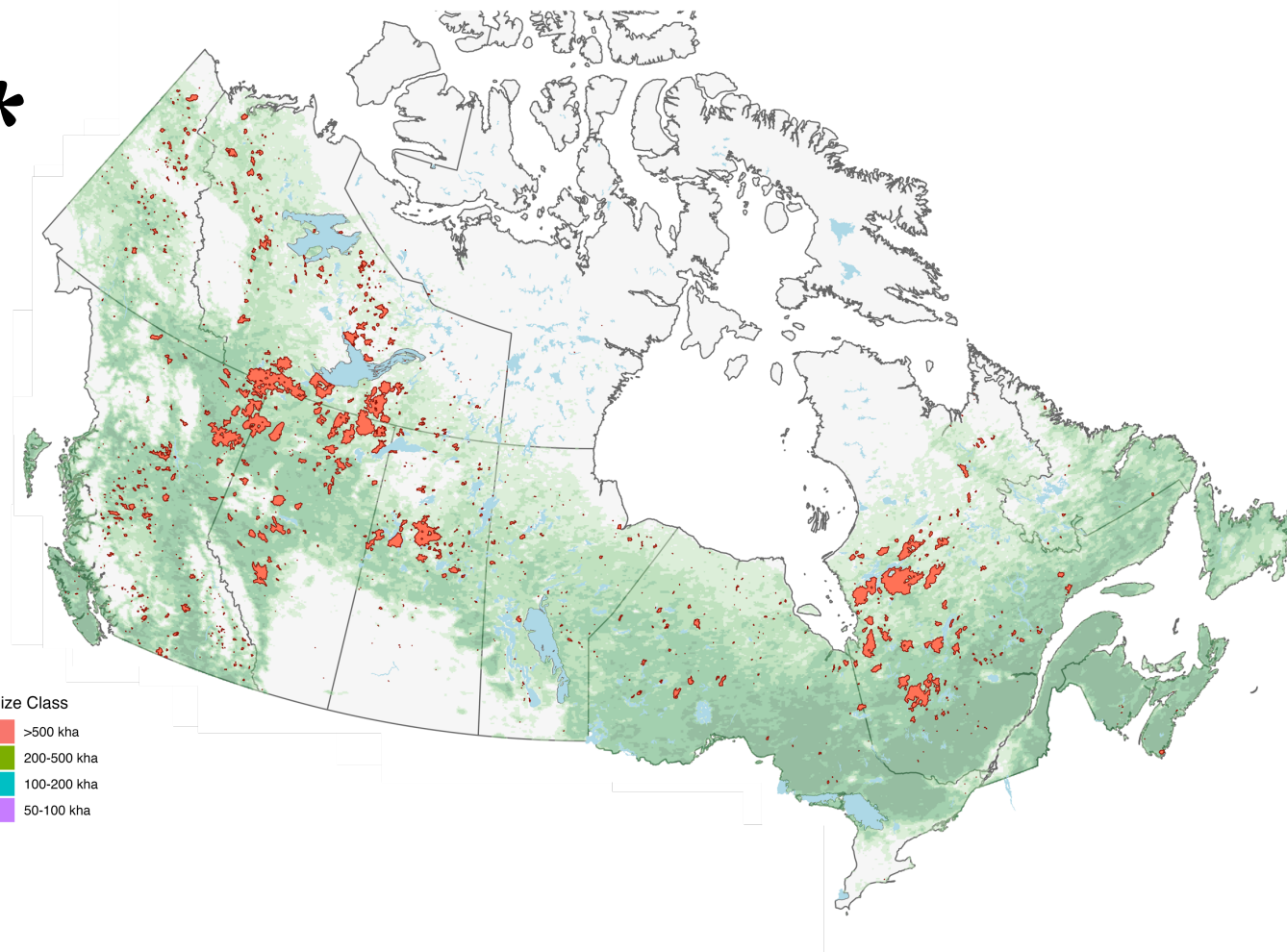
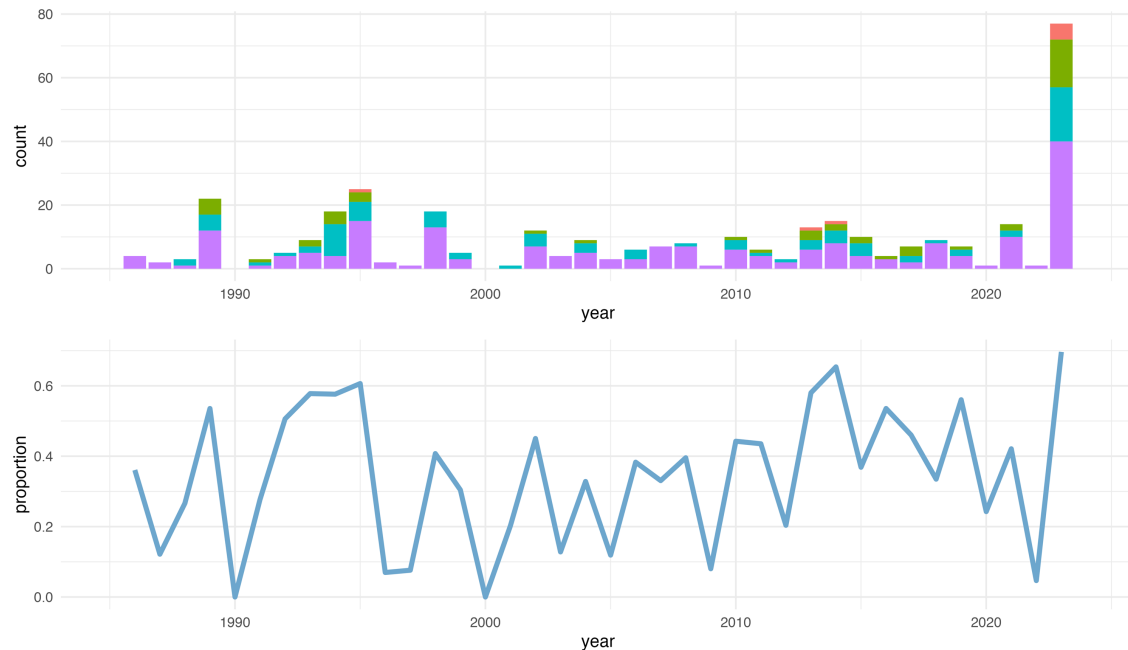


Region	Season start	Season end	Total AB
Alaska	2023-05-01	2023-09-10	121,765
Alberta	2023-04-23	2023-11-03	3,656,896
British Columbia	2023-04-27	2023-10-31	3,022,525
Manitoba	2023-05-01	2023-10-11	206,249
Maritimes	2023-04-28	2023-10-29	24,628
Newfoundland and Labrador	2023-06-02	2023-07-15	27,045
Northwest Territories	2023-05-12	2023-10-03	4,061,278
Nunavut	2023-07-24	2023-08-13	5,266
Ontario	2023-05-25	2023-10-04	458,575
Quebec	2023-05-28	2023-10-01	5,048,550
Saskatchewan	2023-04-29	2023-10-26	1,561,474
Yukon Territory	2023-06-02	2023-09-17	380,132



Large fires dominated*

- **15** largest fires were responsible for half of the total area burned
- Median duration of largest **15** fires was 103 days (38-169)
- **5** fires over **500 kha**



