Bi-Hourly Wildfire Behaviour Monitoring: A Canadian Solution to a Global Problem

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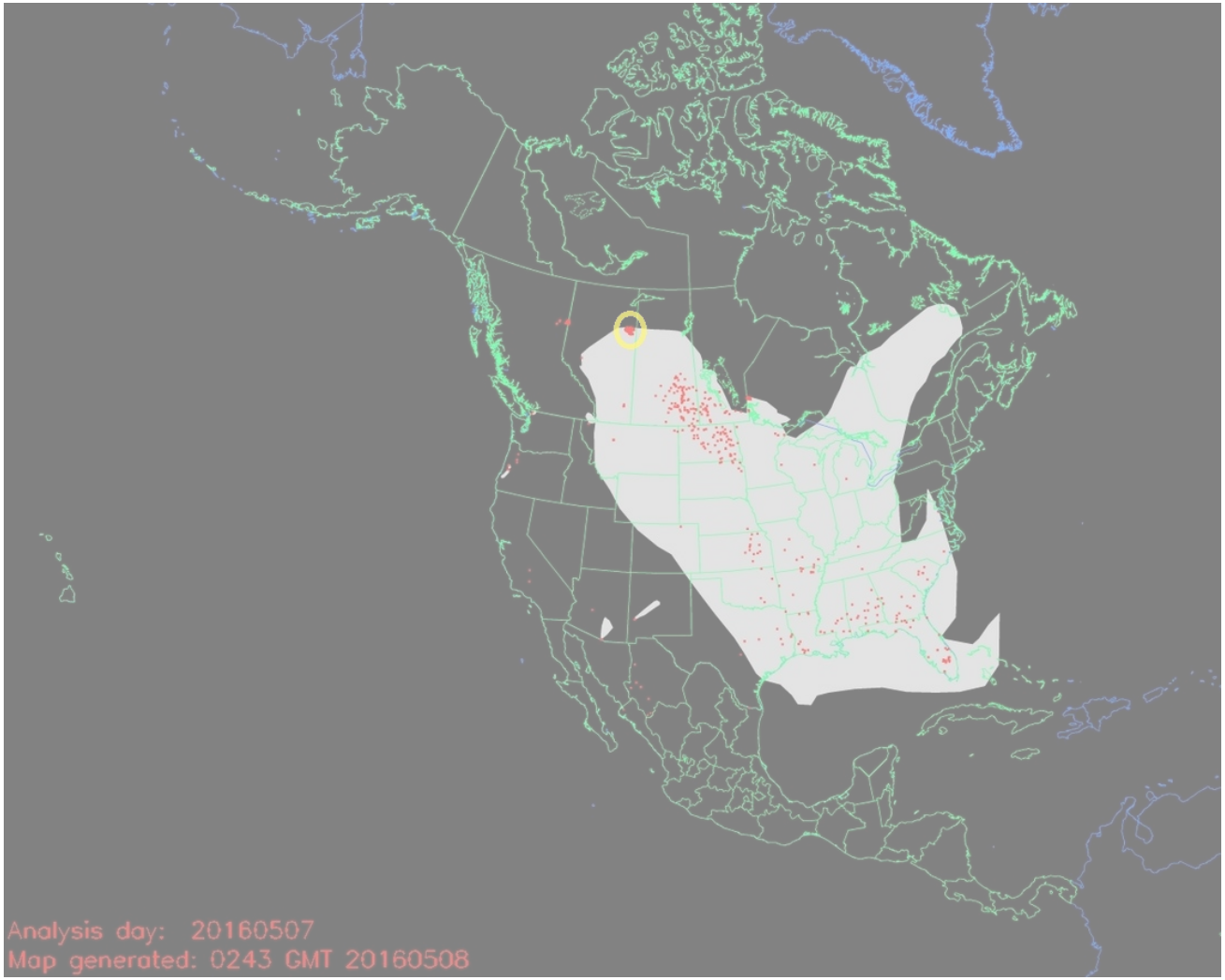
GOFC-Fire Nov. 2016, Santiago, Chile

Problems Caused by Wildfire (Canada)

- More than 1 billion $ yearly cost to manage,
- Significant health hazards (degraded air quality),
- Carbon release into the atmosphere,
- $Billions in damage and indirect costs:
  - Destruction of communities, industrial sites, national and provincial parks,
  - Evacuations and health costs,
  - Insurance losses (Ft McMurray 2016 - $3.8B)
  - Loss or revenues:
    - Timber, Energy, Farming, Tourism.

