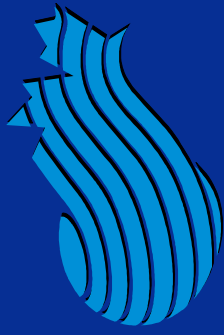


# *Fire Research at Canada Centre for Remote Sensing*

1. Fire ecology and forest fire in Canada
2. Satellite detection of boreal forest fires
3. Smoke plume detection
4. Burned area mapping
5. Fire Monitoring, Mapping, and Modeling  
(Fire M3) information system



# *Boreal fire ecology*



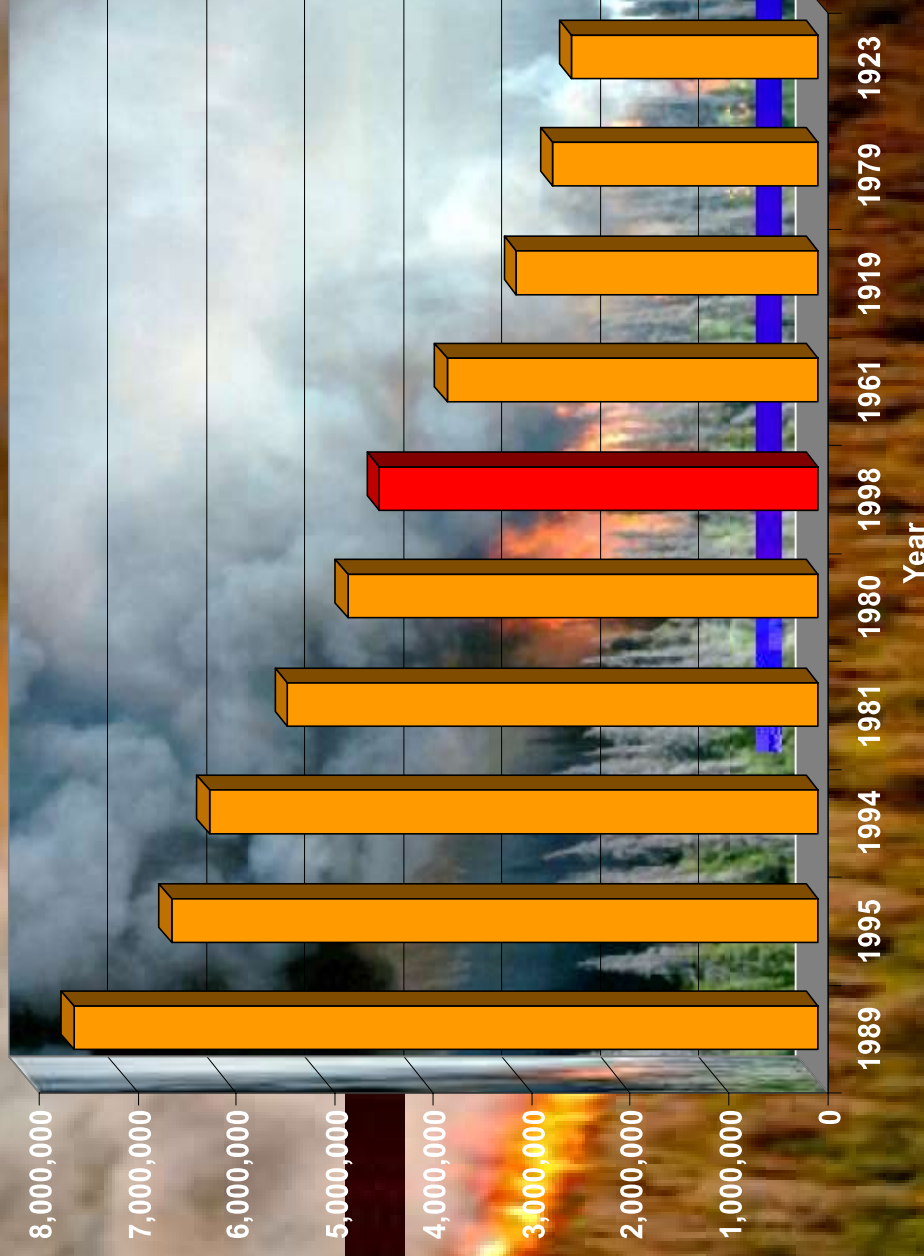
- 25% of world's forest area
- Fire is natural ecosystem process
- Crown fires caused by lightning represent most burned area

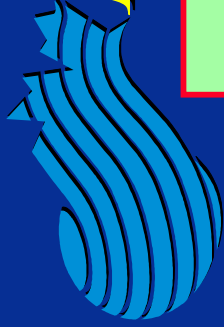
# *Forest Fire in Canada*

- 9000 fires per year
- More than 2 million ha burned annually on average
- \$500 million fire management cost
- Climate change impacts?
- Large fires (>200 ha) account for 97% of burning
- Well suited to monitoring by coarse resolution satellite sensors

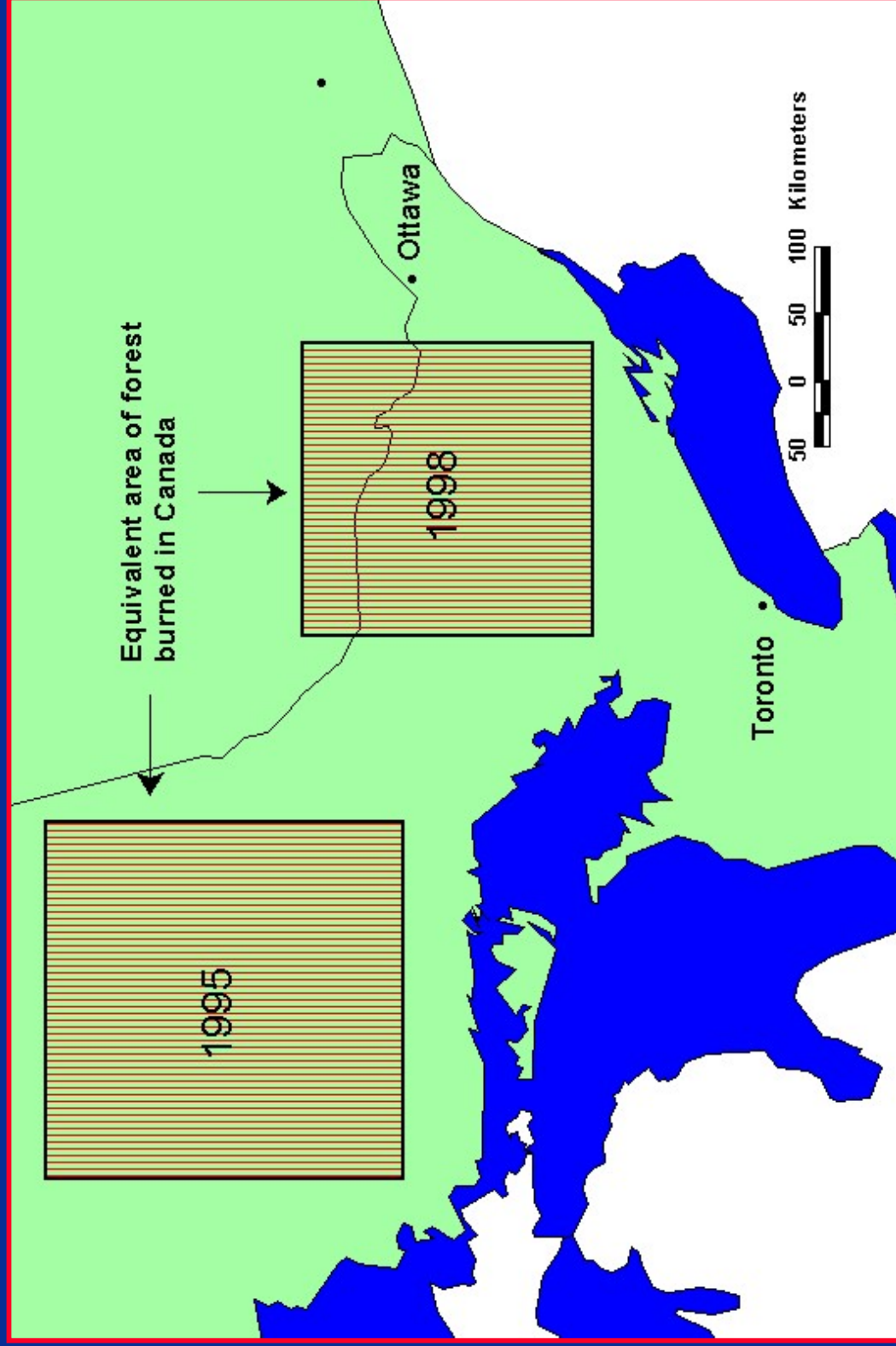
# Top 10 Fire Years in Canada

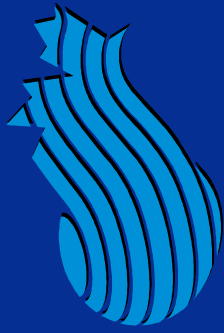
- The six most severe fire years on record have occurred since 1980
- In 1998 an all time record of \$712 million was spent on forest fire suppression