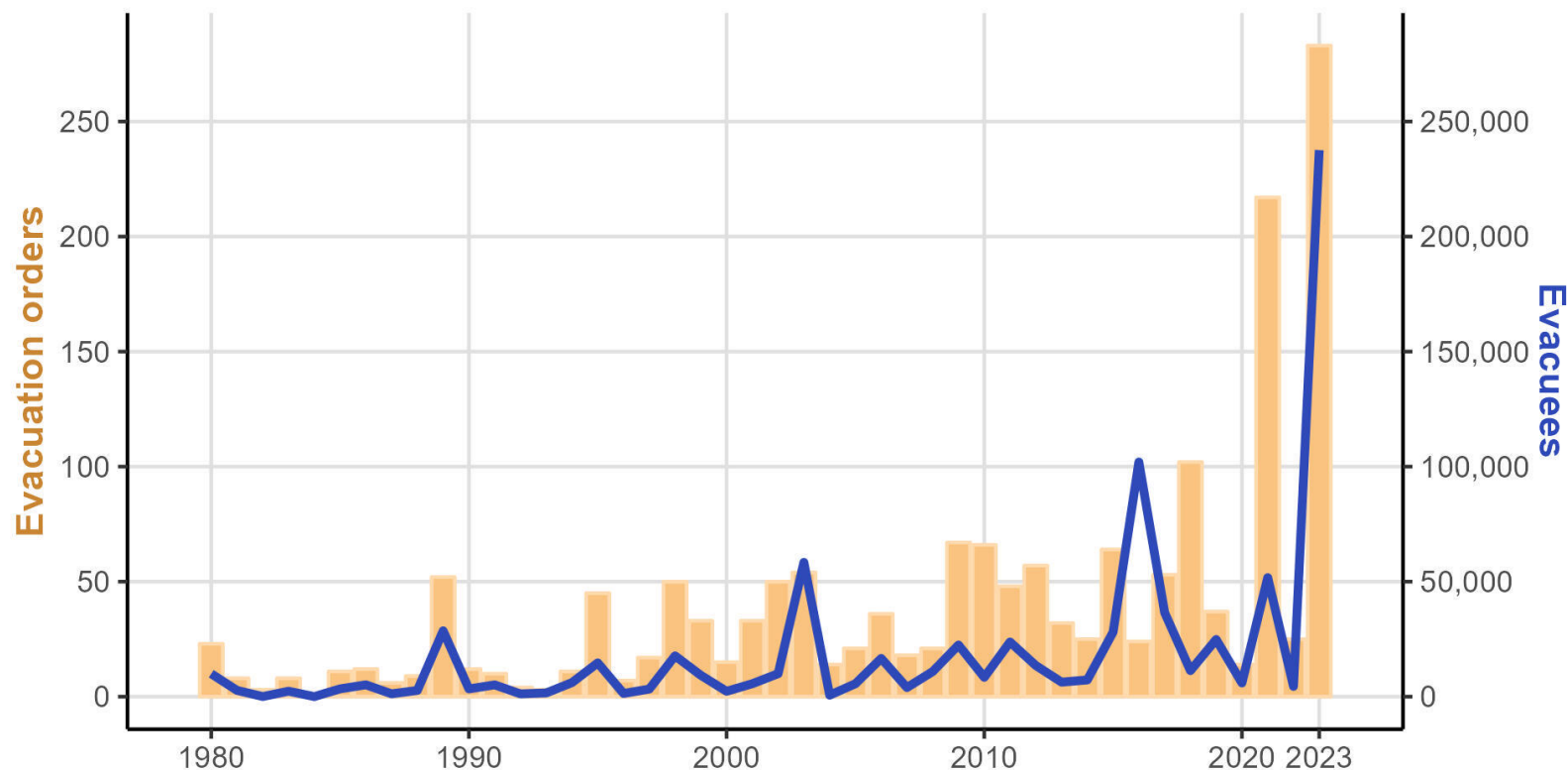
Proportion of area
burned for fires
over **50 kha**
(70% in 2023)



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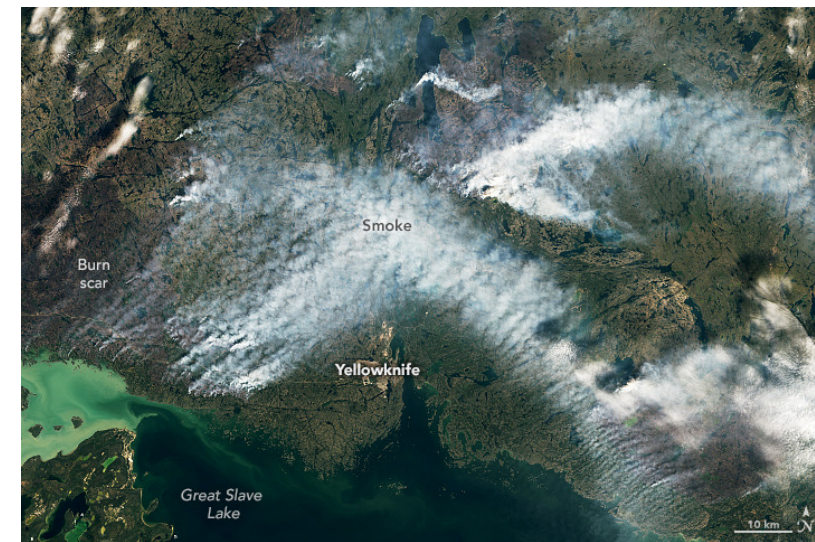
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Evacuations



- Approximately 240,000 people were evacuated
- Most evacuees in evacuation database (since 1980)
- Data is provisional

Canadian Forest Service, 2023. Canadian Wildland Fire Evacuation Database



Largest 10 evacuations since 1980:

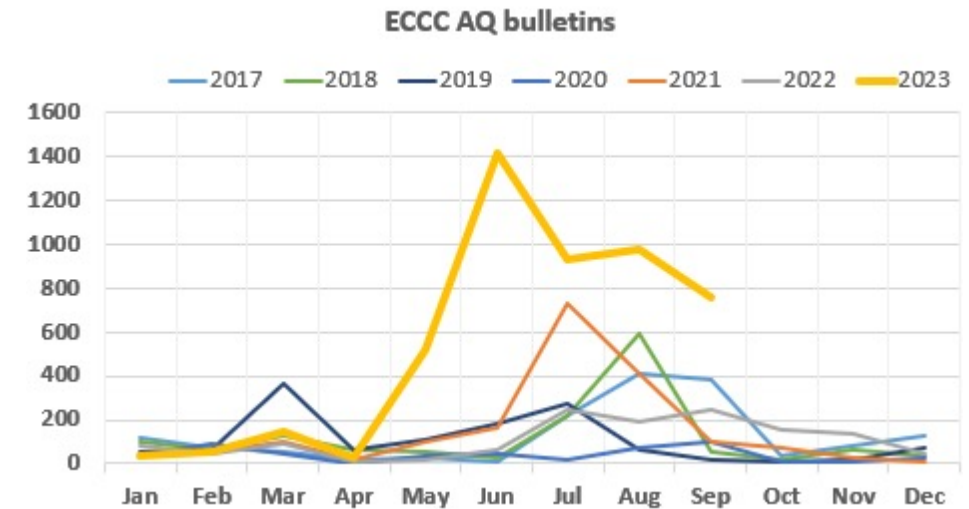
Evacuation Date	Province	Location	Evacuees
2016-05-03	AB	Fort McMurray	88000
2003-08-18	BC	Kelowna	33050
2023-08-16	NT	Yellowknife	21720
2023-08-17	BC	West Kelowna	19809
2023-05-28	NS	Halifax	16400
2009-07-18	BC	West Kelowna	11000
2017-07-15	BC	Williams Lake	10753
2023-08-17	BC	Kelowna	9757
2023-06-09	AB	Edson	8374
1998-08-10	BC	Salmon Arm	8000

