2011 Seasonal Prediction for Canada

Kerry Anderson

Canadian FWI System

Physical Property	FWI	FBP	US
0-2 cm	FFMC	-	10 hour moisture
2-5 cm	DMC	-	100 hour
5+ mc	DC	-	1000 hour KBDI
Propogation speed (r)	ISI	ROS [m/min]	SC or BI
Depth of Burn (w)	BUI	TFC [kg/m^2]	?
Fire intensity (I=Hwr)	FWI	HFI [kW/m]	ERC

Methodology

1. Calculate spring start-up conditions based on fall drought code (DC) values and over-winter precipitation amounts,

2. Calculate average daily weather for weather stations across country,

3. Incorporate Environment Canada's seasonal predictions,

4. Determine the fire severity based on the ratio of forecasted over average seasonal severity rating (SSR).

Ensemble Forecasts

Recently, the Canadian Meteorological Centre (CMC) of Environment Canada has begun providing temperature and precipitation probabilistic forecasts based on an ensemble of ten integrations of four independent models:

1. climate ver. of the Global Environmental Multiscale model (GEM-CLIM),

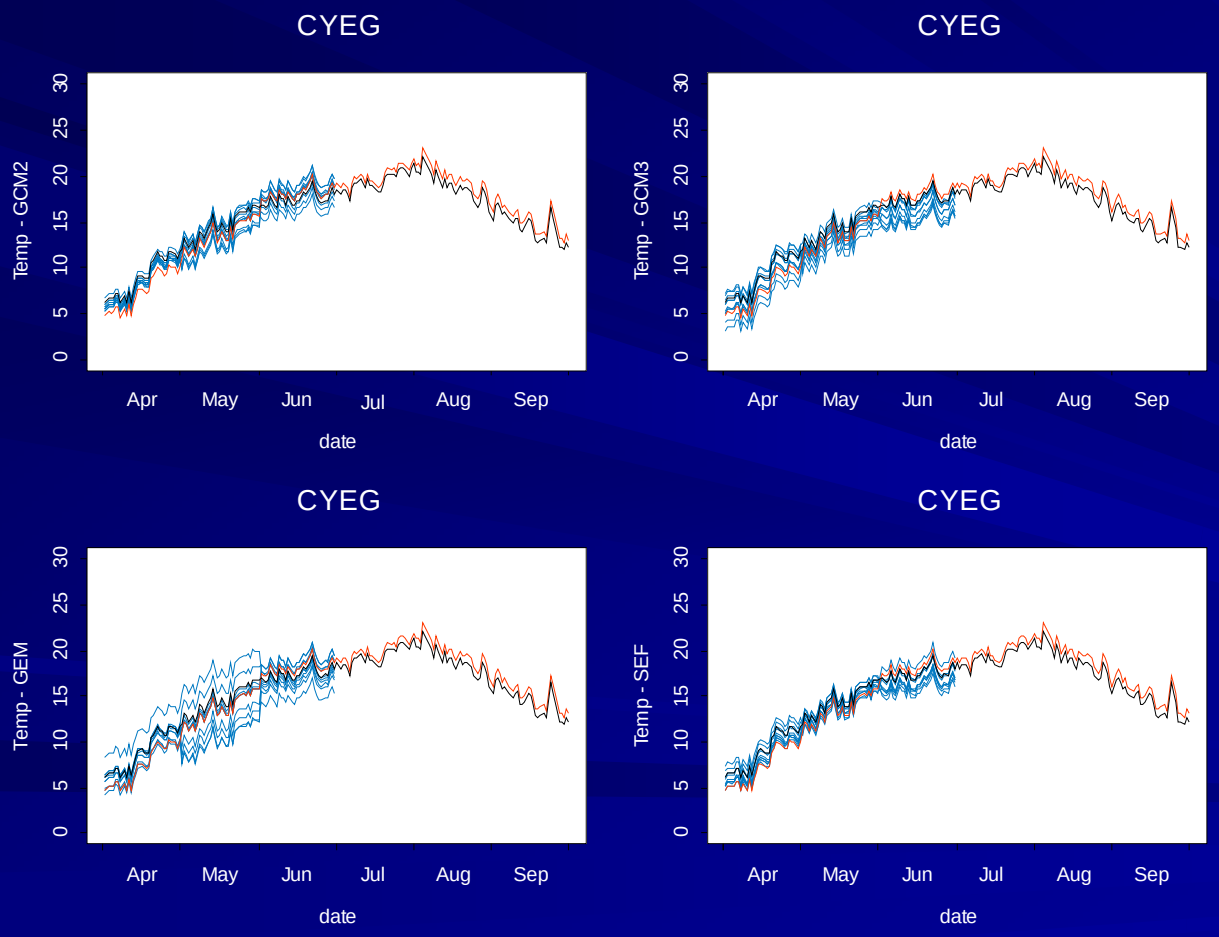
2. 2nd gen. of the Atmospheric General Circulation Model (AGCM2),

3. 3rd gen. of the Atmospheric General Circulation Model (AGCM3),

4. Spectral aux éléments finis (SEF).

Forecasts are provided for the next four months.

Ensemble Forecasts



The ensemble approach provides a measure of confidence indicated by the spread of the ensemble members.