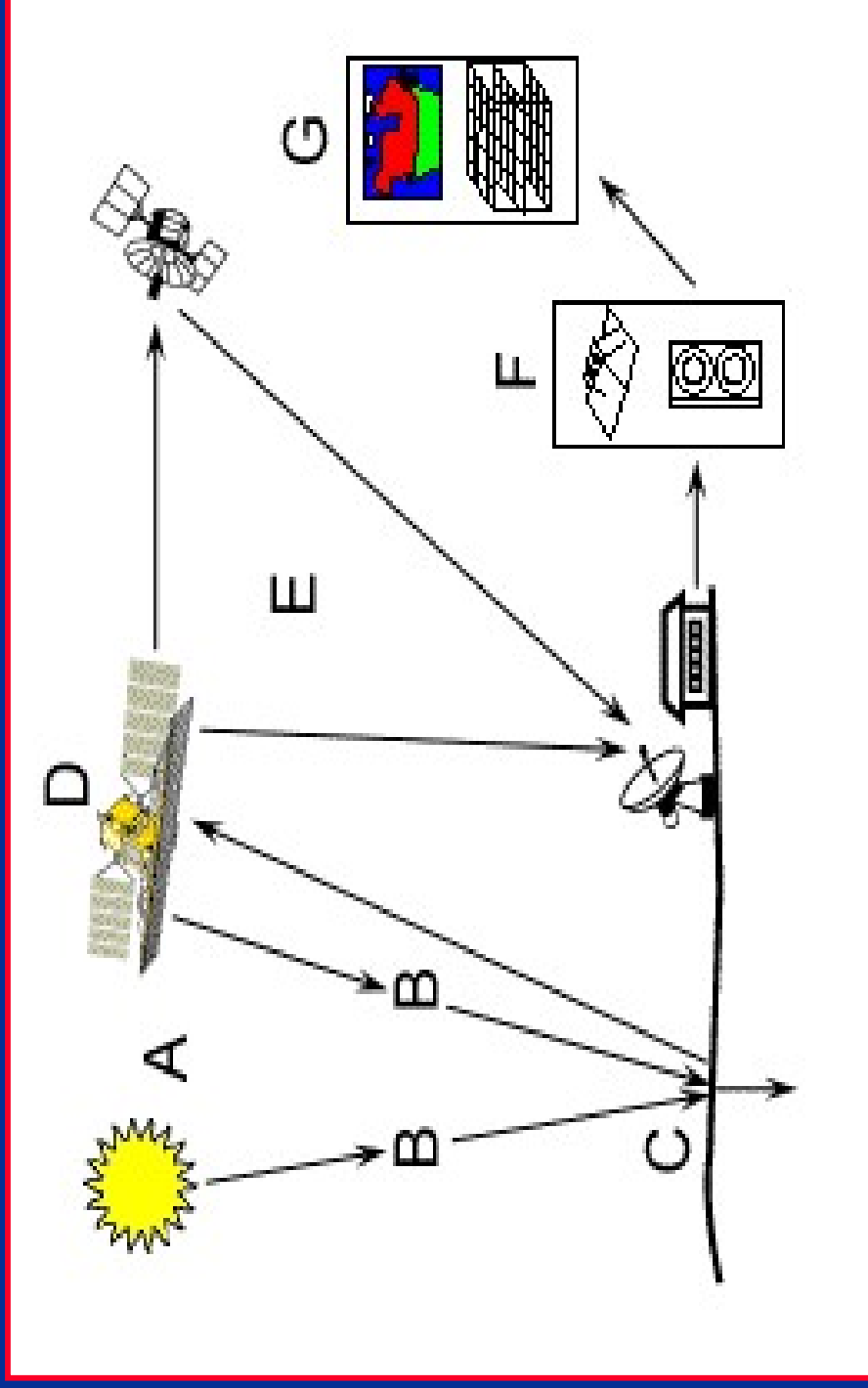
# Extent of forest fires in Canada

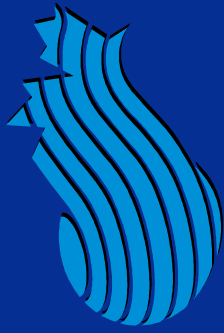




# Satellite Remote Sensing

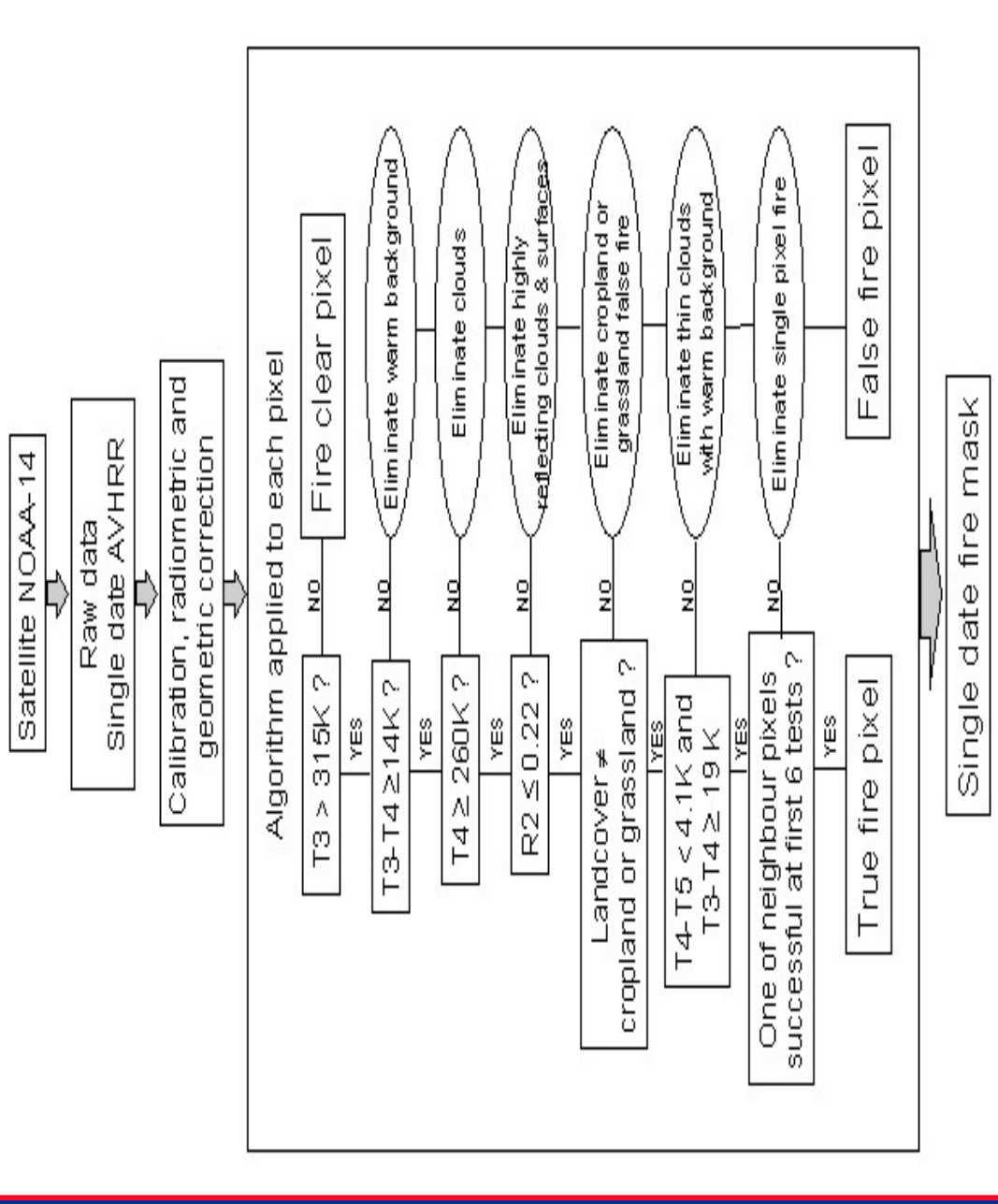
- A. Energy Source
- B. Atmosphere
- C. Interaction with target
- D. Sensor
- E. Transmission
- F. Interpretation
- G. Application