Smoke and air quality

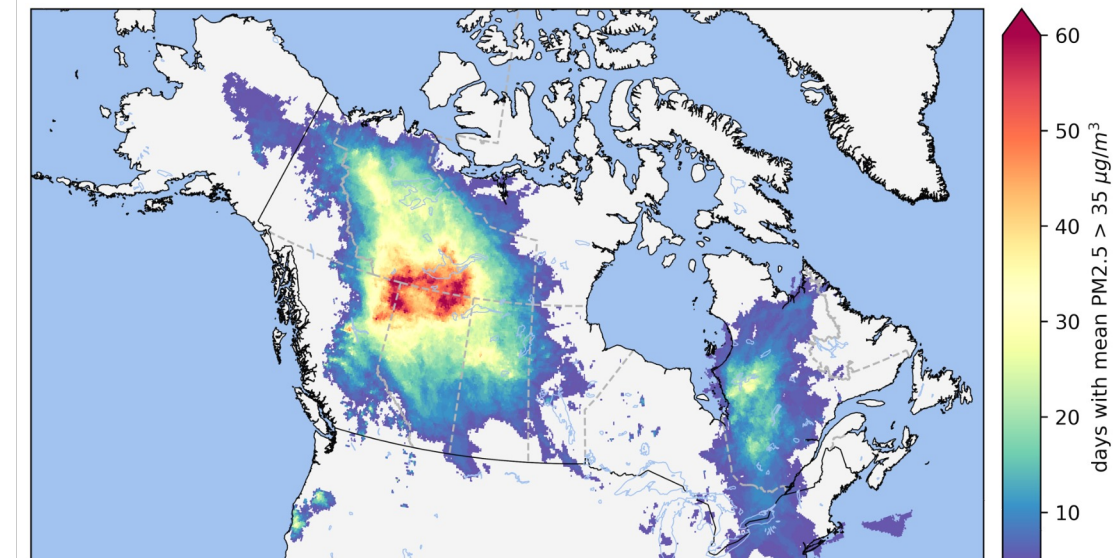
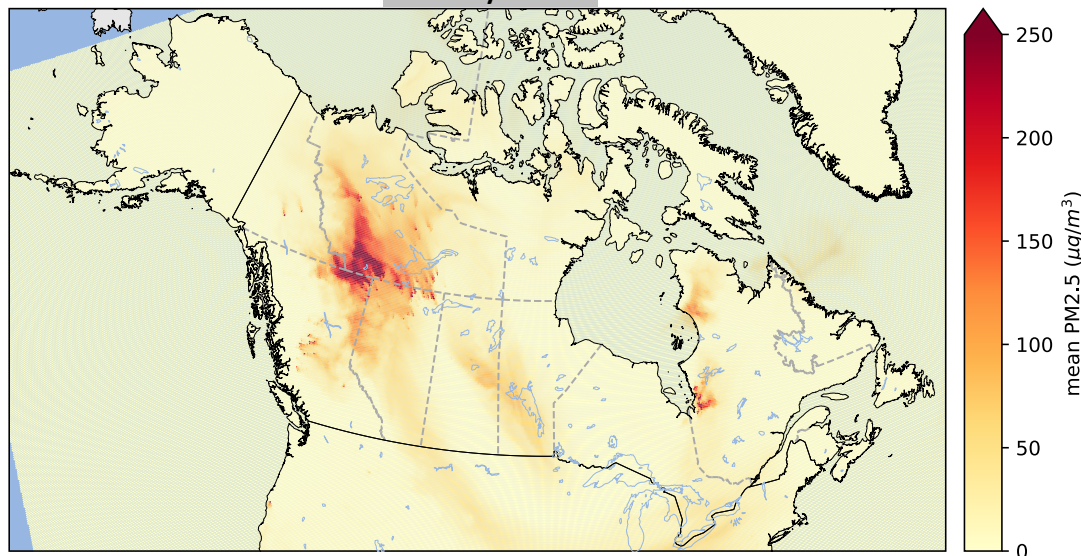
ECCC Regional Air Quality Deterministic Prediction Systems (RADQDPS):

- 72 hour forecast of O_3 , NO_2 , $PM_{2.5}$
- 10km resolution over North America
- Used to forecast Air Quality Health Index (AQHI)

https://weather.gc.ca/airquality/pages/index_e.html



16 July 2023





DAVE SANDERS FOR THE NEW YORK TIMES
STRANGE DAYS An acrid haze shrouded the Brooklyn Bridge on Wednesday and put the air quality needle on "hazardous." Page A18.

Northern Fires Spread Smoke And Anxiety

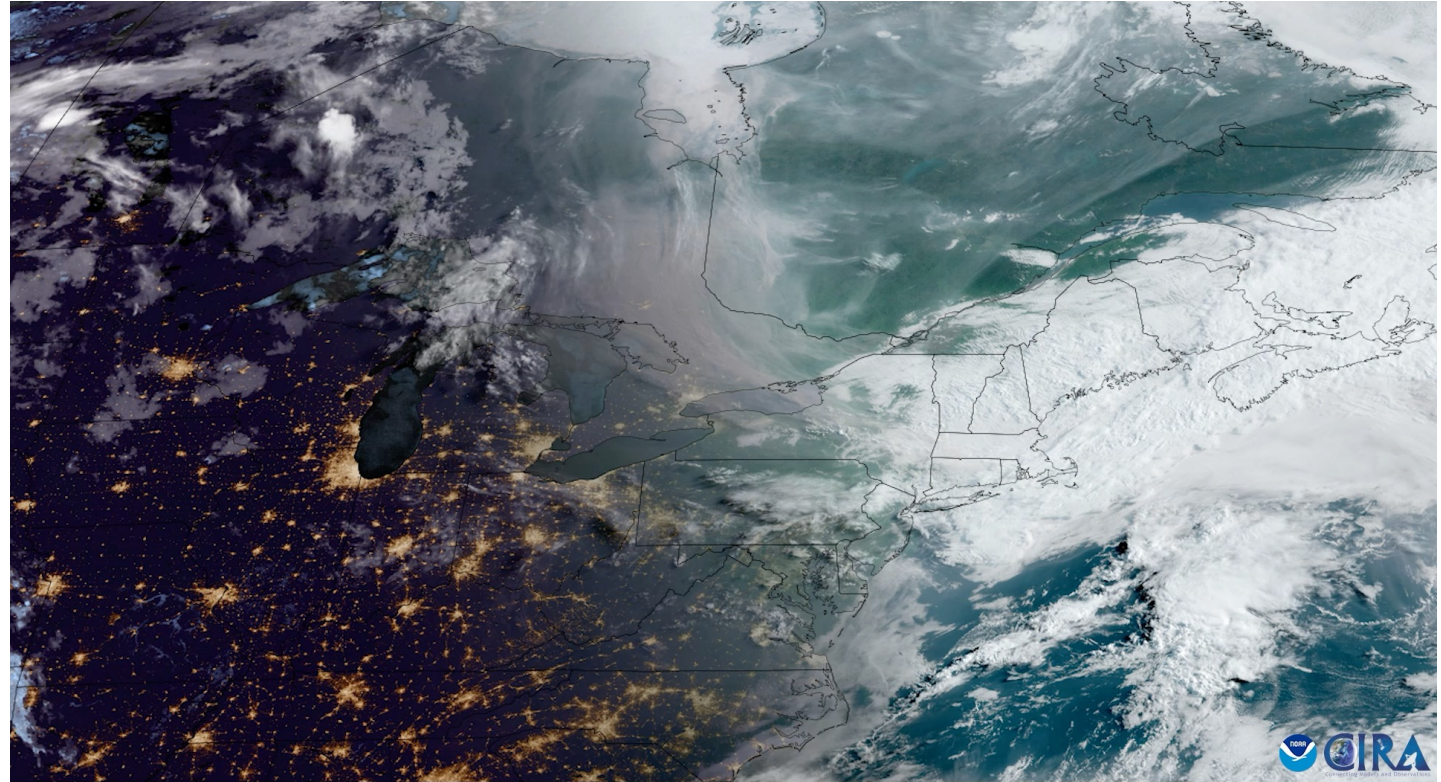
Blazes Across Canada Also Choking U.S.