- The amount of wildfire is growing on a yearly basis.

Area Affected by Smoke from Fort McMurray

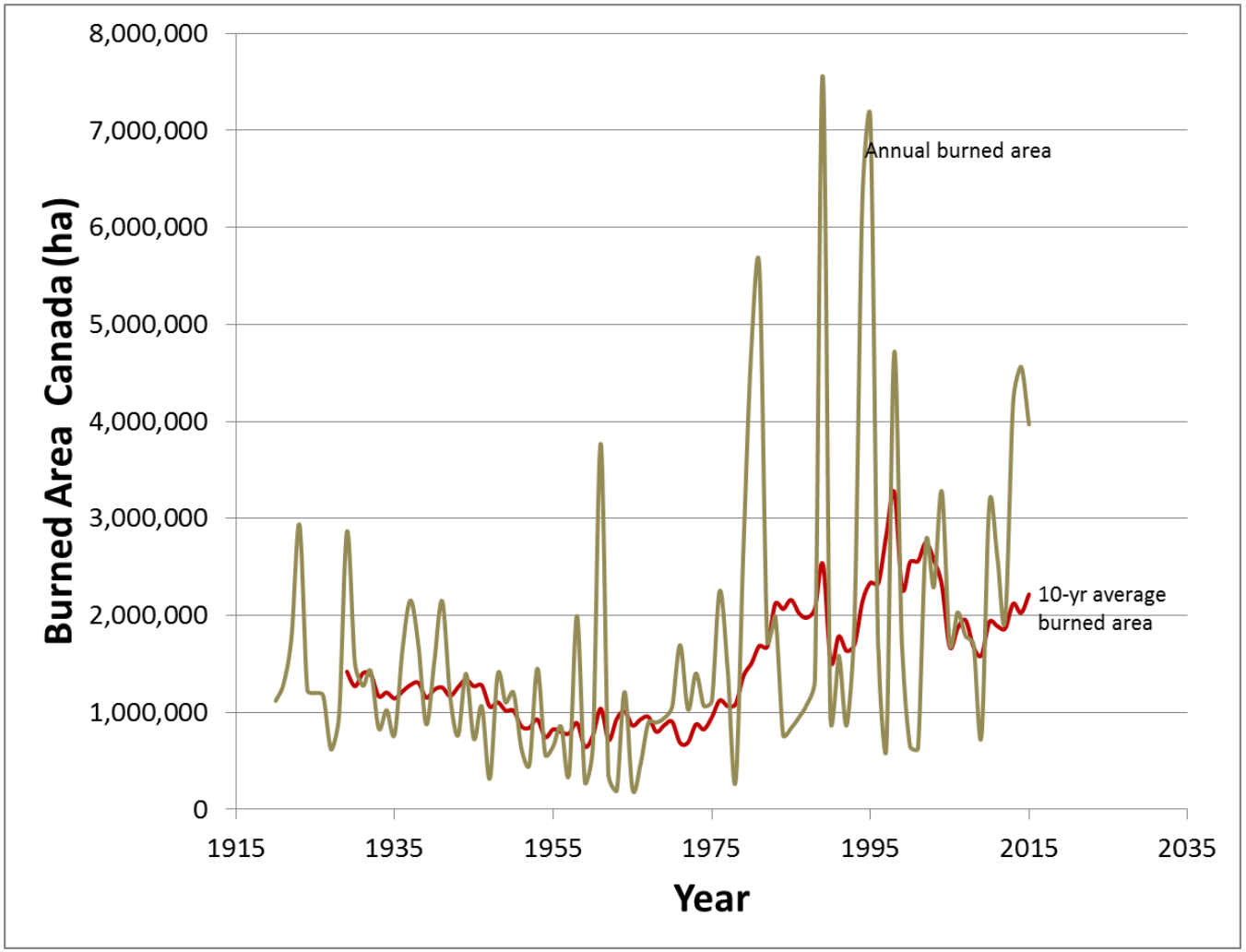


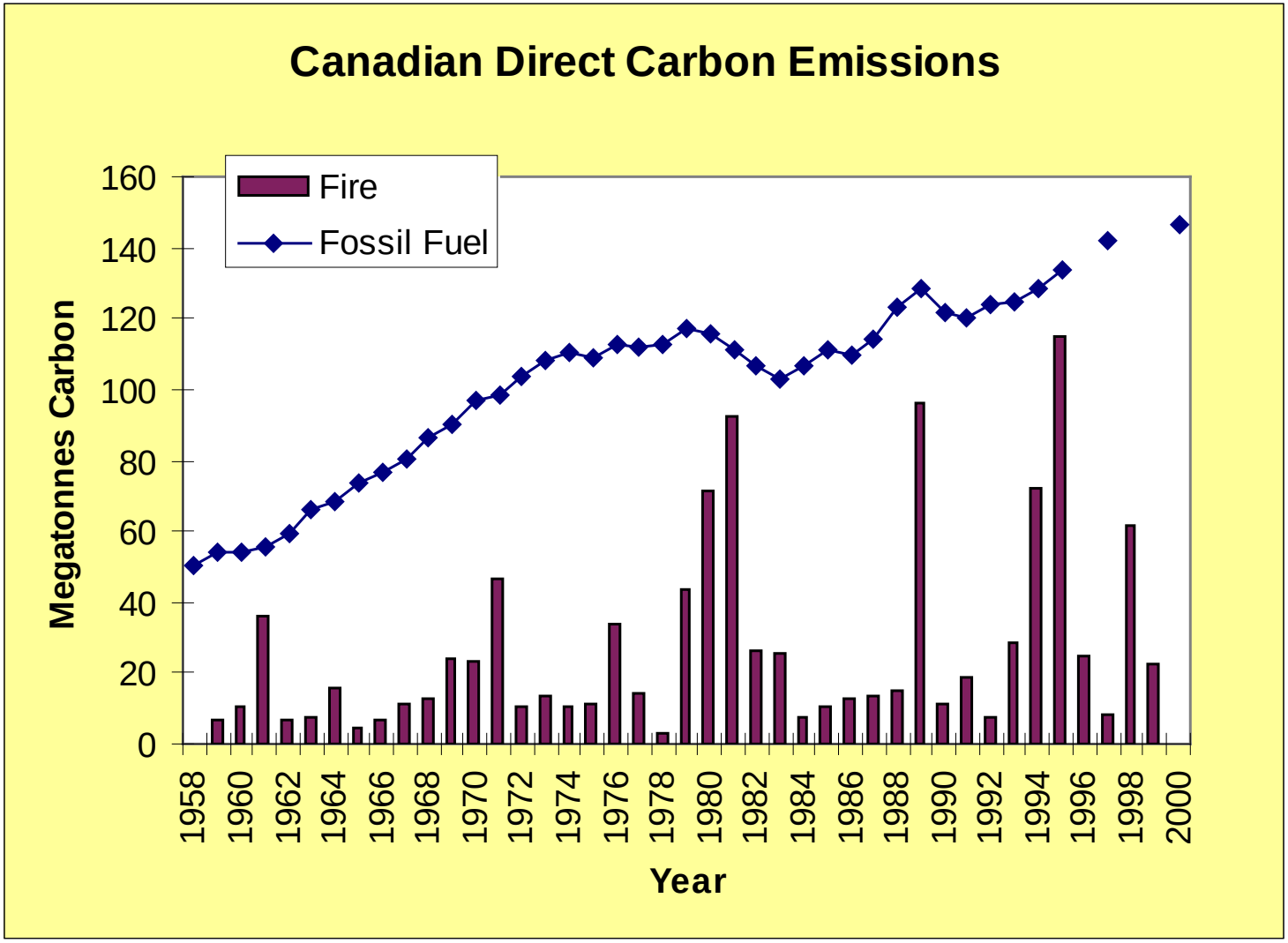
Facts about wildland fires in Canada

Average # of forest fires per year:	7,500
Total area burned annually:	2.3 million hectares

3% of the fires account for 97% of total area burned

Wildfire Occurrence – Canada 1918-2015





Sources:
Fossil fuels: www.nrcan.gc.ca/es/ceo/update.htm
Fire: Amiro, B.D. *et al*. 2001. Can. J. For. Res. 31: 512-525

Prioritization of Fires

- Limited resources available for fire suppression;
- Only subset of all fires can be tackled;

Which fires to choose for attack?