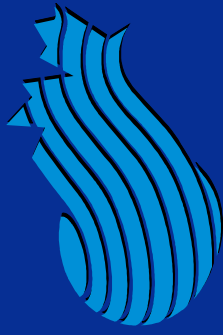




# CCRS Fire Detection Algorithm

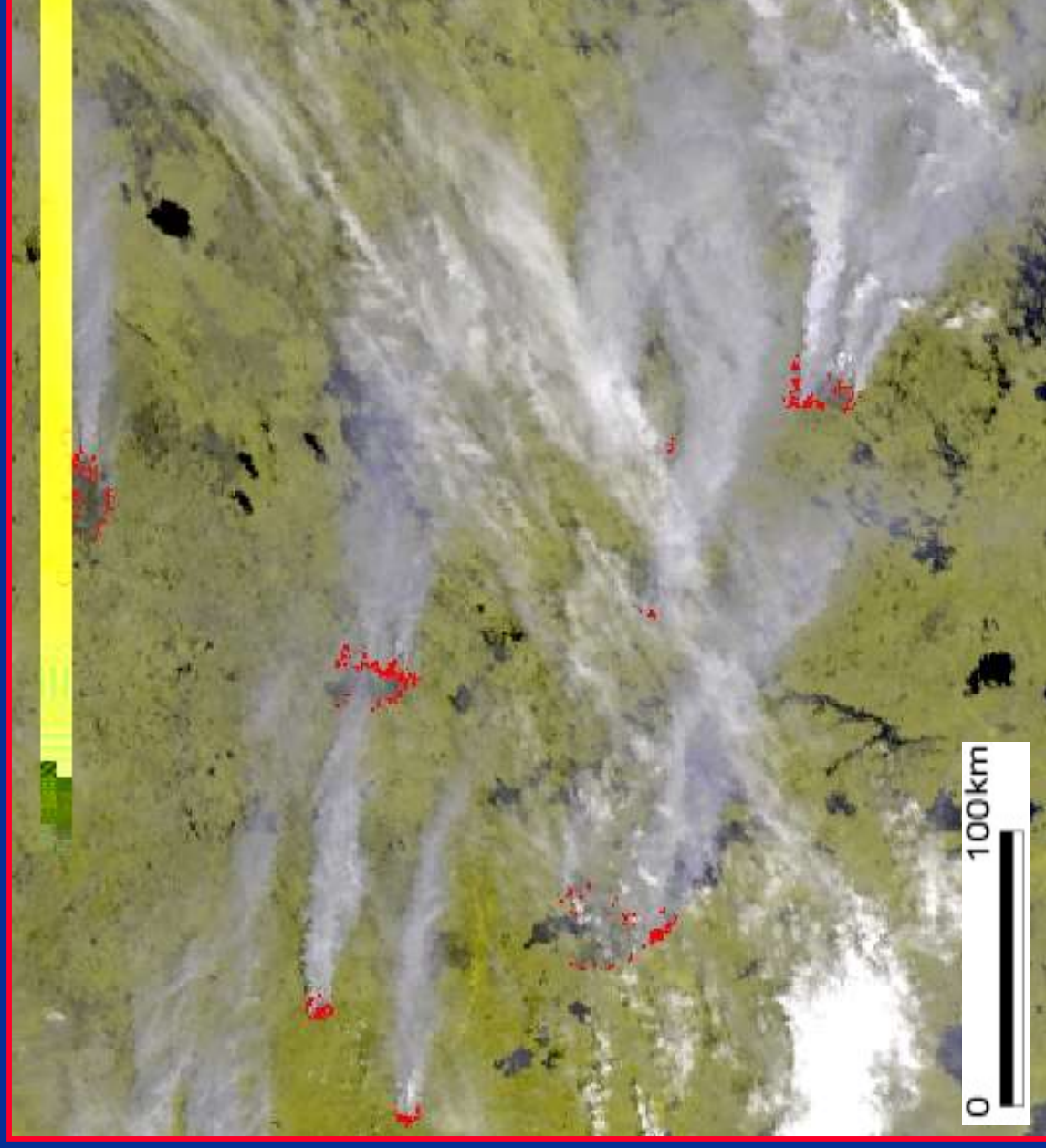
- Threshold approach
- Includes a series of tests to reduce false alarms