*This article is by Dan Bilefsky,
Liam Stack and Vjosa Isai.*

MONTREAL — Canada on Wednesday was struggling to fight an extraordinary outbreak of wildfires across the country that sent smoke pouring over the border and forced millions of Canadians and Americans to stay indoors as skies darkened over large portions of both nations.

Over 400 fires burned in Canada, and blazes this year have already scorched roughly 9.8 million acres of forest — more than 10 times the acreage that had burned by this time last year, officials say — sending smoke billowing down the east coast of the United States, from New York past Washington and as far west as Minnesota.

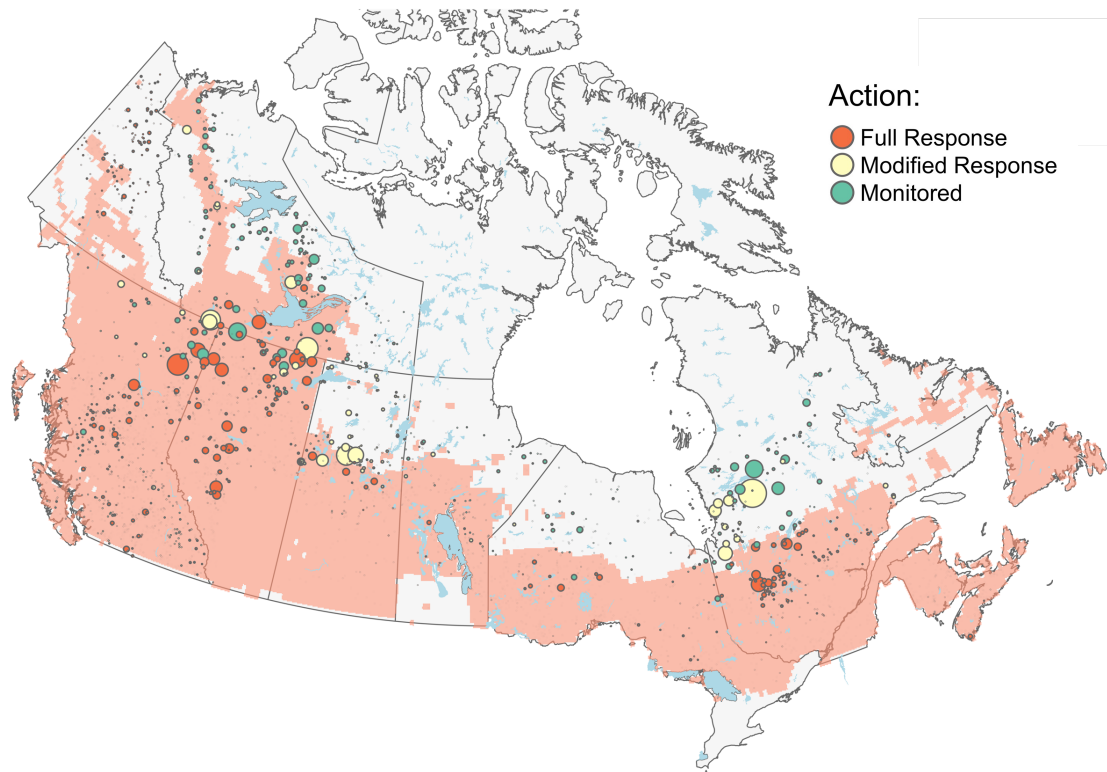
In Canada, a country known for its picturesque landscapes and orderliness, the out-of-control wildfires have stoked national anxiety. They have also stretched fire-fighting resources in a sprawling



06-03-2023 | 11:00:21 UTC | GOES-16 | GeoColor

CREDIT: Cooperative Institute for Research in the Atmosphere at Colorado State University and the National Oceanic and Atmospheric Administration (**CSU/CIARA & NOAA**).

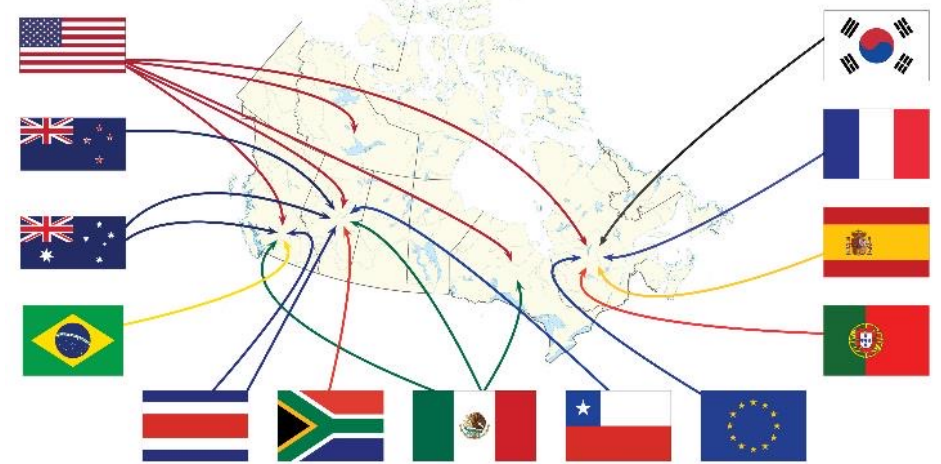
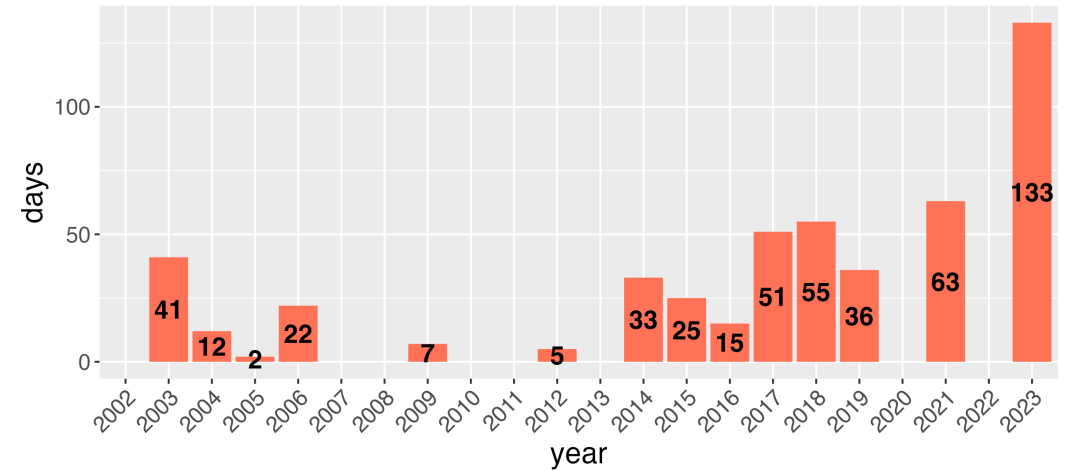
Fire response



- Response type data from Data Integration Project (CFS)
- Resource sharing data from CIFFC

Full suppression zone: Hope et al, 2016. PloS one, 11(8), p.e0157425.