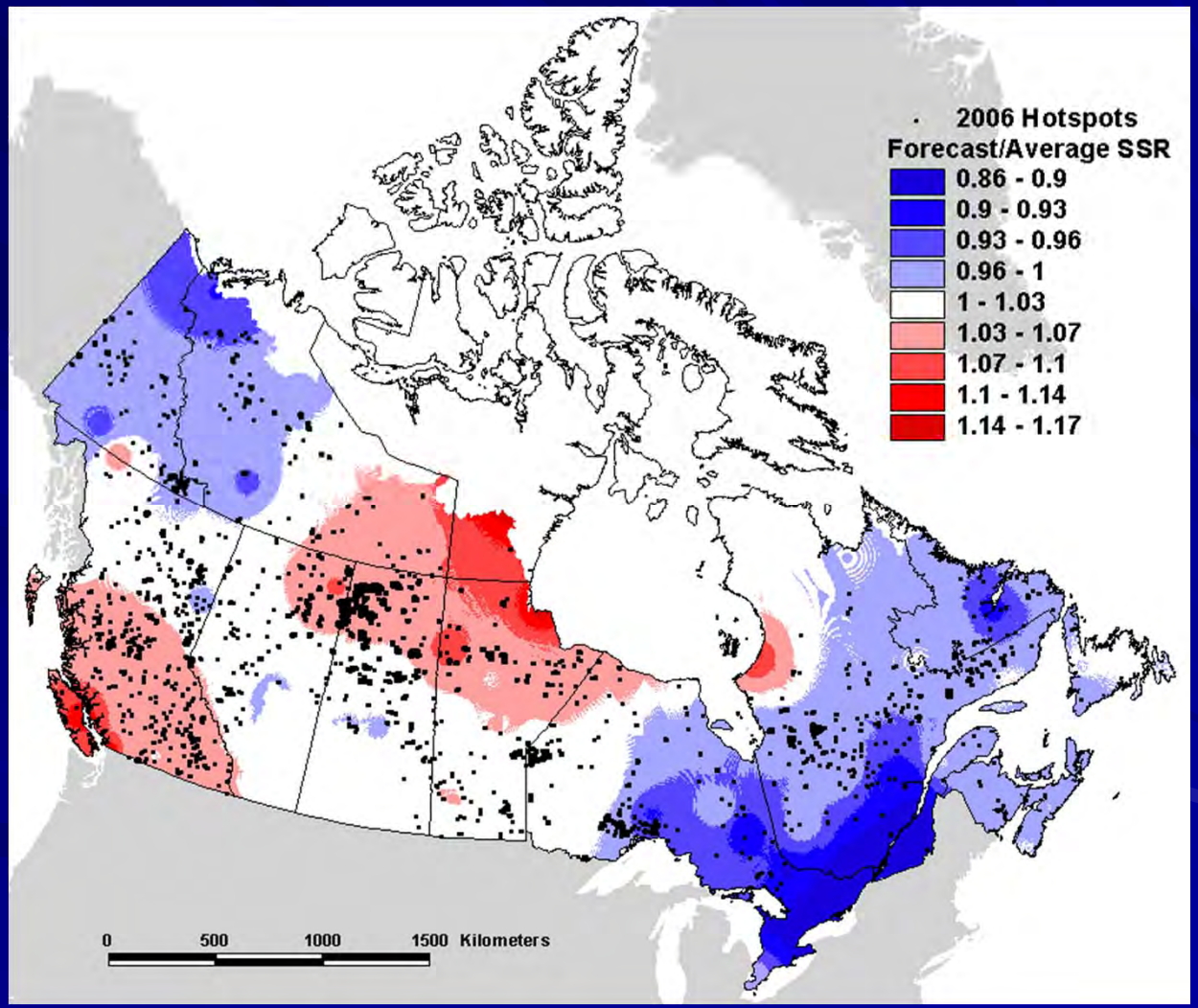
The extended forecast continues to use the single, deterministic forecast

Past Predictions

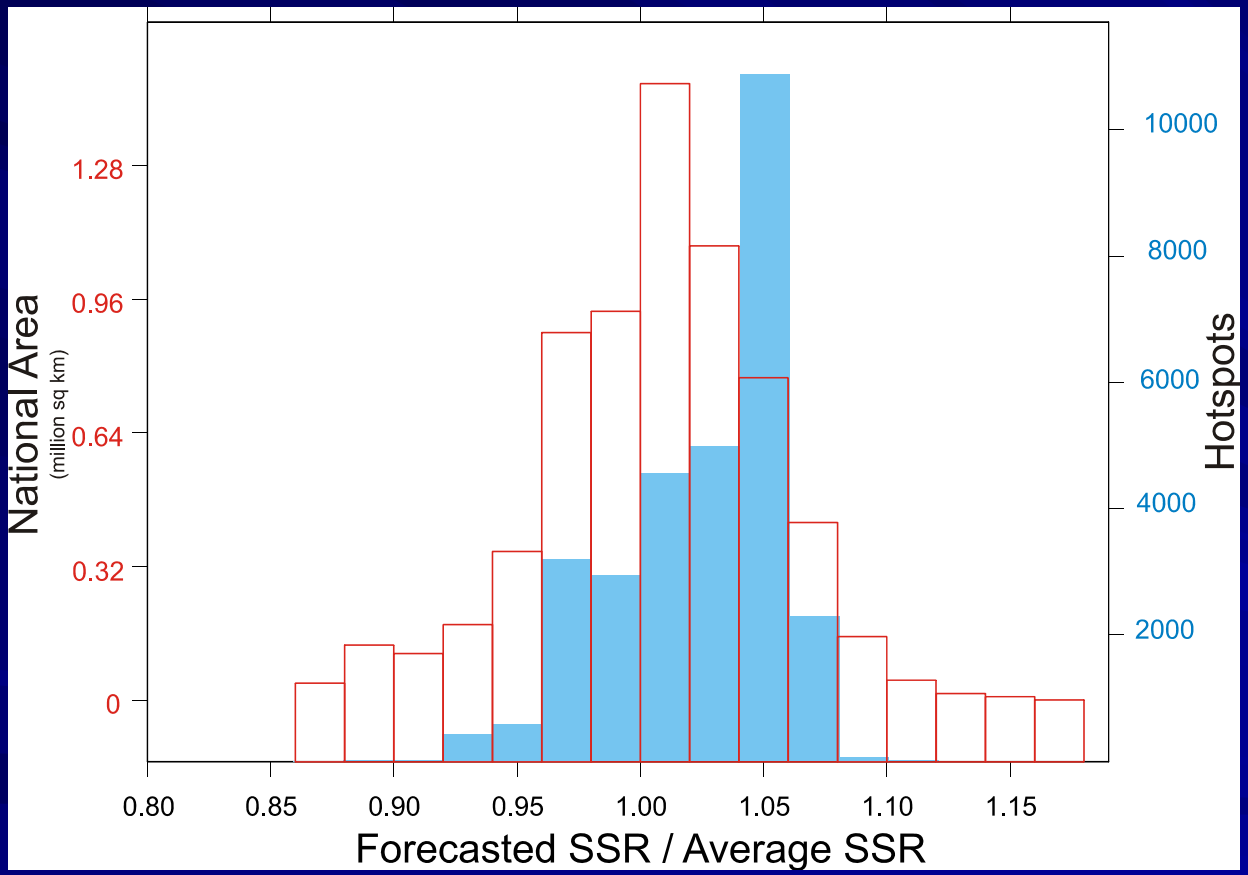
2006 Prediction

Using hotspots to assess the seasonal outlook, the forecast was good for Southern BC, the Northern Prairies and western Quebec.