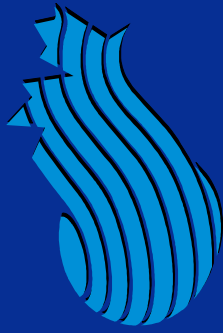


*Fire algorithm  
hotspots overlaid  
on satellite image*

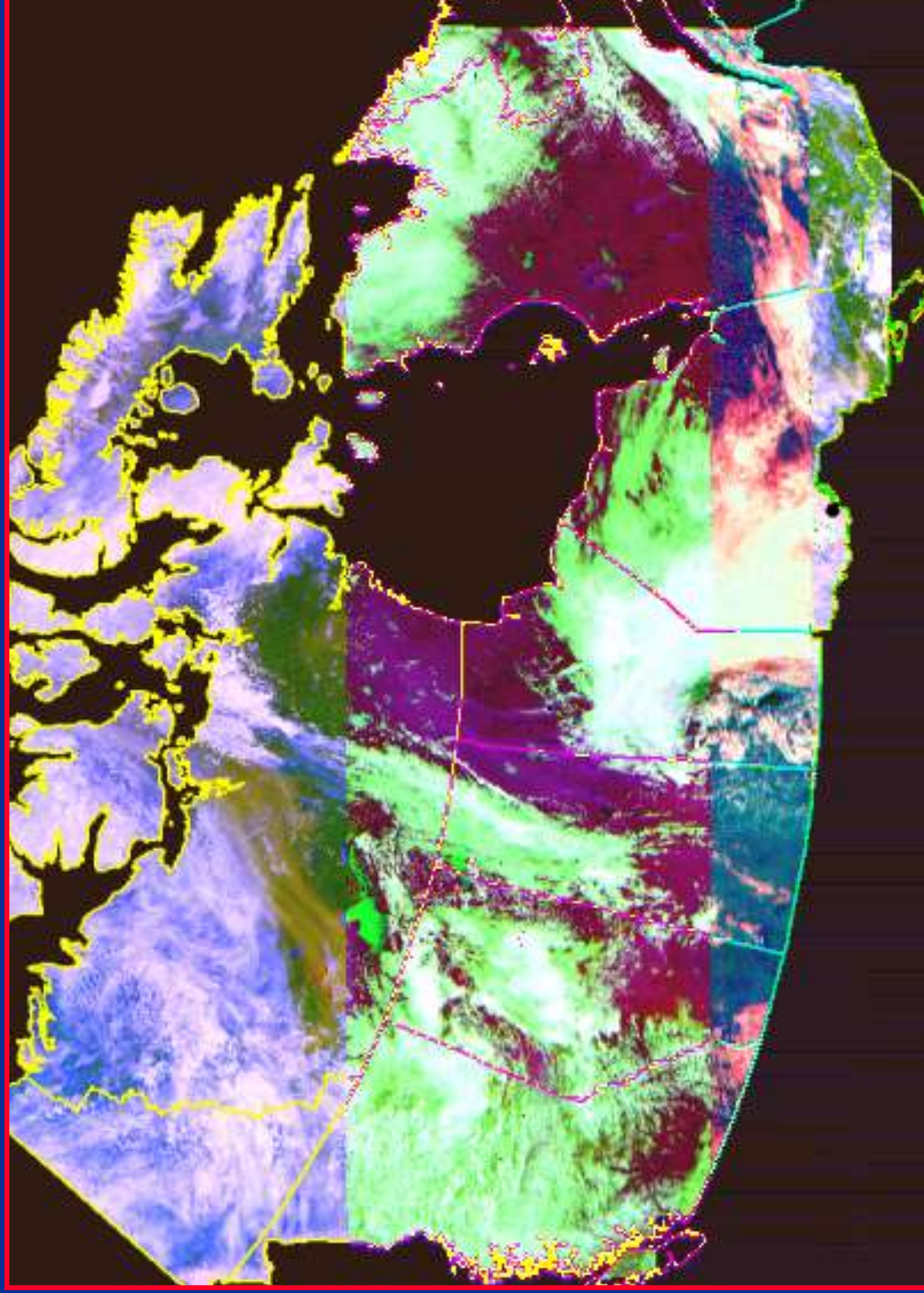
Saskatchewan  
Aug 11/98







*Hotspots and  
smoke plumes  
June 25, 1995*

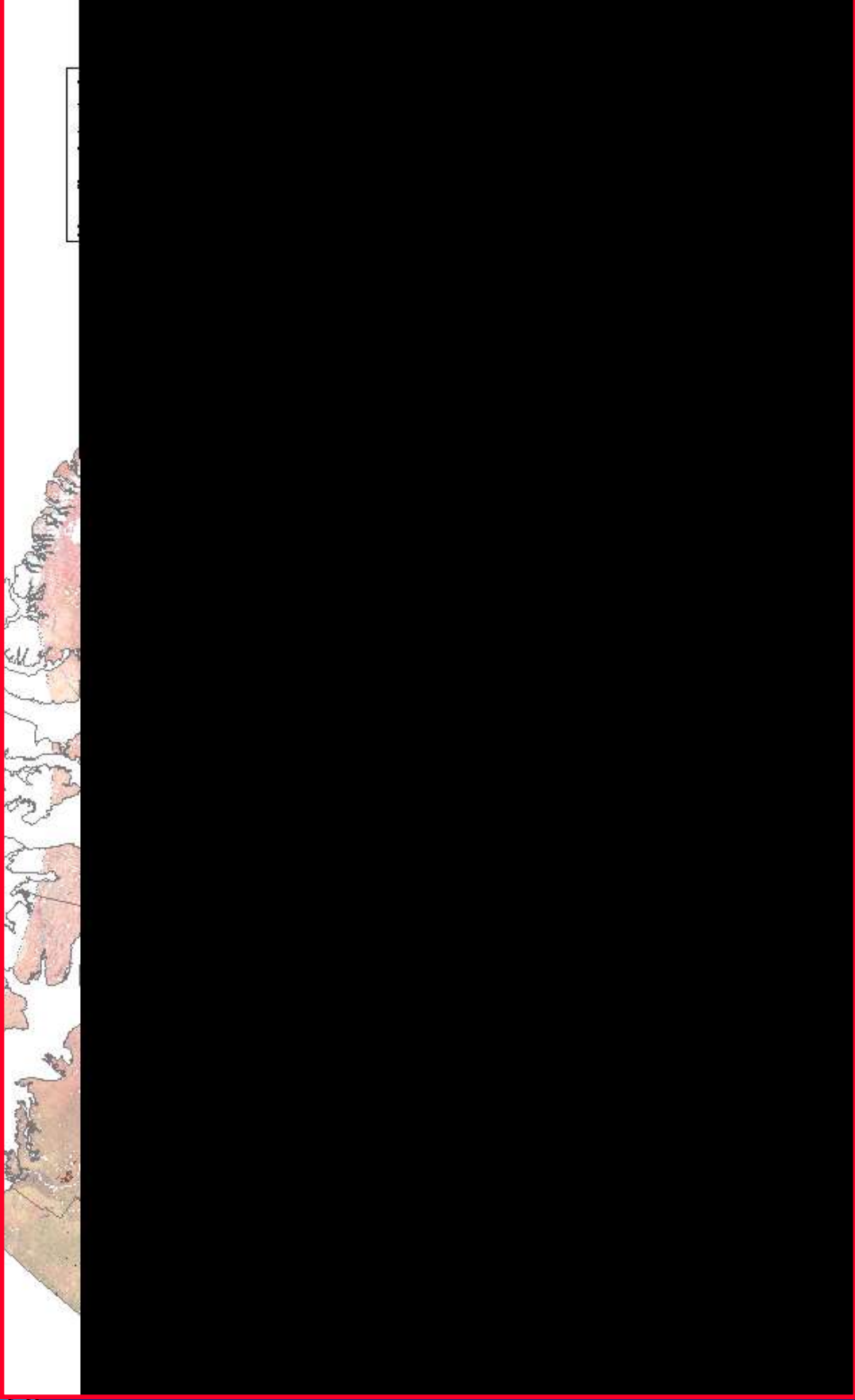


**CANADA CENTRE FOR REMOTE SENSING**  
*Applications Division*

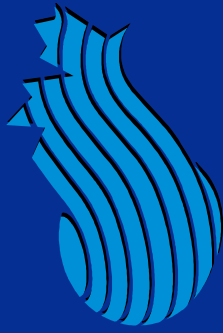
**Canada**  
Natural Resources Canada



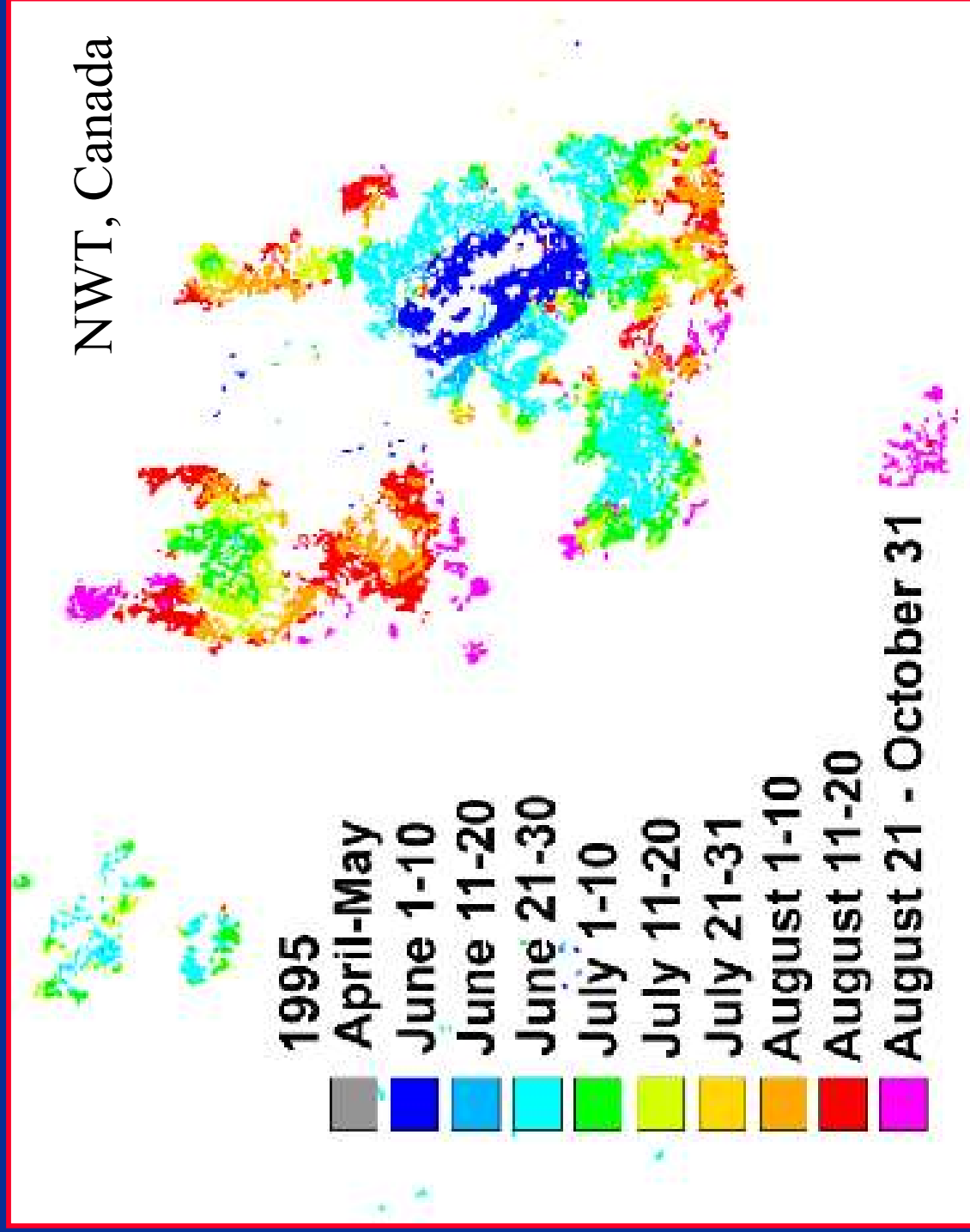
# *Forest fire hotspots detected in Canada*