- Goal: reduce the number of large escape fires
  - i.e. the 3% of fires that cause most damage;

→ **Save drastically on overall cost**

Fire Danger Rating (FDR)

Fire Hazard (amount, type orientation…)

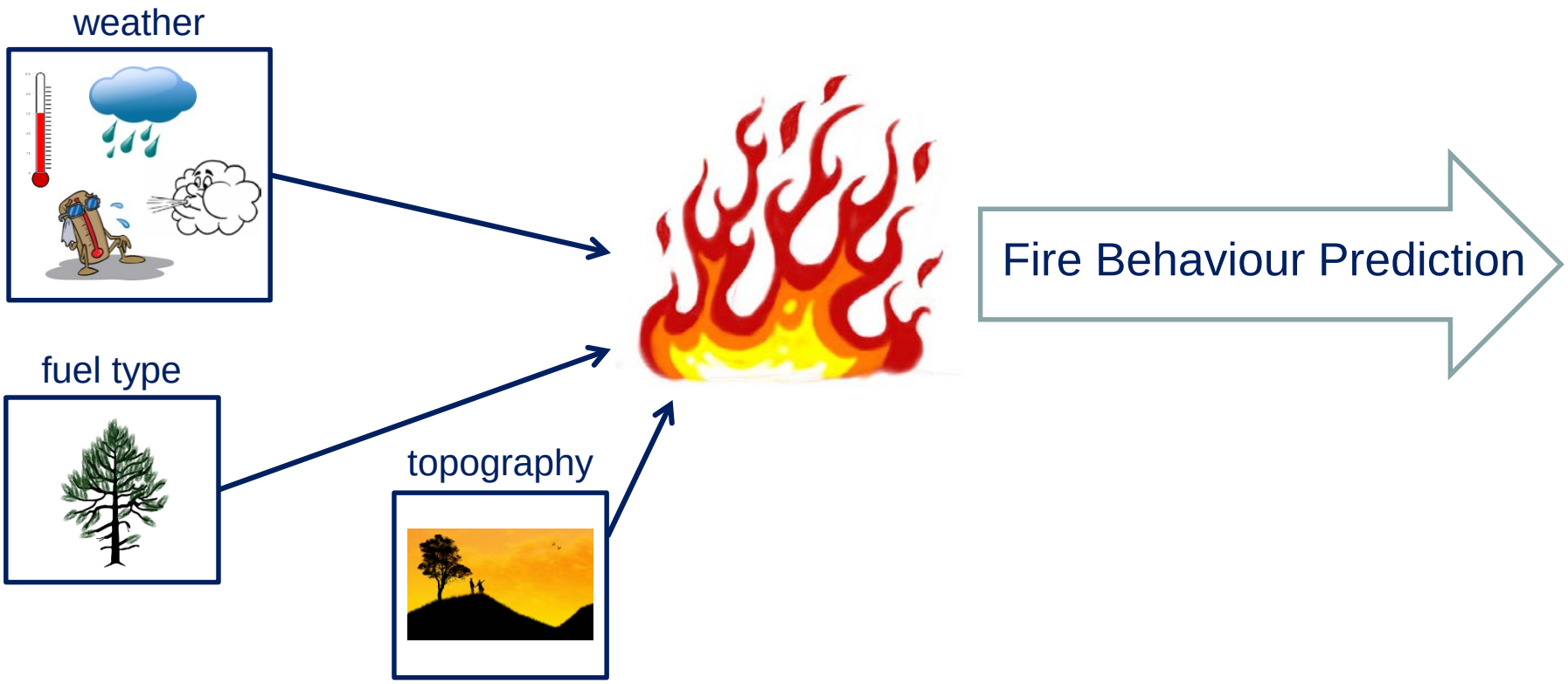
X

Ignition Risk from people & lightning

=

Fire Danger Rating

Fire Behaviour Prediction

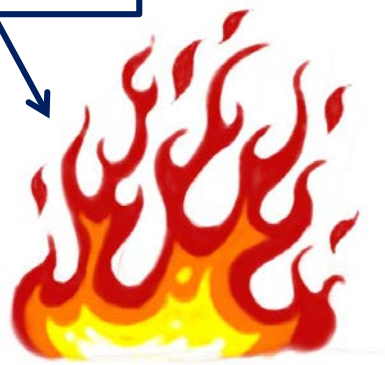


Fire Behaviour Prediction

fire characterization

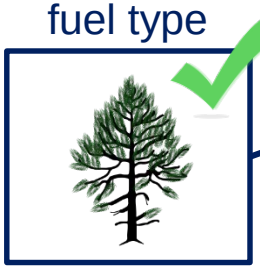
Location

weather



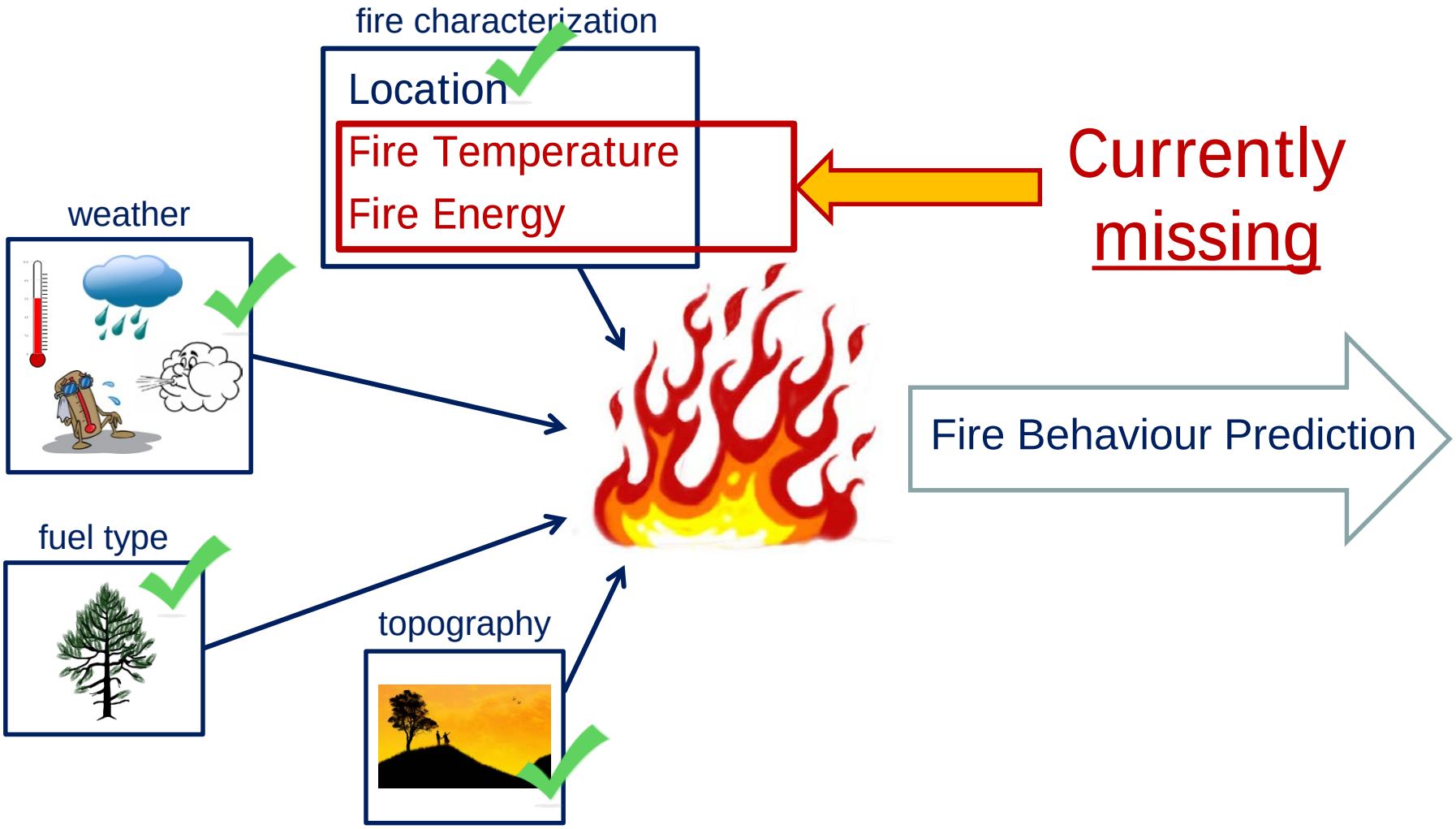
Fire Behaviour Prediction

fuel type



topography

Fire Behaviour Prediction



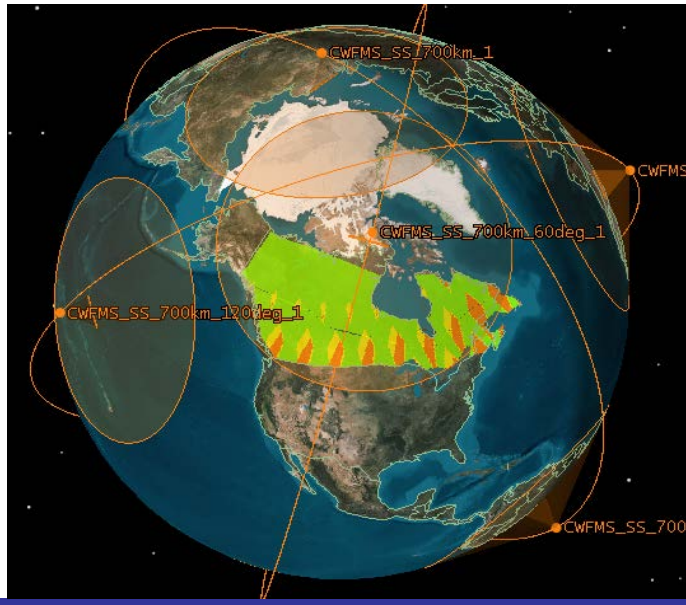