On the other hand, the forecast was marginal for the Southern Yukon and central Alberta and poor for central Ontario, central Quebec and Labrador.



2006 Prediction

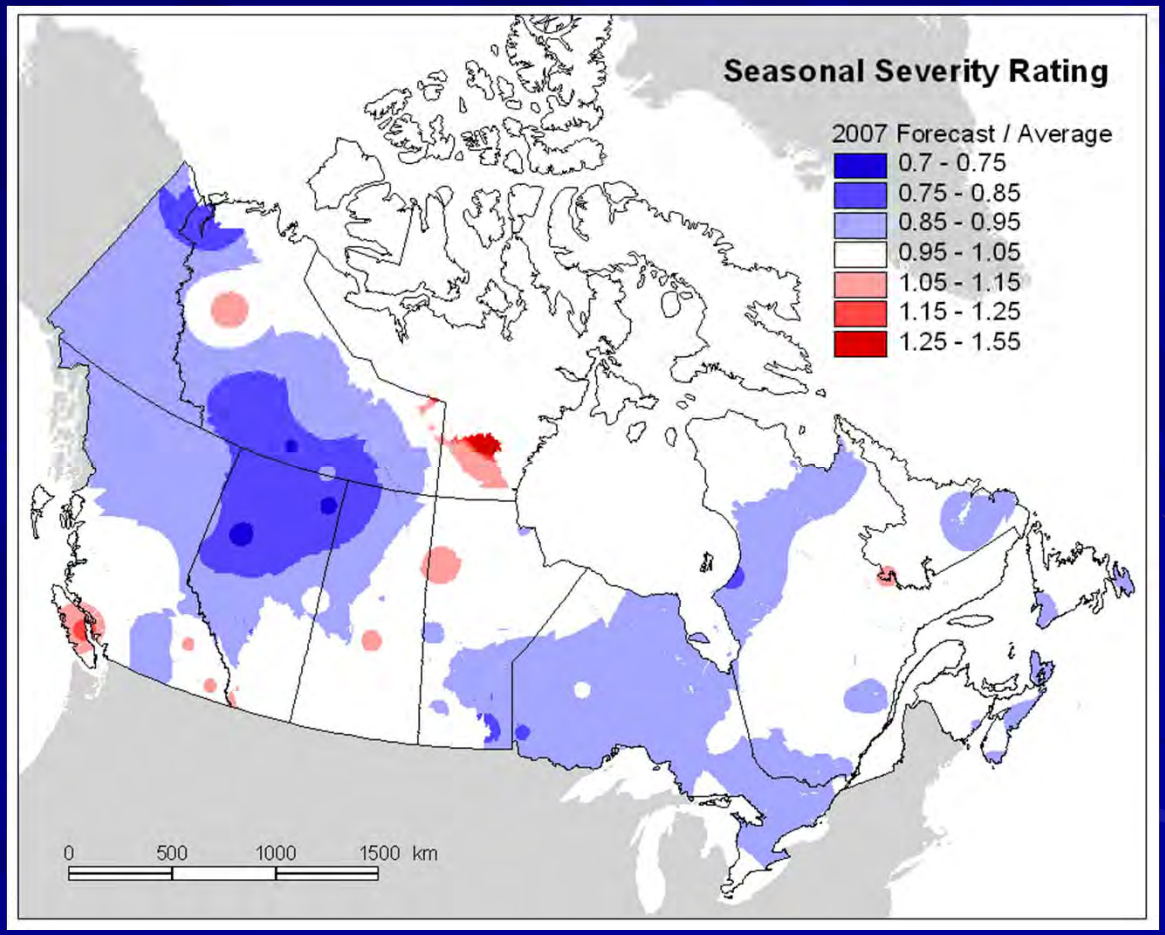


Comparing the distribution of the forecasted over average SSR values for all of Canada (area within each prediction value) and for hotspot locations shows that the seasonal forecast had skill at predicting fires for most of Canada.