Days with Natural Preparedness Level (NPL) 4 or 5



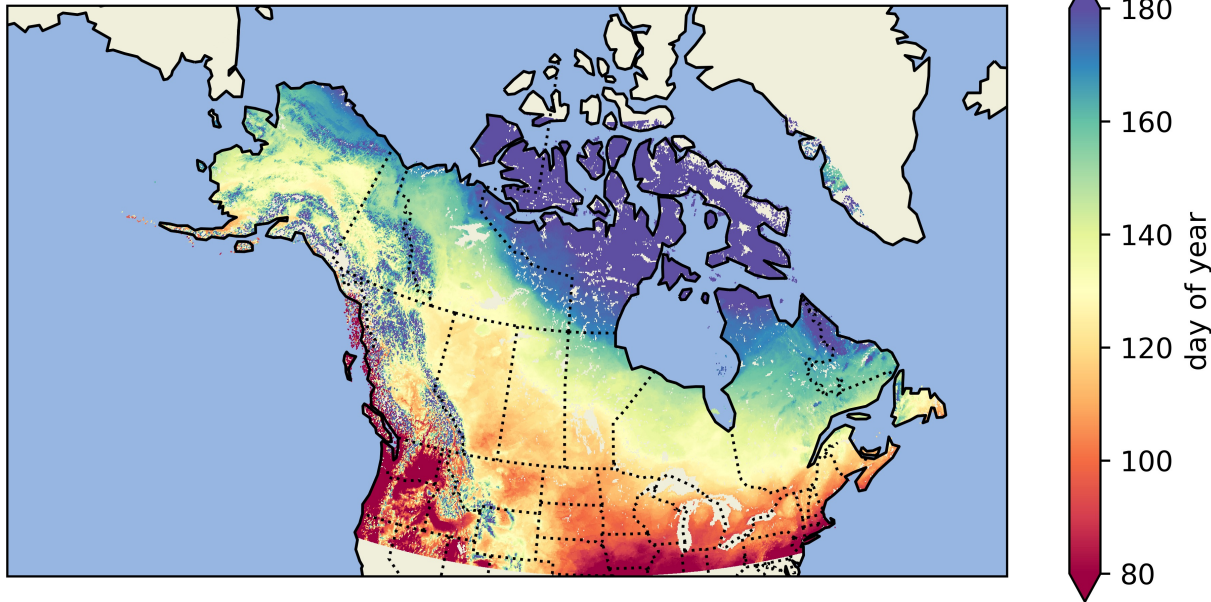
5000 International personnel deployed from:
Australia, Brazil, Chile, Costa Rica, France, Mexico, New Zealand, Portugal, South Africa, South Korea, Spain and the United States

What made 2023 different?

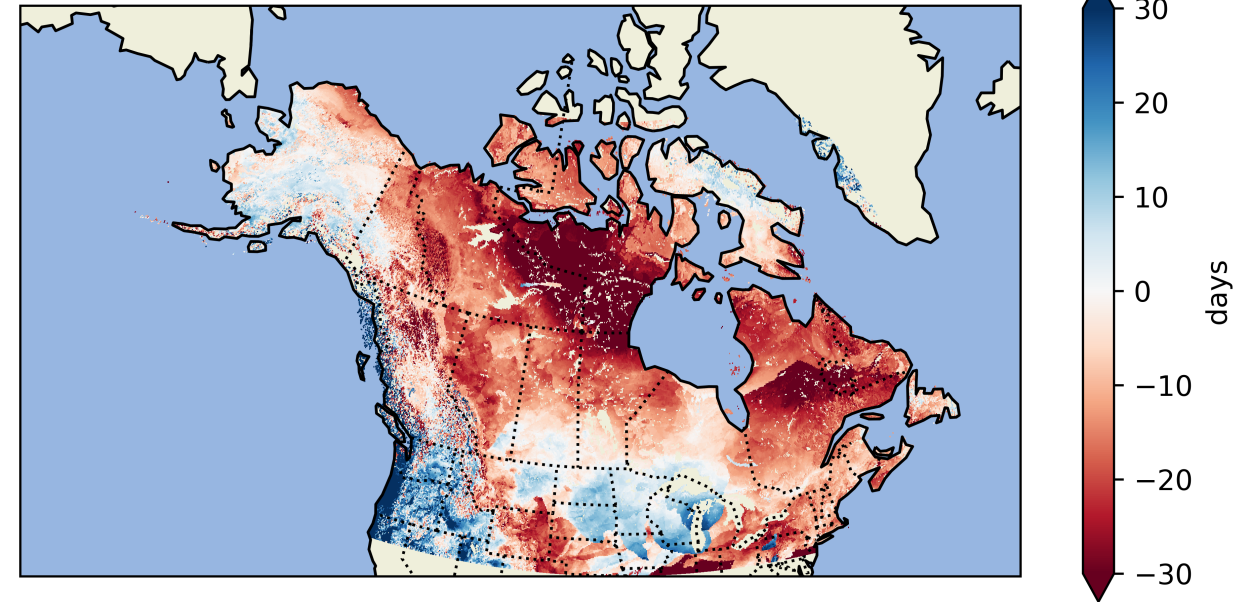


Snowmelt was early in most places

Snow melt timing average (2004-2022)



2023 Snowmelt timing departures



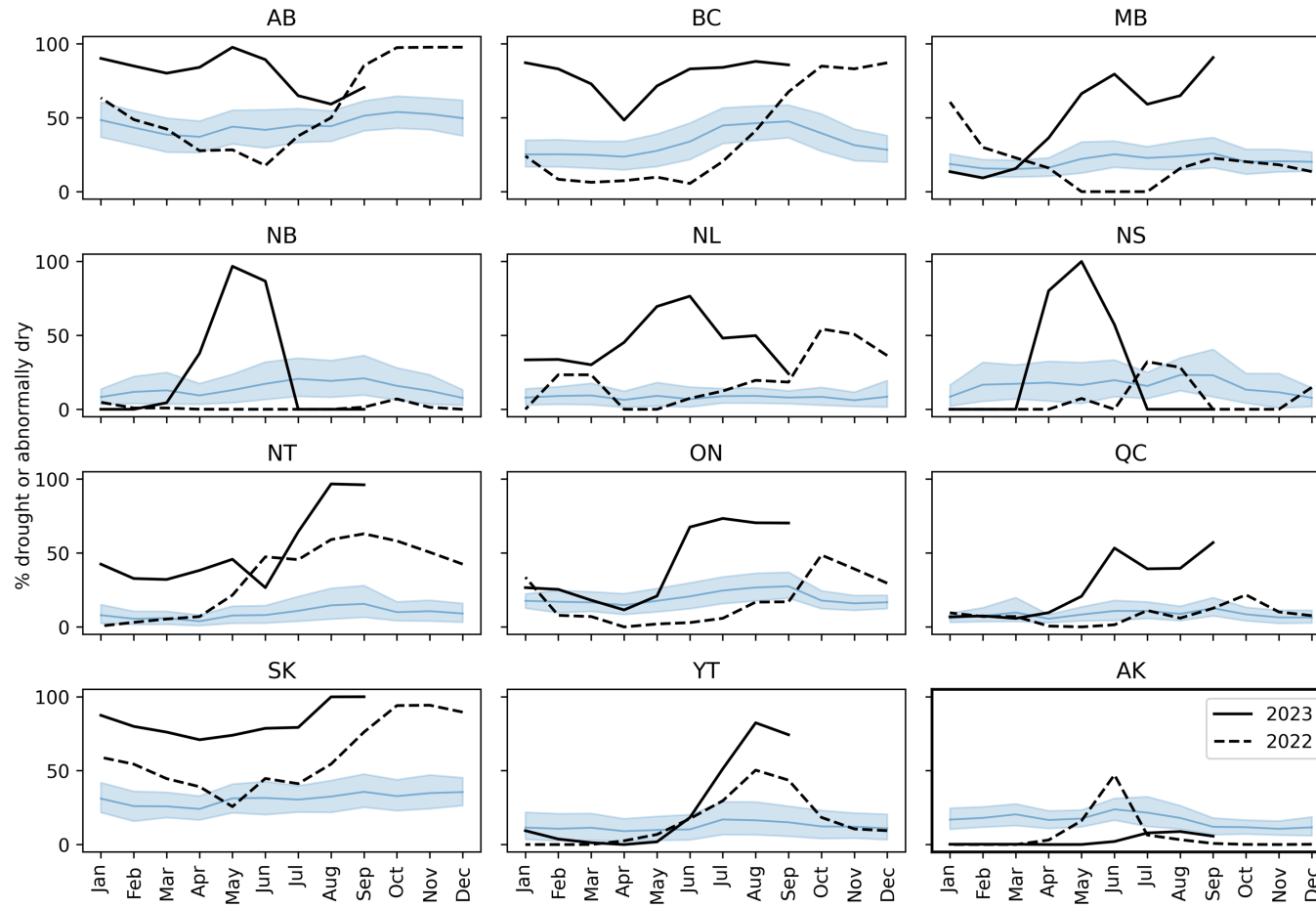
U.S. National Ice Center. (2008). IMS Daily Northern Hemisphere Snow and Ice Analysis at 1 km, 4 km, and 24 km Resolutions, Version 1.2 and 1.3 [G02156]. Boulder, Colorado USA. National Snow and Ice Data Center. <https://doi.org/10.7265/N52R3PMC>. Date Accessed 11-07-2023.