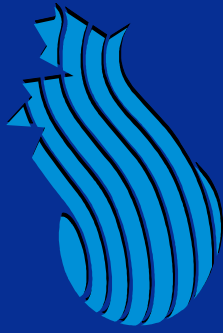


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*Applications Division*



# *Fire progression from satellite hotspots*

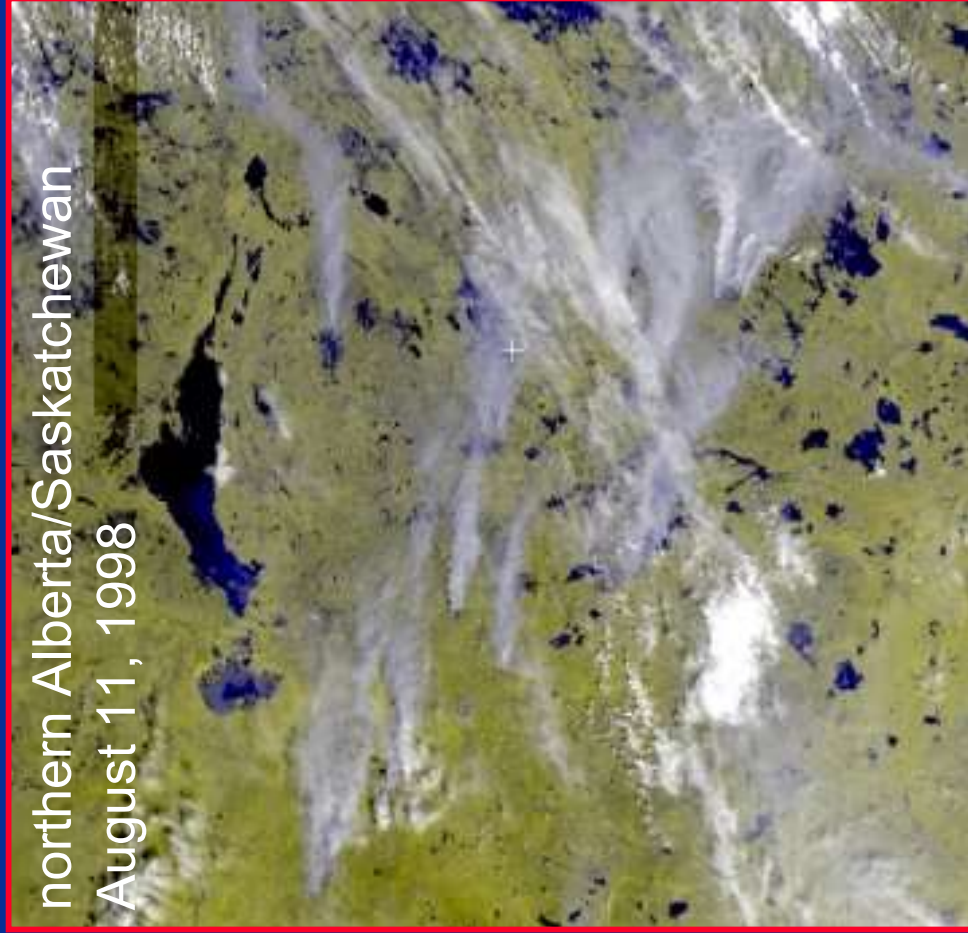




# *Smoke detection using satellite imagery and artificial neural networks*

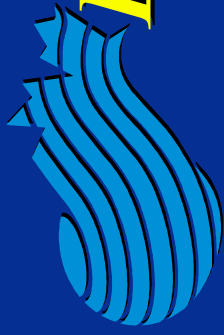
northern Alberta/Saskatchewan

August 11, 1998



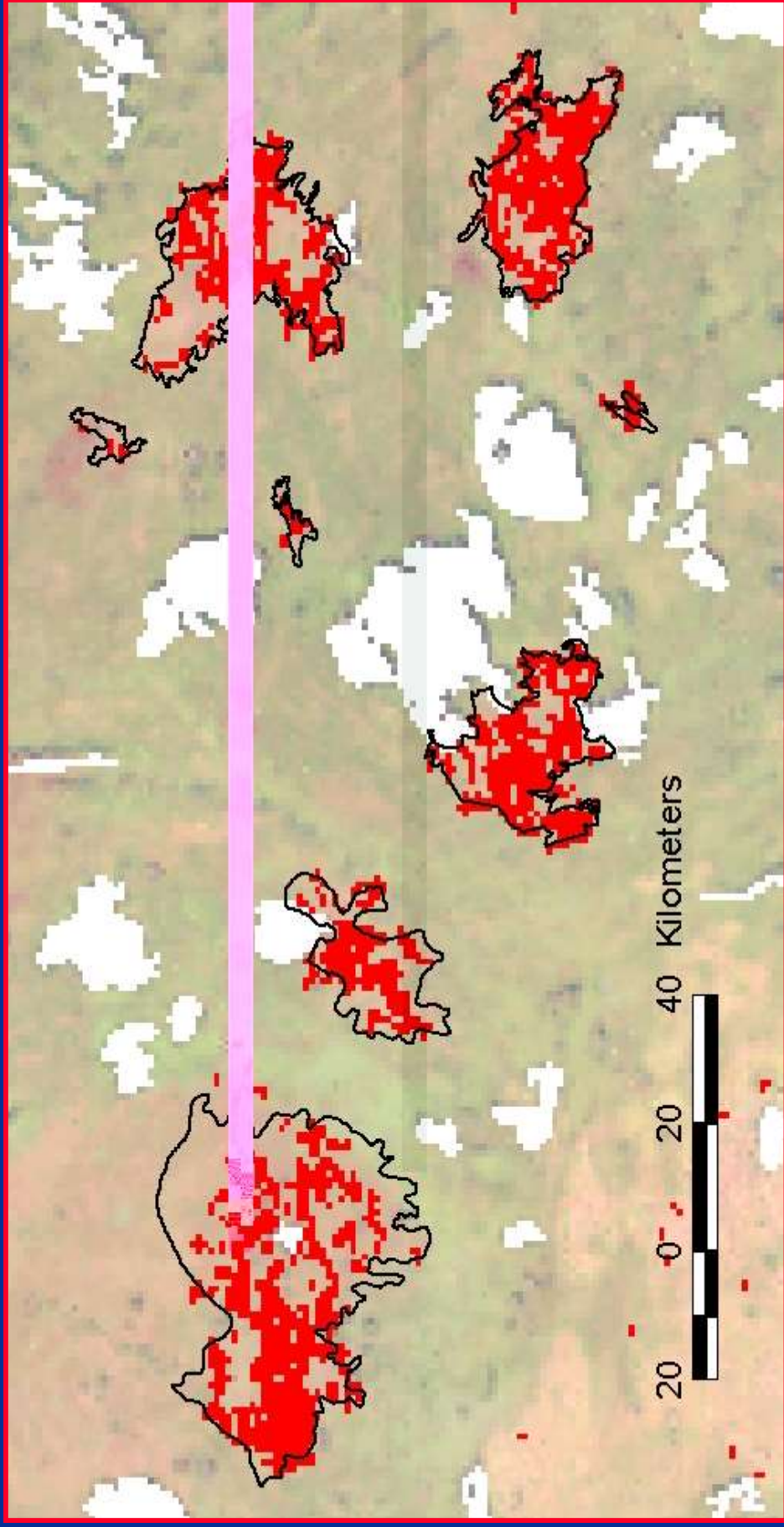
**CANADA CENTRE FOR REMOTE SENSING**  
*Applications Division*