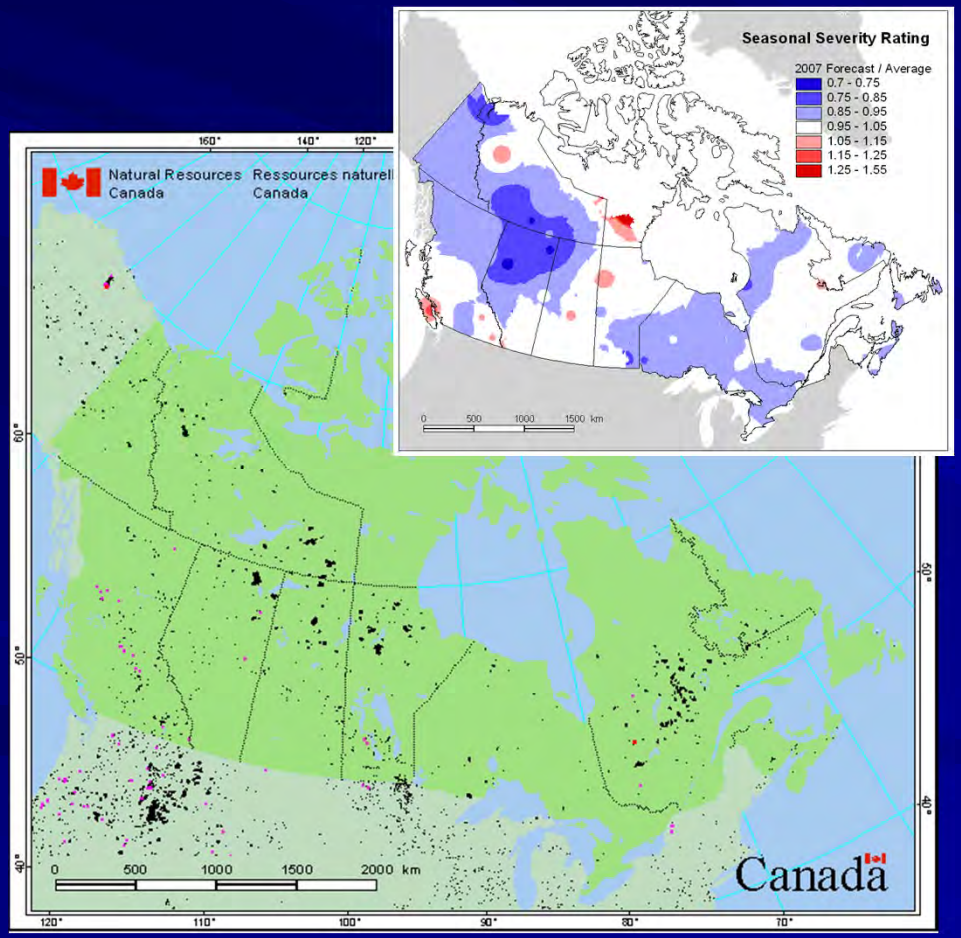
2007 Prediction

The 2007 prediction showed below-average conditions throughout much of Canada.

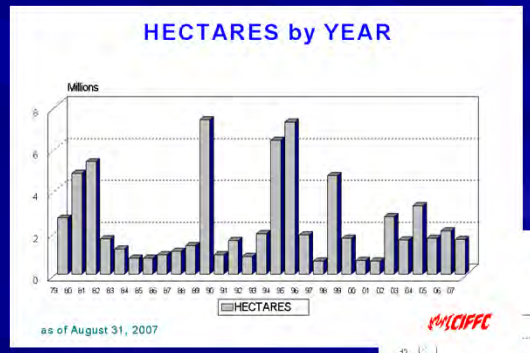
Only Vancouver Island, central Saskatchewan and northern Manitoba show above-average severity.

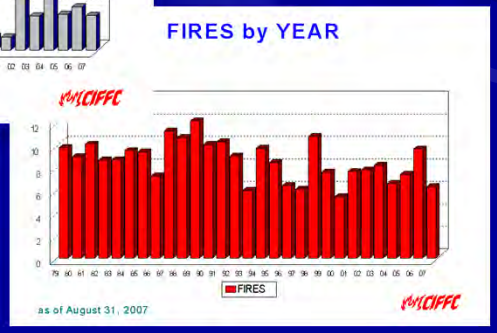


2007 Prediction



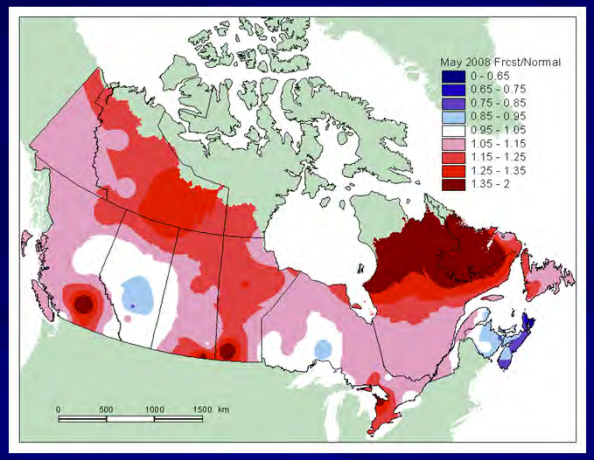
As it turned out, 2007 was a quiet fire season with fire activity limited to Quebec, Southeastern BC, and the northern boreal plains.