What we are Missing

- Fire characterization data:
  - ✓ Every 2 – 3 hours;
  - ✓ Of every point in Canada;
  - ✓ For fires as small as 15 m by 15 m;
  - ✓ Available within 30 min. after data acquisition.

Only possible from space

With a constellation of satellites

Affordable with low-cost satellites

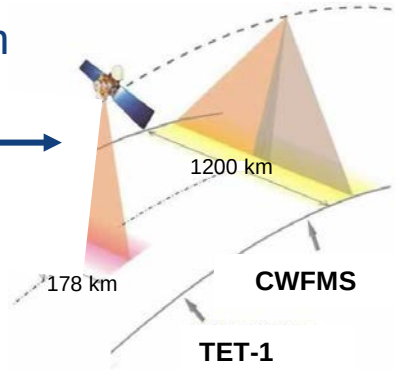


Systems Currently Available

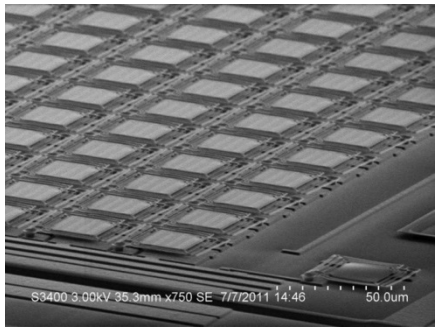
- Have insufficient:
  - Temporal or spatial resolution;
  - Data latency;
  - Measurement performance (saturation issues);
- Do not provide the necessary coverage of Canadian forests;
- Come from cooled Infra-Red detectors;
  - High-cost payload technology;
  - High mass, volume and power demands lead to costly satellites that are not suitable for a multi-sat constellation.

A Canadian Solution:
Uncooled Infrared Detector Technology

- Canadian industry developed a novel infrared sensor called a **microbolometer**;
- Contrary to infrared sensors used in other missions, the microbolometer does not require cooling;
- This allows for a relatively low-cost mission with both high spatial resolution as well as high temporal resolution (large swath)



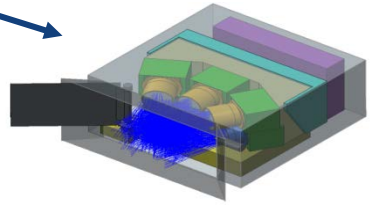
Canadian **UNCOOLED** infrared detector technology



LOW COST – LOW POWER
LOW VOLUME – LOW MASS

Result:

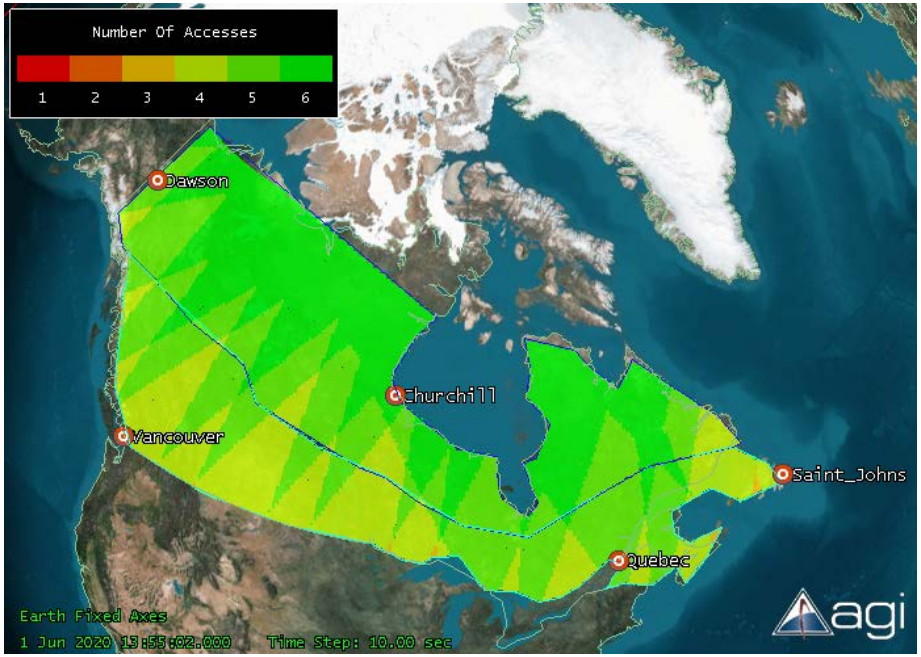
- **High Revisit:**
  - Multiple sensors packed in one satellite → large swath;
  - Low-cost microsatellite → makes constellation of satellites affordable.
- **Short Data Latency:**
  - Use of Canadian Ground Stations;
  - Maximum 30 min. latency.
- **Routinely Scanning of the whole of Canada:**
  - Low power needs allow for long-duration scanning.



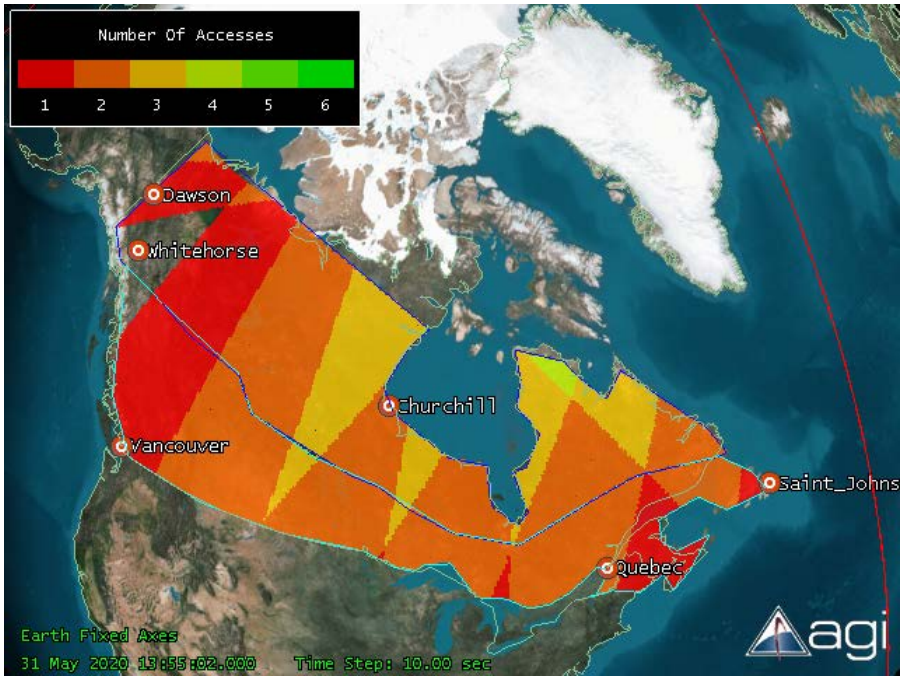
Canadian Wildland Fire Monitoring System (CWFMS)

Number of Accesses with a 9-sat Operational CWFMS Constellation:

During the burning period of one day
(09:00 – 21:00 local time)



During the PEAK burning period of one day
(15:00 – 19:00 local time)



Additional Benefits
from a Canadian Wildland Fire Monitoring System

- Enabling ecologically beneficial fires to burn on the landscape;
- Accurate fire statistics for the whole of Canada for future optimization and research;
- Accurate estimations of fire carbon emissions;
- Accurate prediction of Smoke and Air Quality;
- Industrial innovation/growth in Canada
  - space technology, remote sensing, data service;
- Benefits not limited to Canada → global coverage.

Contact Information

- For more information, please contact:

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