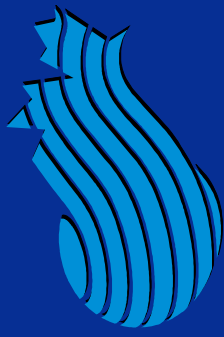
**Canada**  
Natural Resources Canada



# *Burned area mapping using satellite*

- Hotspot detection underestimates burned area





# *Burned area mapping by combining hotspots and change detection (HANDS)*

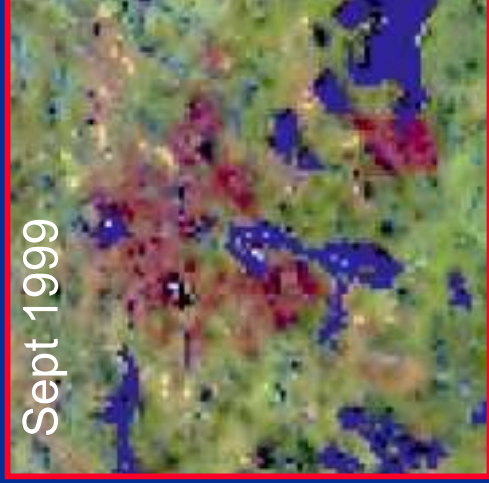
1. AVHRR hotspots



2. Multi-temporal differencing (SPOT VGT)

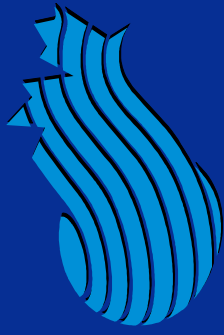


Sept 1999

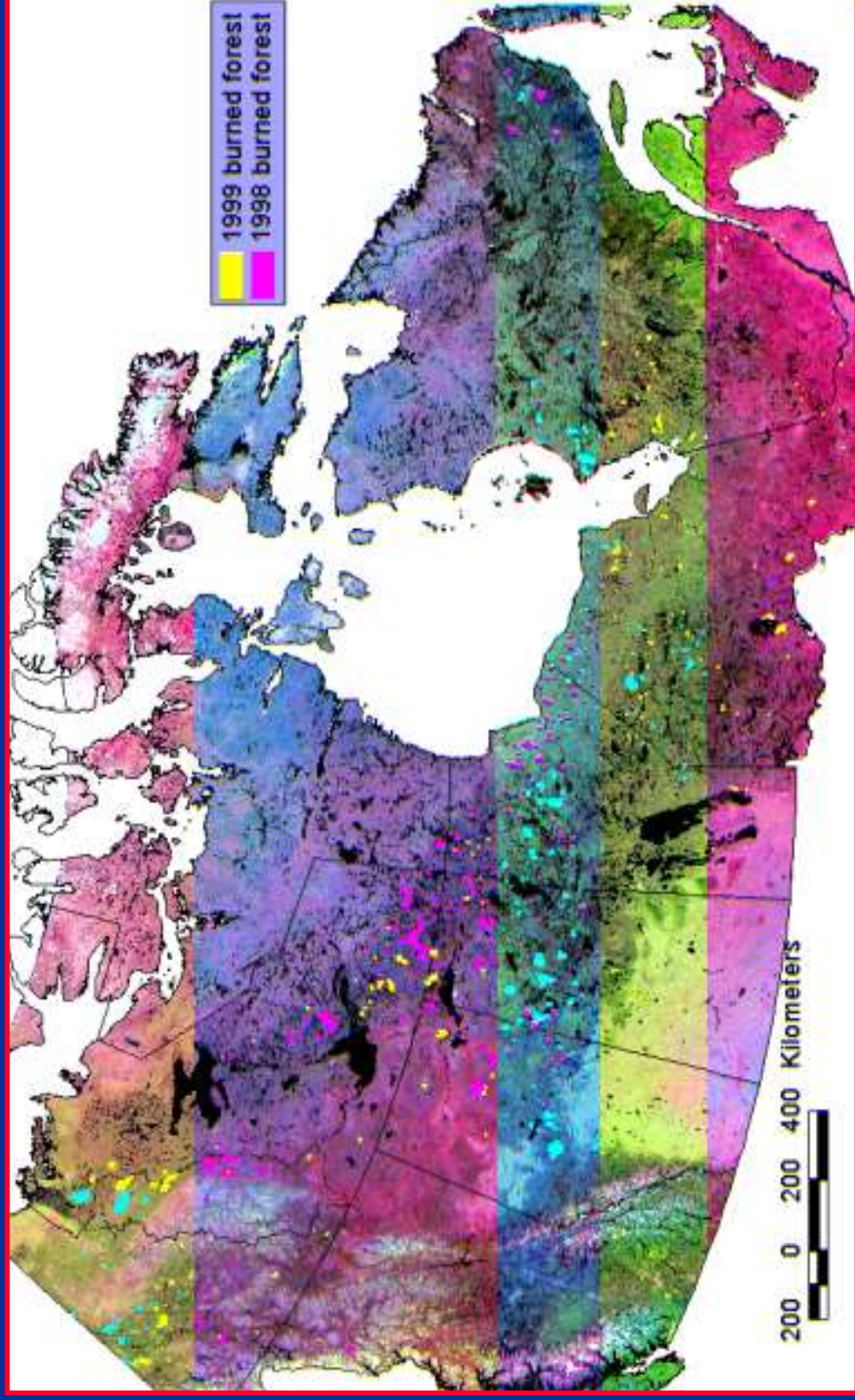


Burned Area

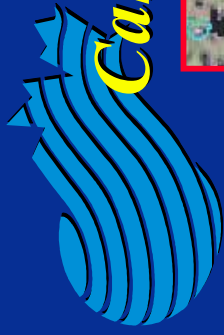




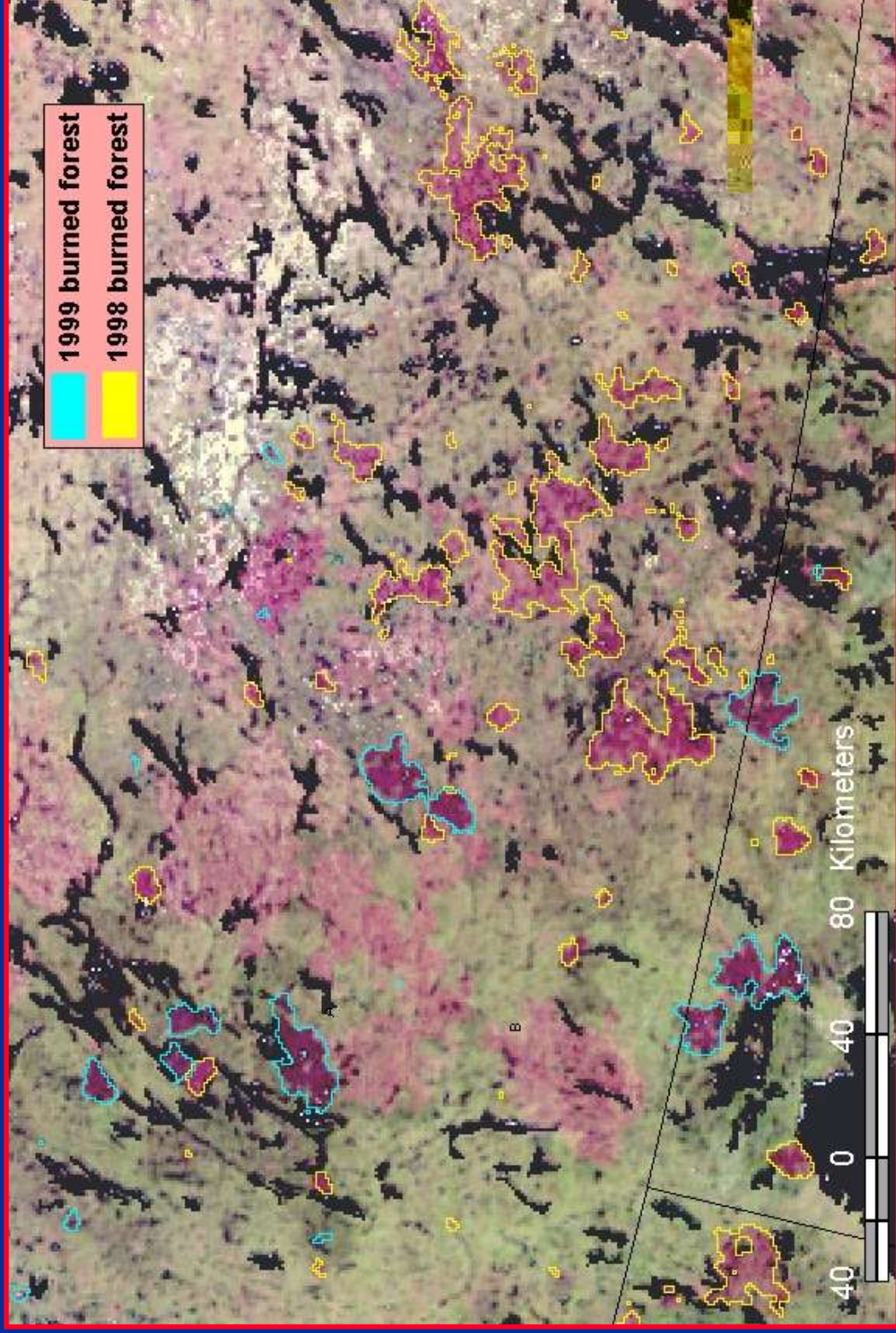
# *Canada-wide burned area mapping using HANDS satellite algorithm*



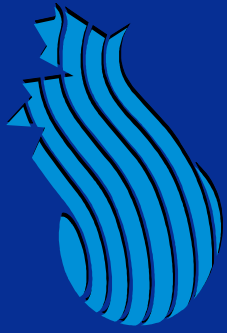
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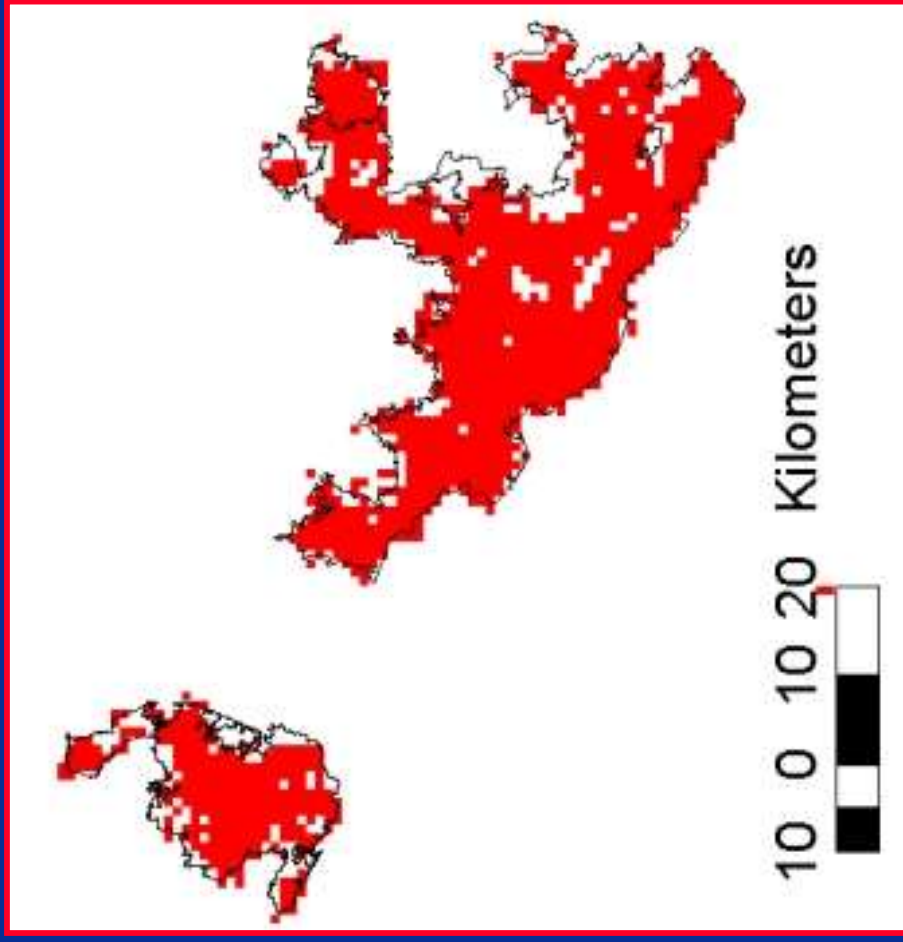
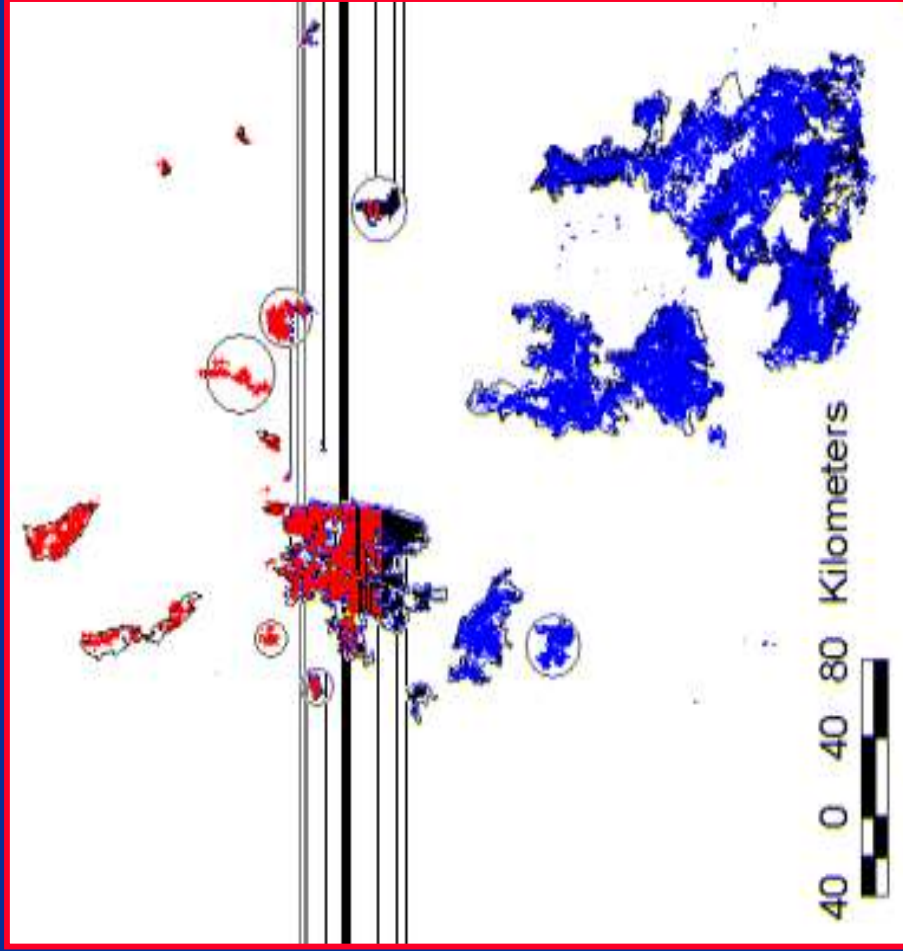
# Canada-wide burned area mapping - regional view