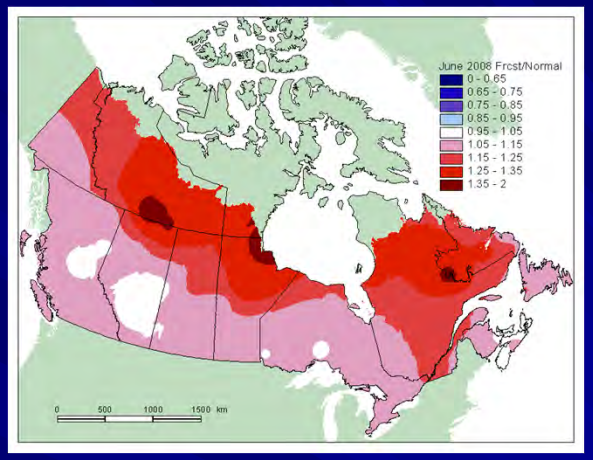


2008 Prediction

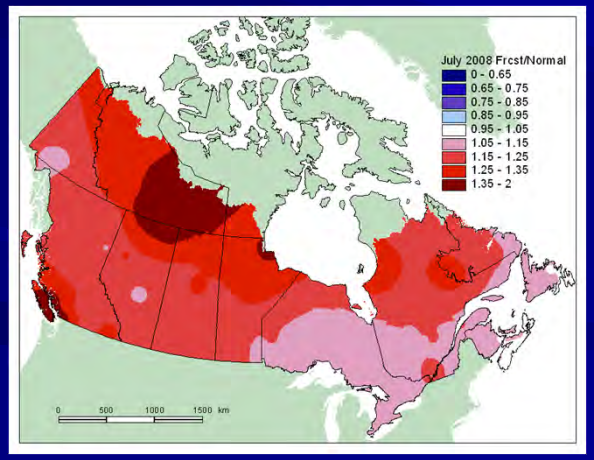
May



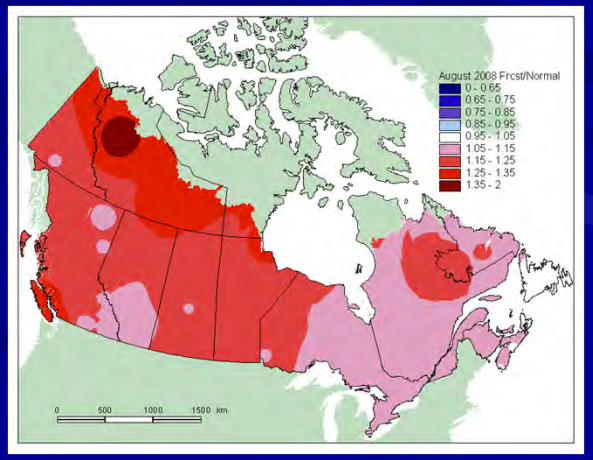
June



July



August

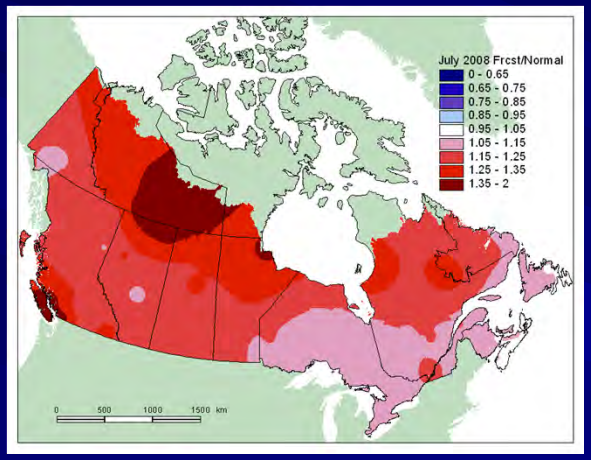


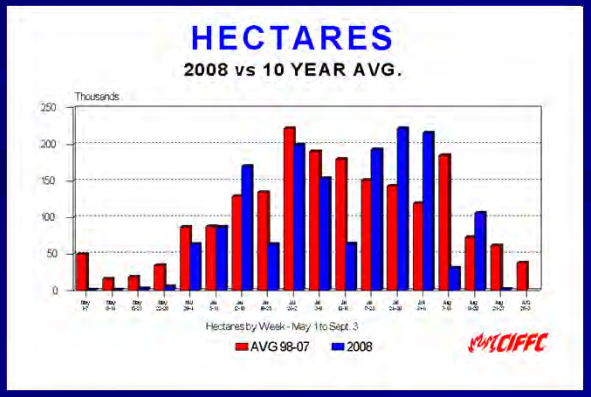
For 2008, monthly predictions indicated an above-average year for most of Canada.

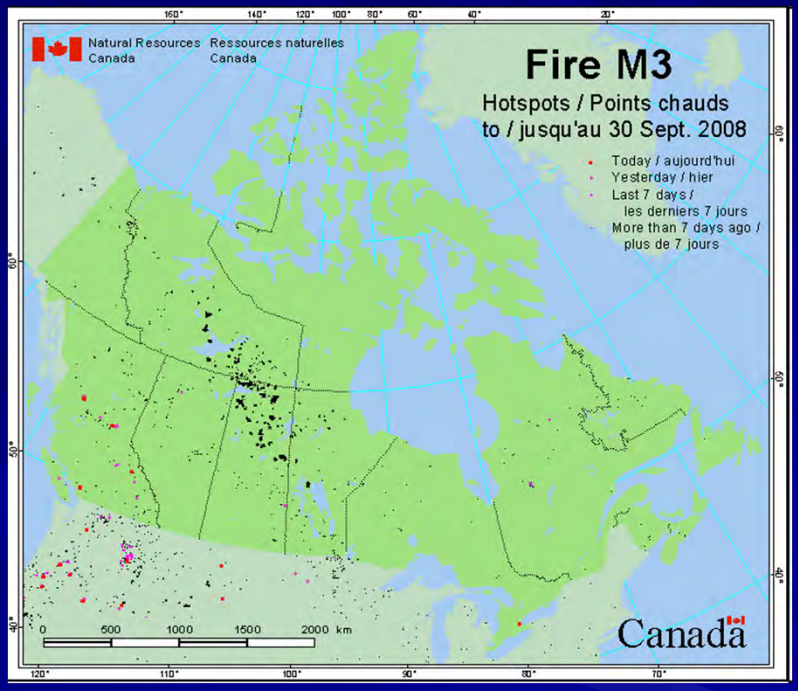
2008 Prediction

2008 turned out to be a quiet fire seasons with only 1.49 million ha burned (10 year average is 7 million ha).

July



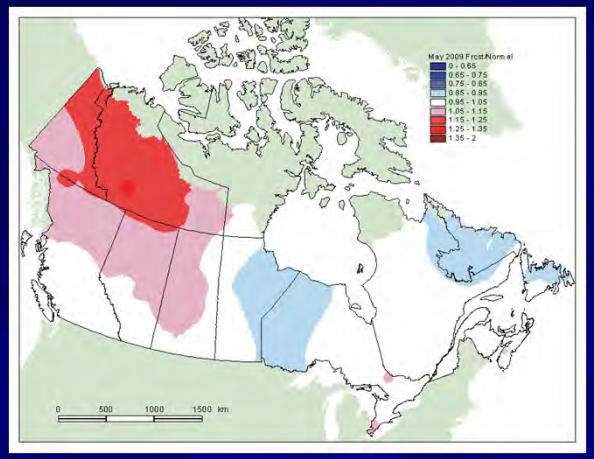




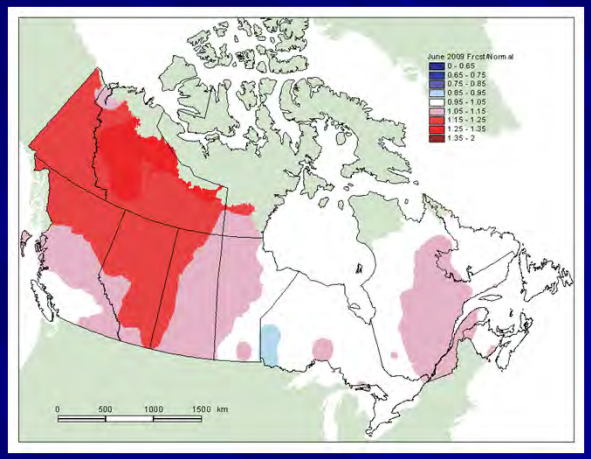
Most of the fire activity (95%) occurred in Saskatchewan and NWT (mainly in July) suggesting that while we over-predicted the severity of the fire season, we correctly predicted the region of peak fire activity.