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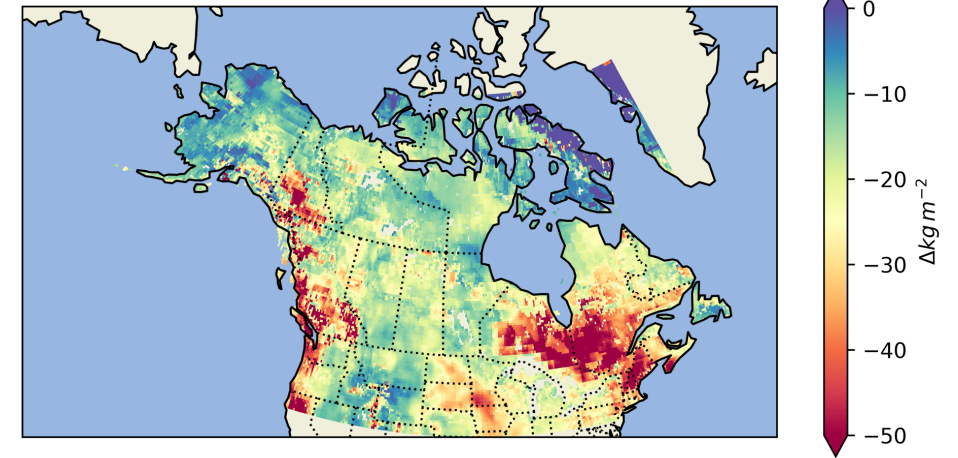
Drought conditions



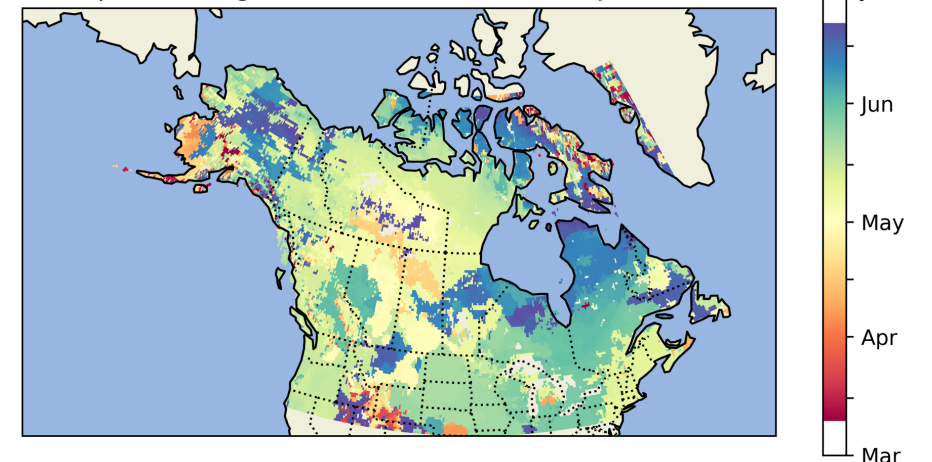
North American Drought Monitor

<https://droughtmonitor.unl.edu/NADM/>

Maximum two week decrease RZSM (March-June, 2023)



Midpoint of largest decrease RZSM (March-June, 2023)



Root zone soil moisture ~1m

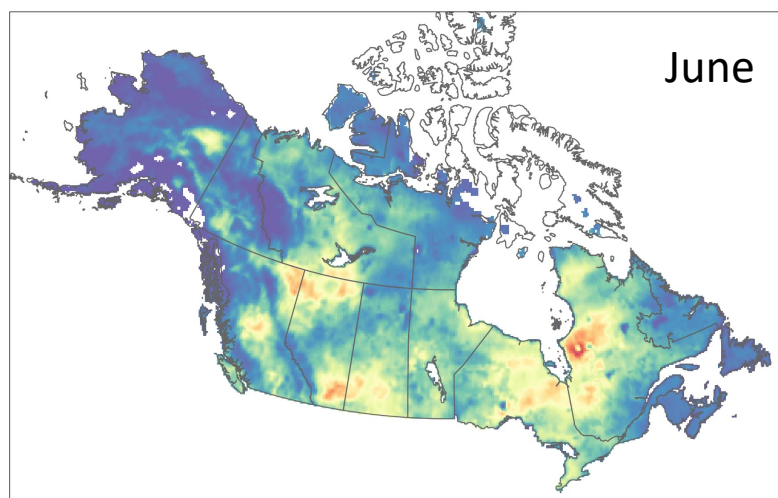
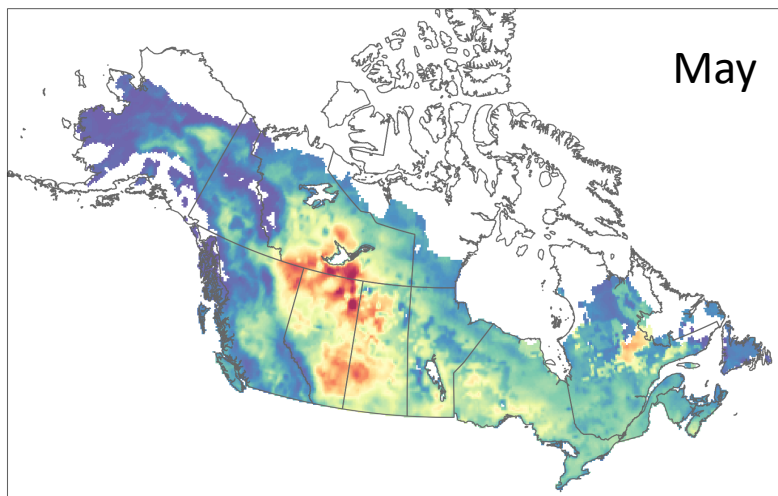
https://disc.gsfc.nasa.gov/datasets/GLDAS_CLSM025_DA1_D_2.2/summary