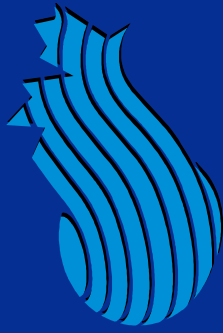


# *Comparison of satellite vs. conventional (aerial) burned area mapping*



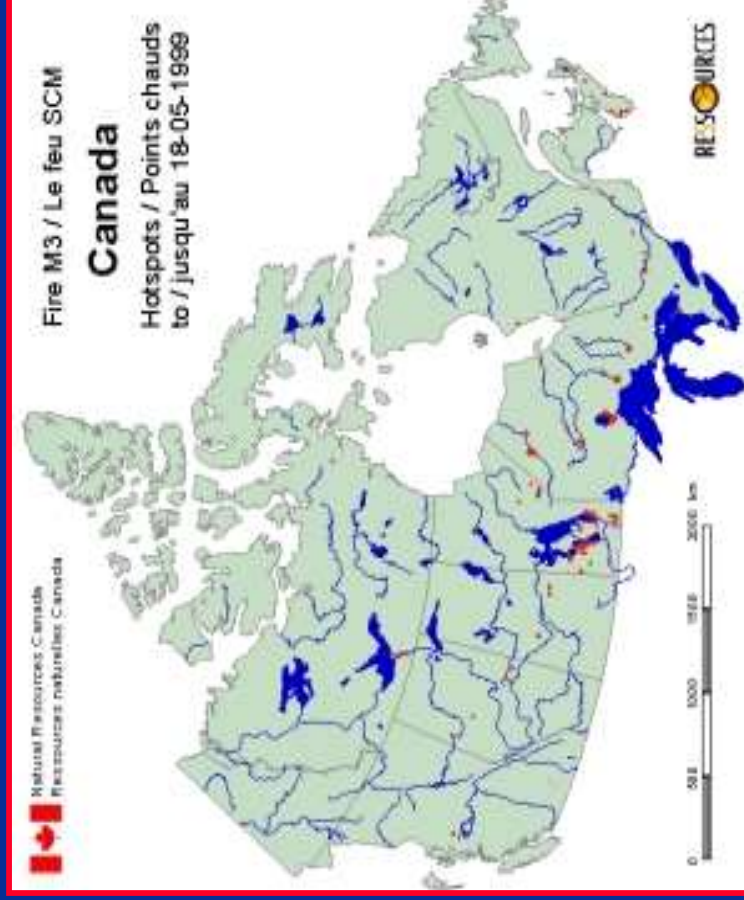
# *Fire Monitoring, Mapping & Modeling System: Fire M3*

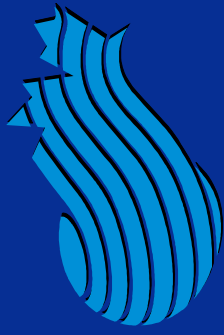
- Initiative of CCRS and CFS
- Fire M3 Goals
  - Daily **monitoring** of hot spots and smoke by satellite
  - Canada-wide burned area **mapping** by satellite
  - GIS integration and fire behavior and effects **modeling**
- National level reporting
- Operational from May through September
- Data accessible via the Internet



# Fire M3 Web Site

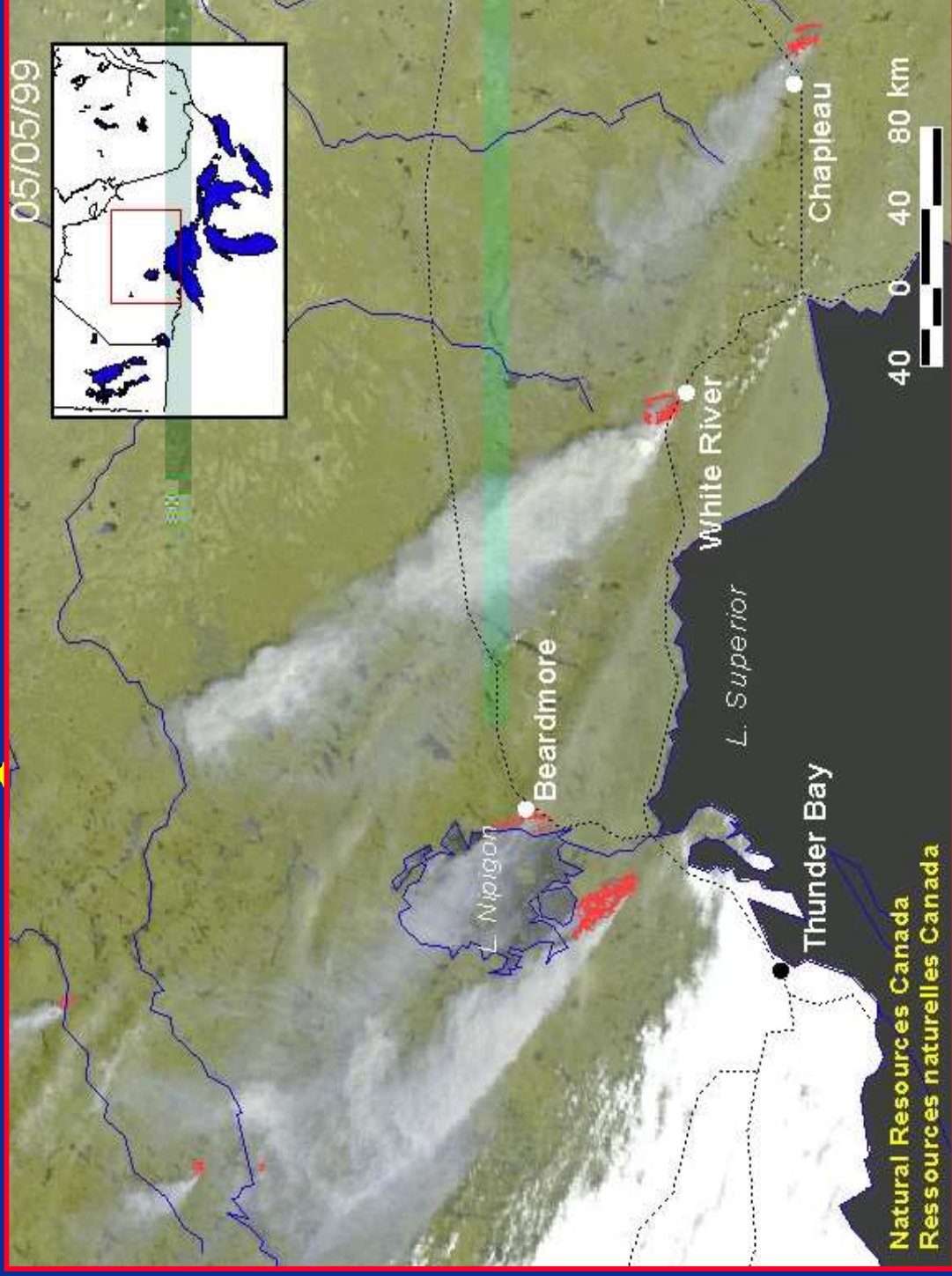
<http://fms.nofc.cfs.nrcan.gc.ca/FireM3/>





# Fire M3 Hotspot Products

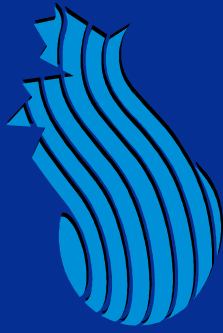
Enhanced  
images of  
significant  
fire events  
with vector  
overlays