2009 Prediction

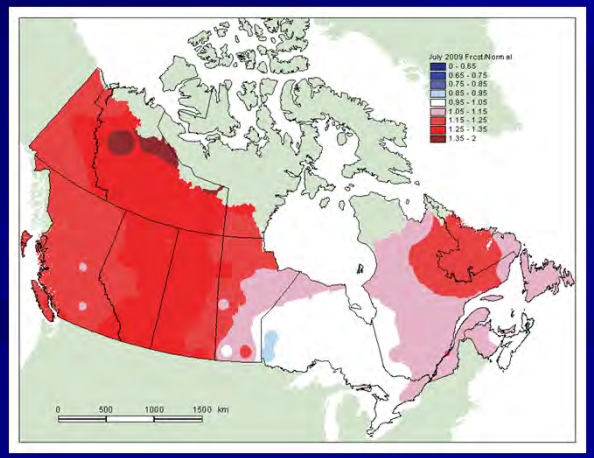
May



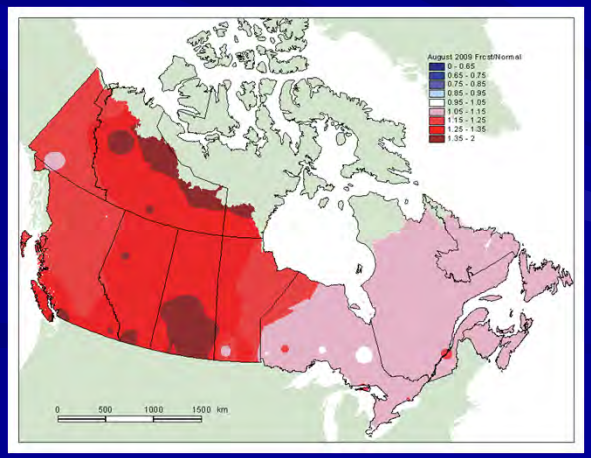
June



July



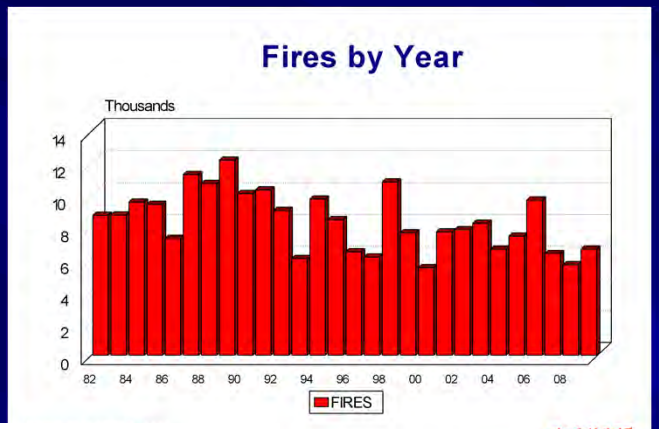
August



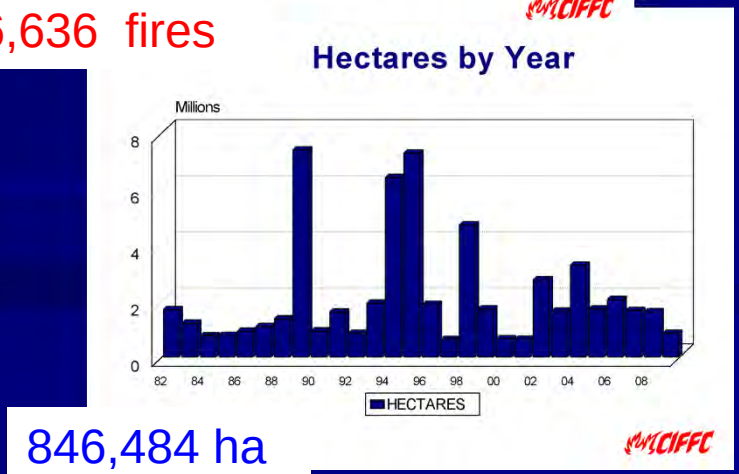
For 2009, monthly predictions indicated an above-average year for western Canada.

2009 Prediction

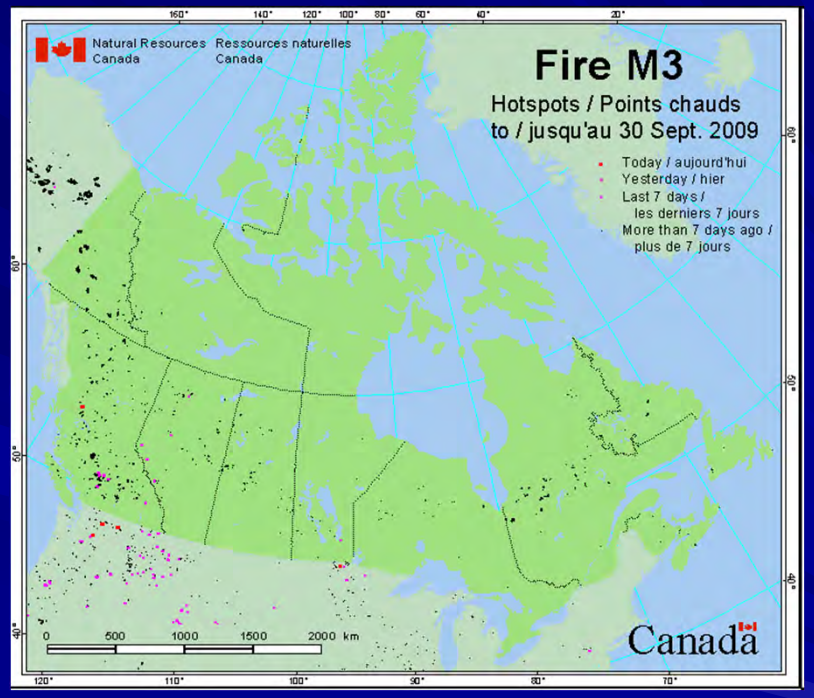
Again, another quiet fire season for most of Canada with only 846 000 ha burned.