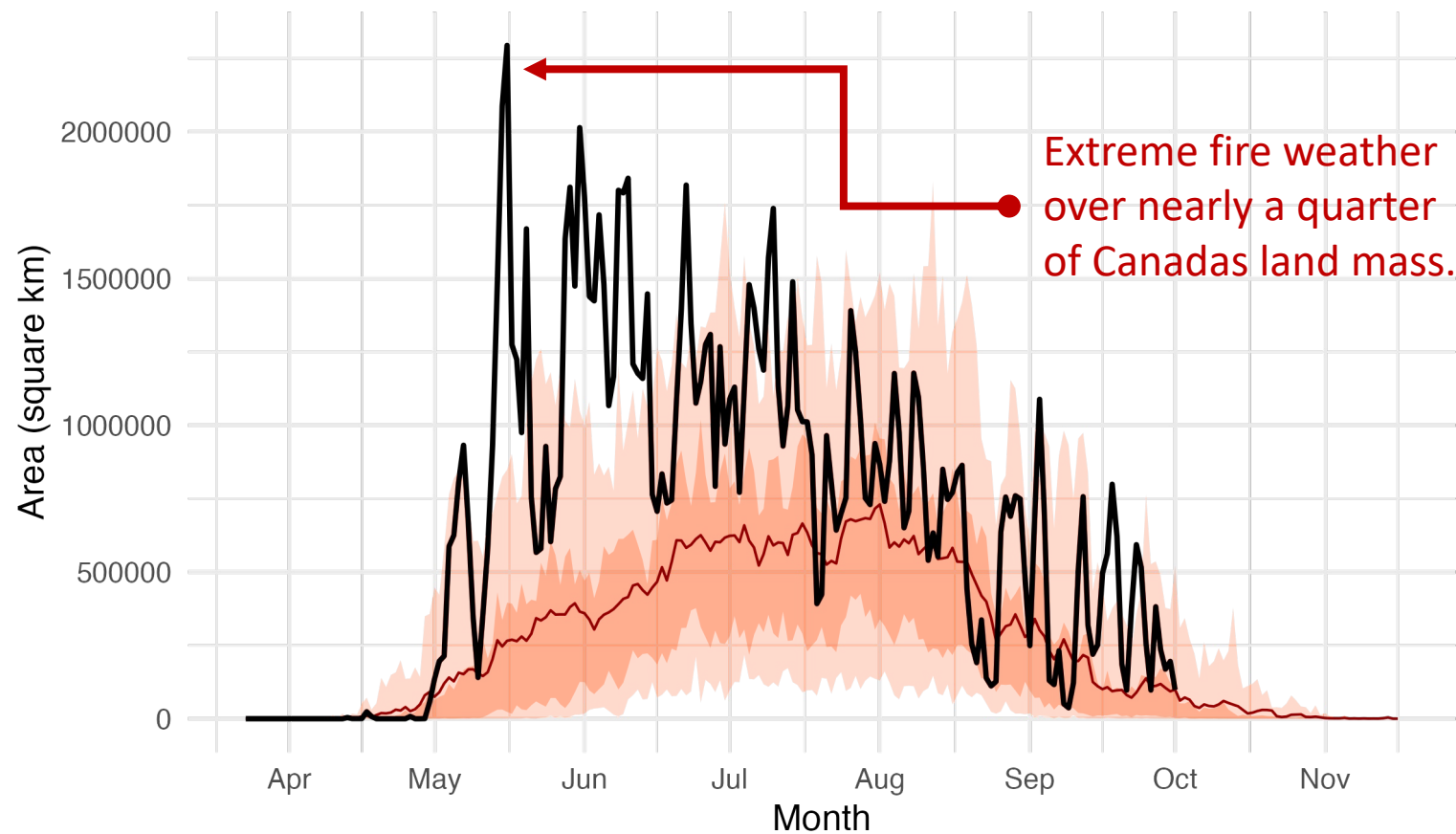
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Early season extreme fire weather



Area exceeding local 95th percentile FWI (1980-2022)

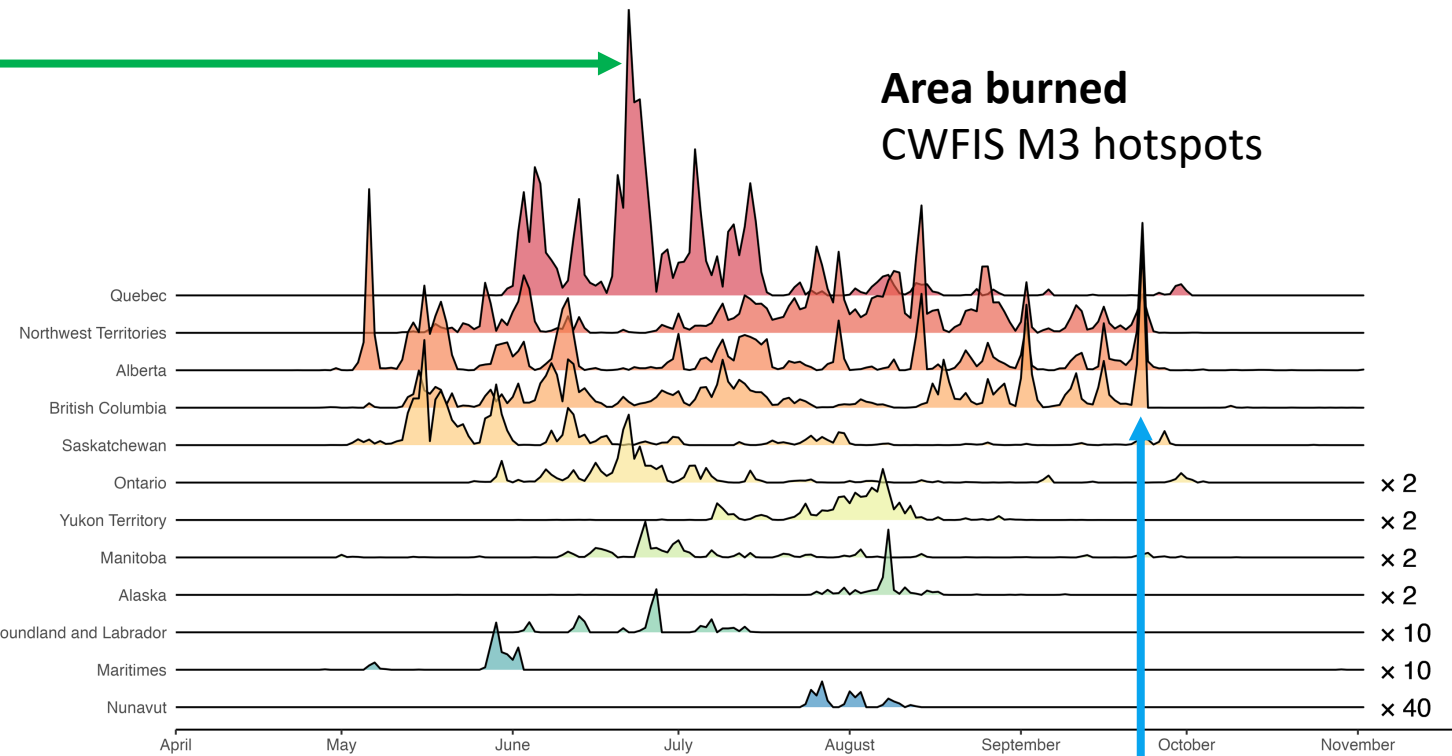
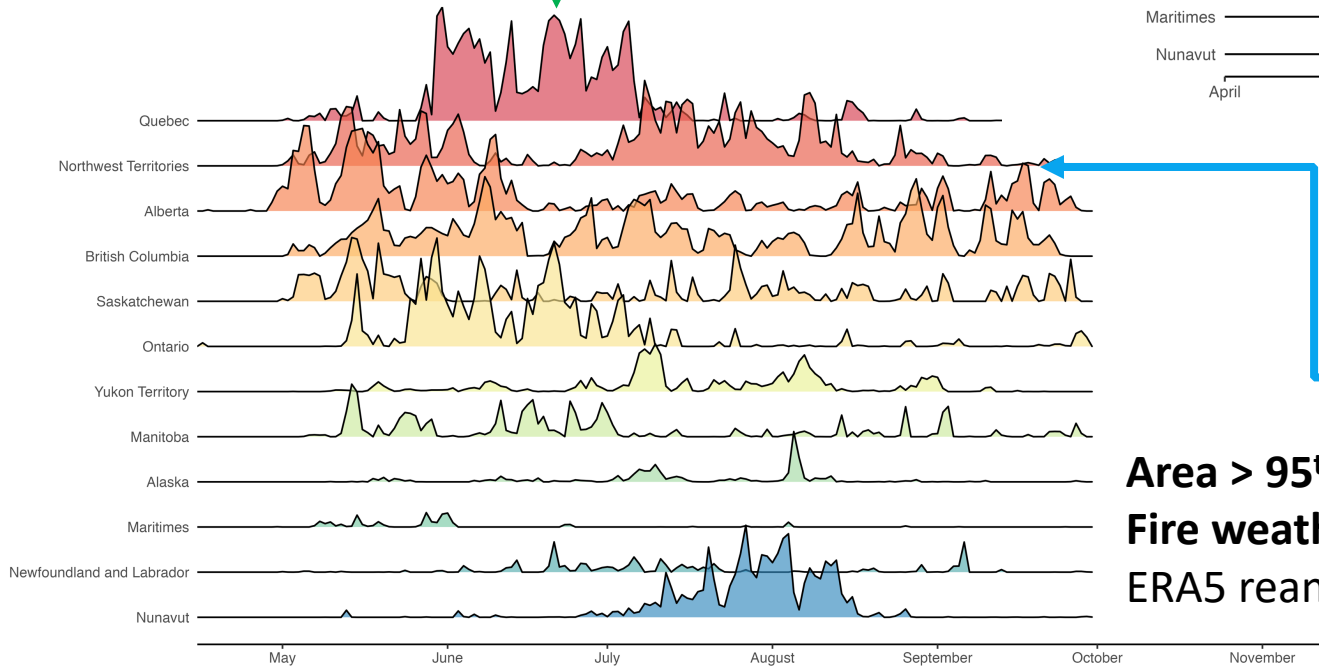