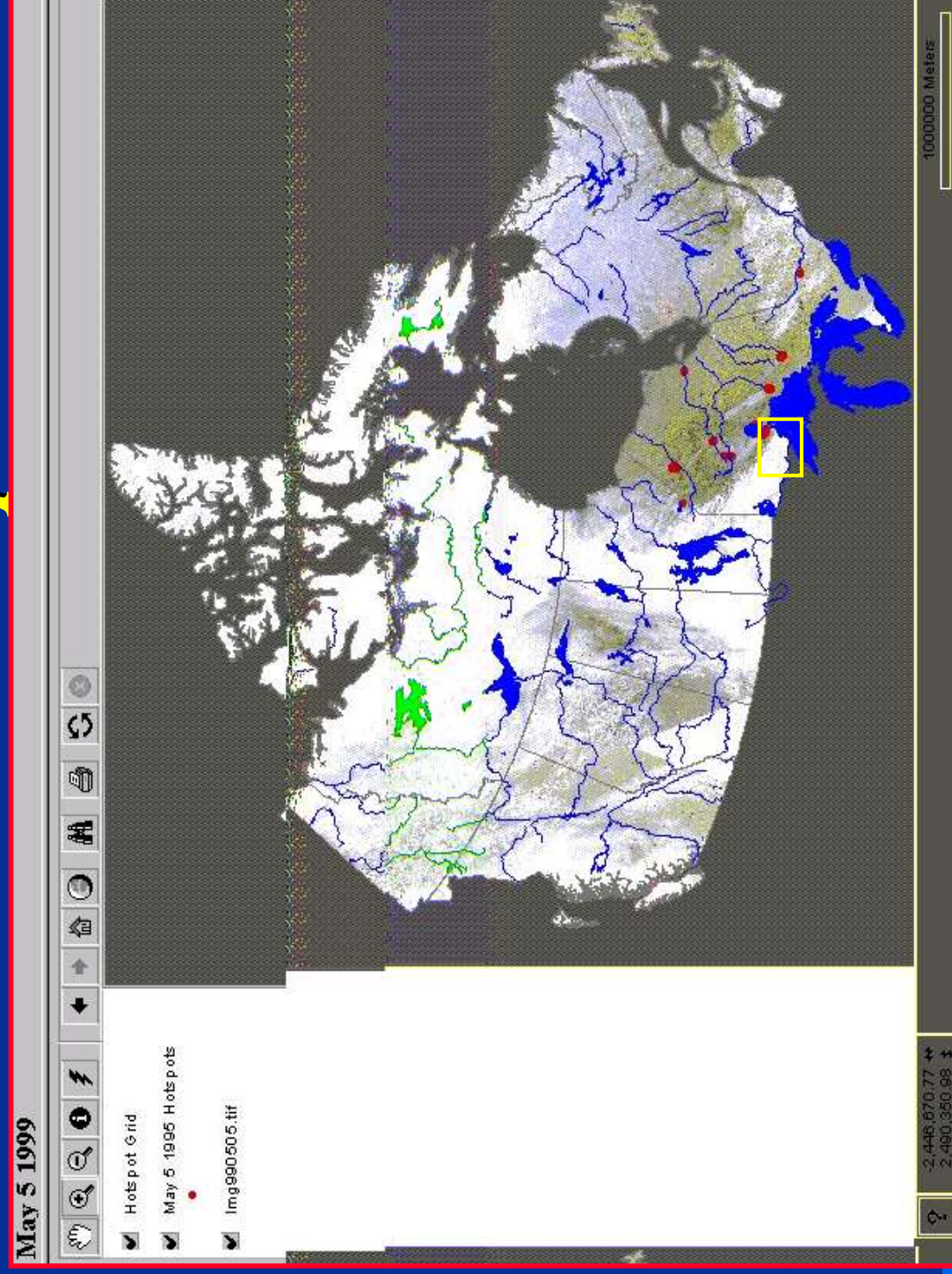
CANADA CENTRE FOR REMOTE SENSING  
Applications Division

CANADIAN FOREST SERVICE  
Fire Research Network

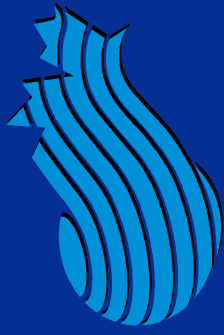
 Canada  
Natural Resources Canada



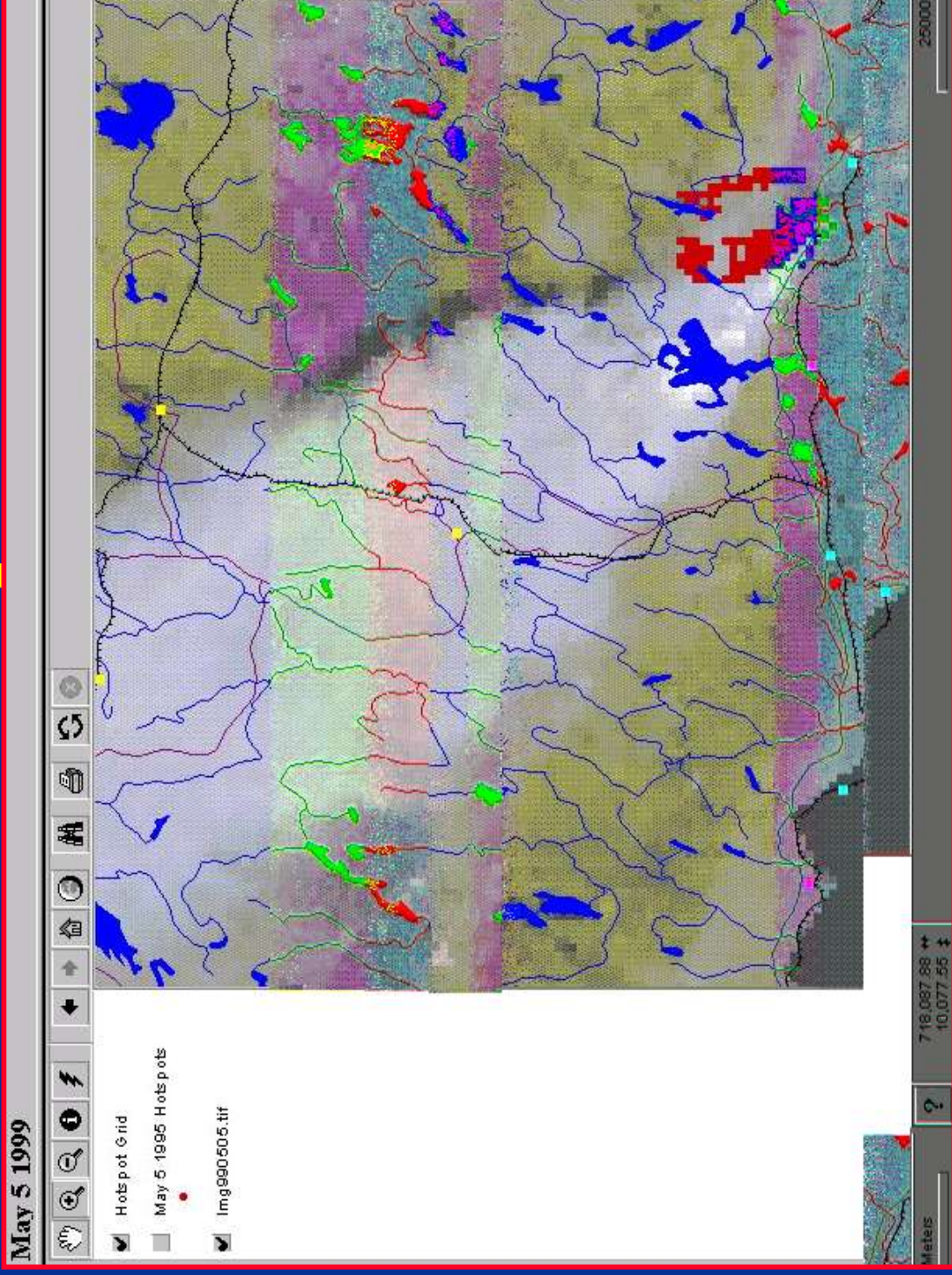
# Fire M3 Internet Map Server



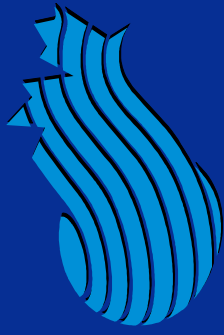
Daily hotspot  
mask over  
background  
image



# Fire M3 Internet Map Server



- Scale-specific GIS layers are overlaid onto satellite imagery



# Fire M3 Burned Area Mapping

Burned area mapping  
of wildland fires using  
SPOT VGT and  
Landsat 5 TM imagery



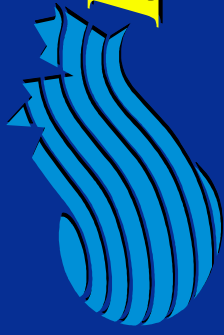
Landsat 5 TM  
mapping for the 1998  
Virginia Hills Fire in  
Alberta

SPOT VGT  
mapping

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*Fire Research Network*

 **Canada**  
Natural Resources Canada



# Fire M3 Fire Behaviour Modeling

Based on CFS  
Forest Fire  
Behaviour  
Prediction  
System

- rate of spread
- fuel consumption
- fire intensity
- type of fire