6,636 fires



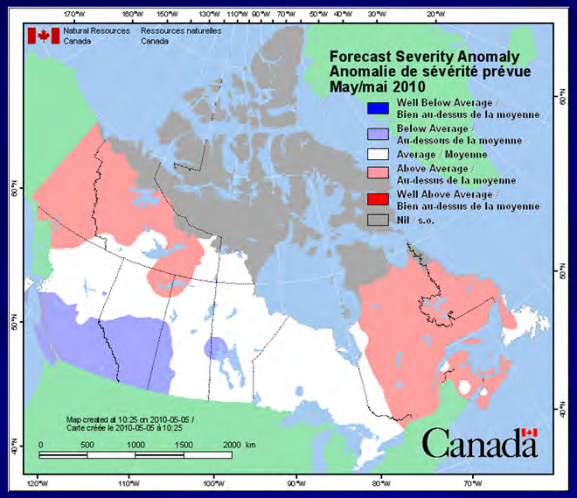
846,484 ha



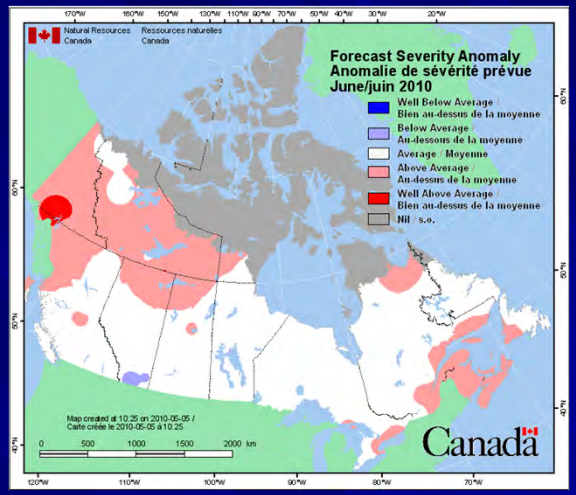
In August, an emergency situation developed in British Columbia burning over 229 000 ha (10 year average 75 000).

2010 Prediction

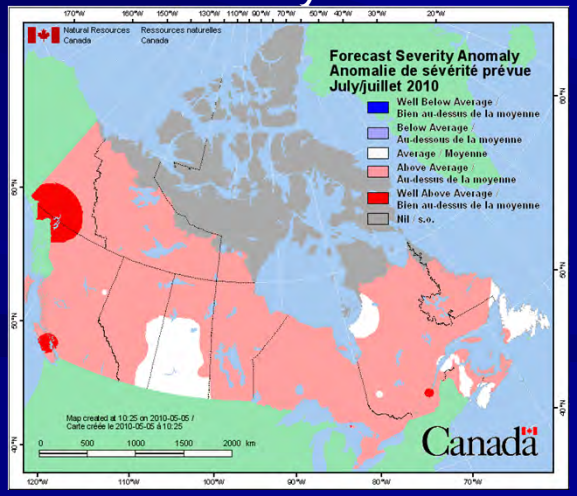
May



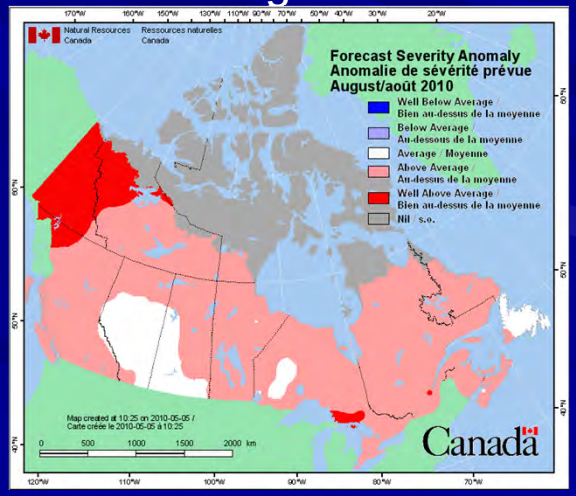
June



July



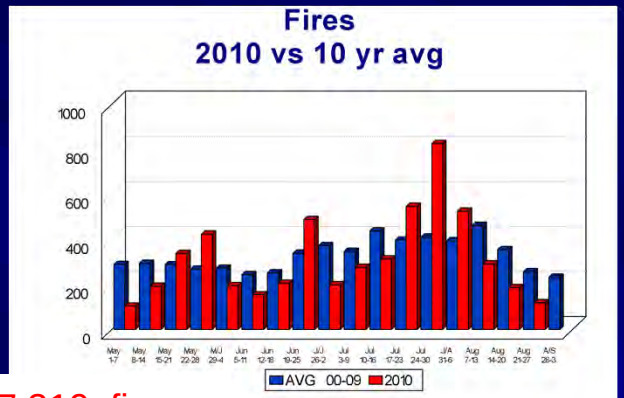
August



For 2010, monthly predictions indicated above-average spring conditions year in Quebec and an above-average summer for most of Canada.

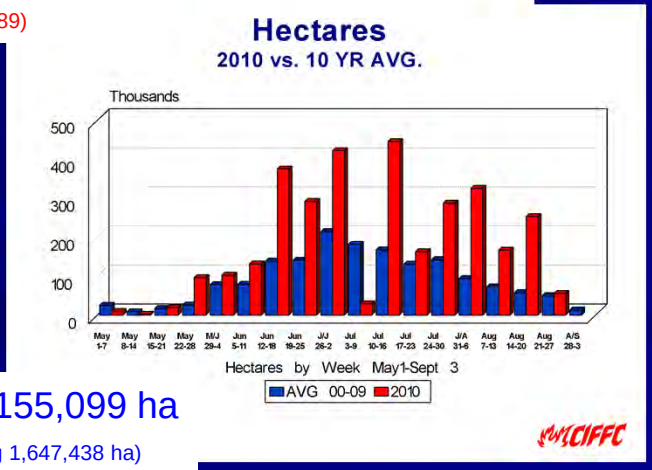
2010 Prediction

An above-average season with twice the average annual area burned.