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Extreme fire weather

June 22nd – 526,354 ha



Area burned
CWFIS M3 hotspots

Sept 23rd – 576,439 ha

Area > 95th percentile
Fire weather index
ERA5 reanalysis



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Ignitions

In 2023:

59% of fires were lightning caused
resulting in 93% of total area
burned*

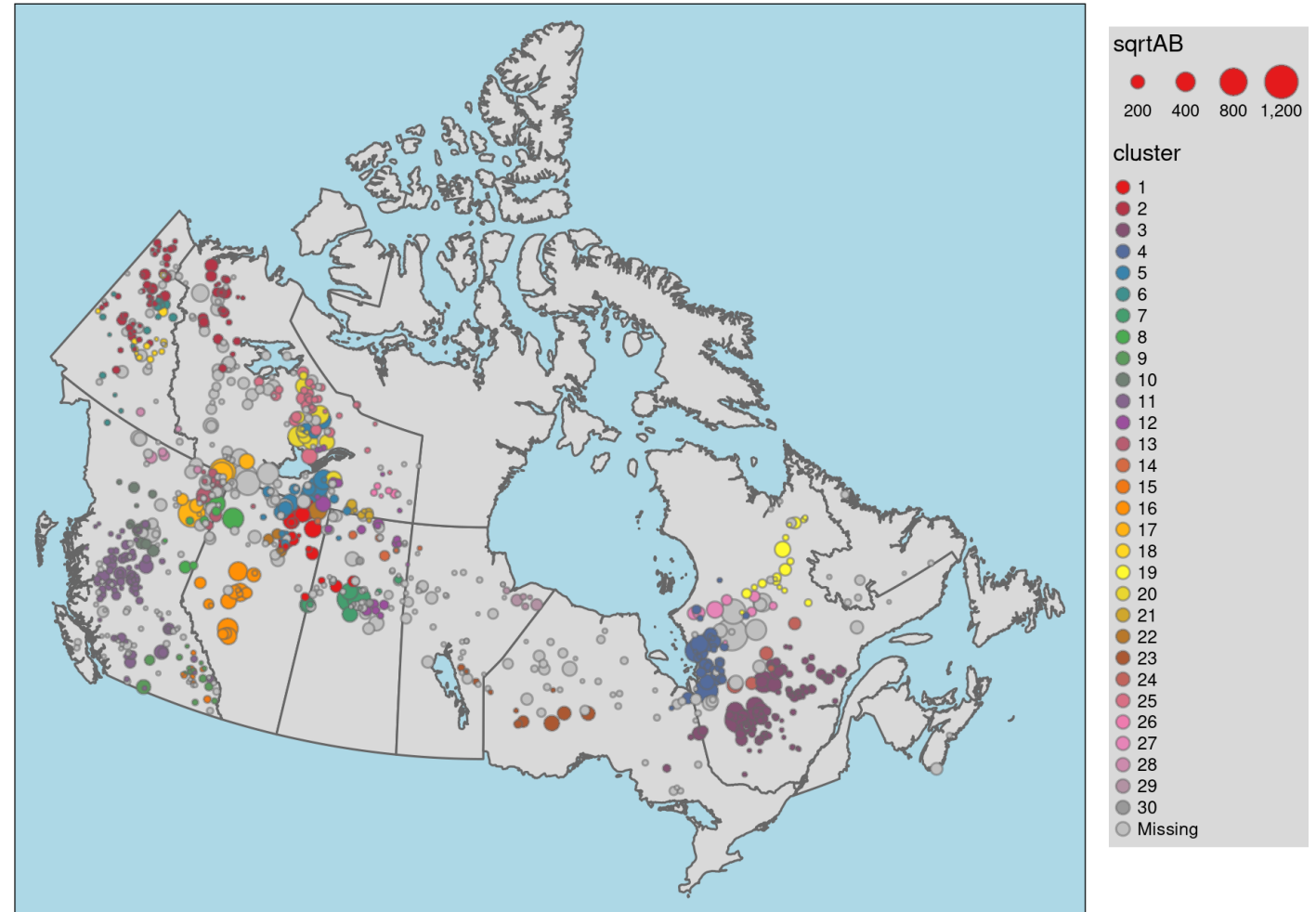
Historically (1959–2015):

75% of fires were lightning caused
resulting in 91% of total area
burned†

* From preliminary agency data

† Hanes et al., *Canadian Journal of Forest Research*. 49(3): 256-269.
<https://doi.org/10.1139/cjfr-2018-0293>

Lightning fires (2023)



Thank you

Questions? Contact me at piyush.jain@nrcan-rncan.gc.ca



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