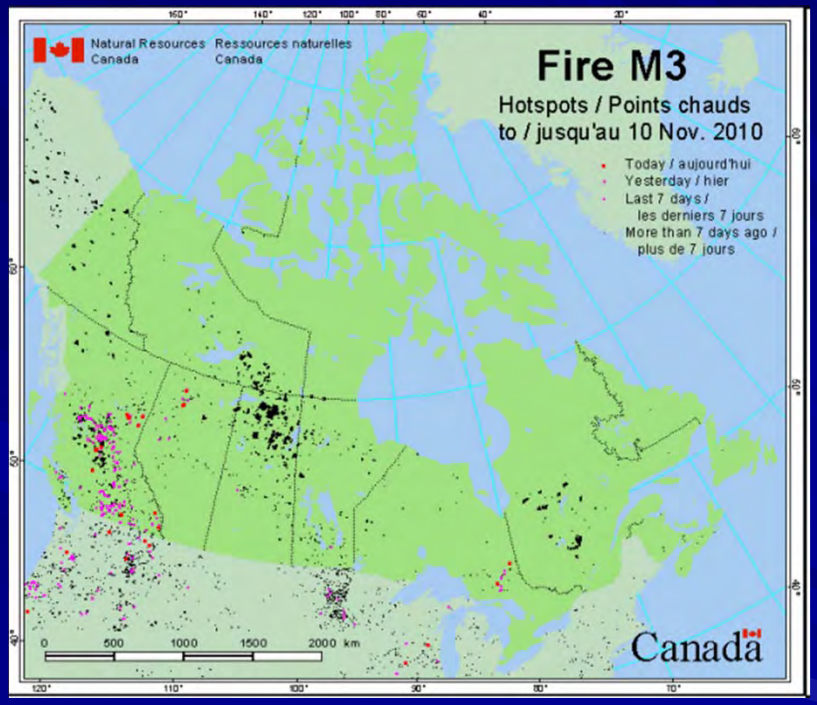
7,319 fires

(avg: 7,389)



3,155,099 ha

(avg 1,647,438 ha)



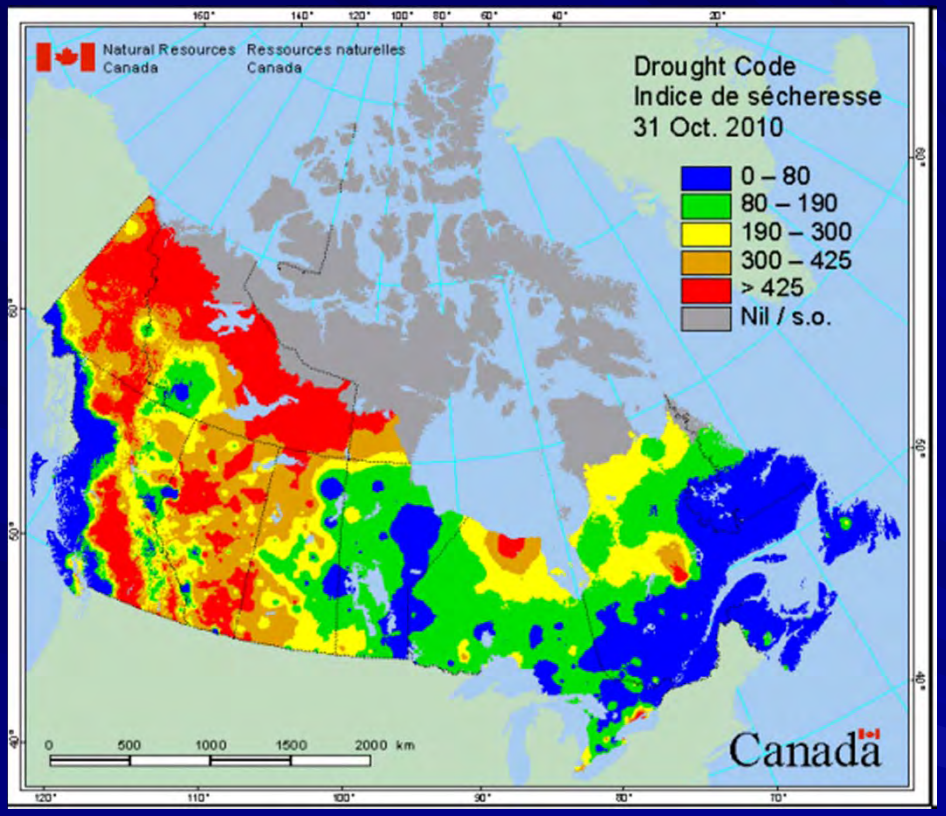
Most of the activity occurred in Quebec (May), Saskatchewan (July) and BC (August).

2011 Starting Conditions

Spring Start-up Conditions

- The Canadian Forest Fire Weather Index (FWI) System allows for the carry-over of fall conditions to the spring.
- This is handled by the Drought Code (DC) (similar to the 1000 hour moisture code).
- All other moisture codes in the FWI system are reset.

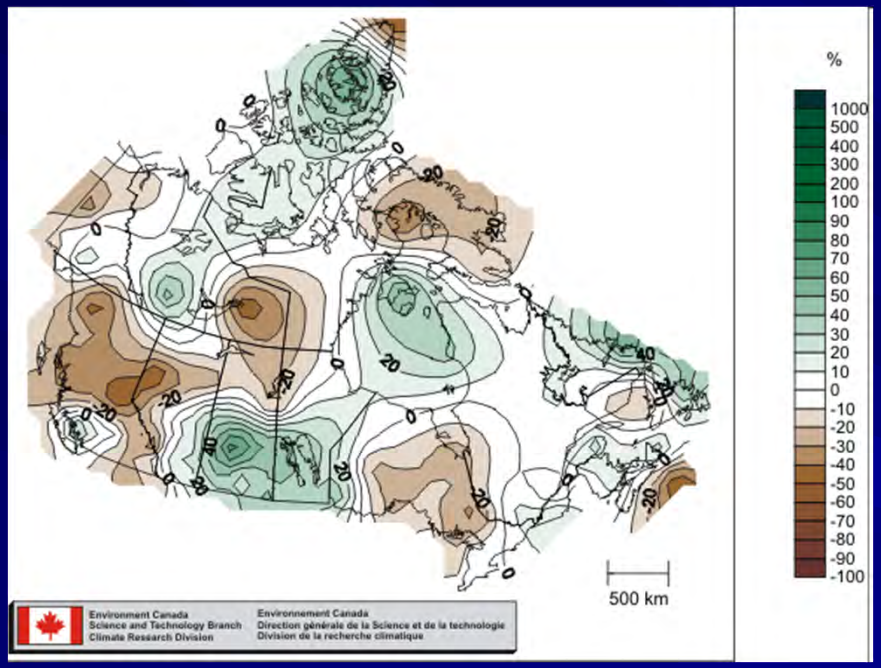
Fall Conditions



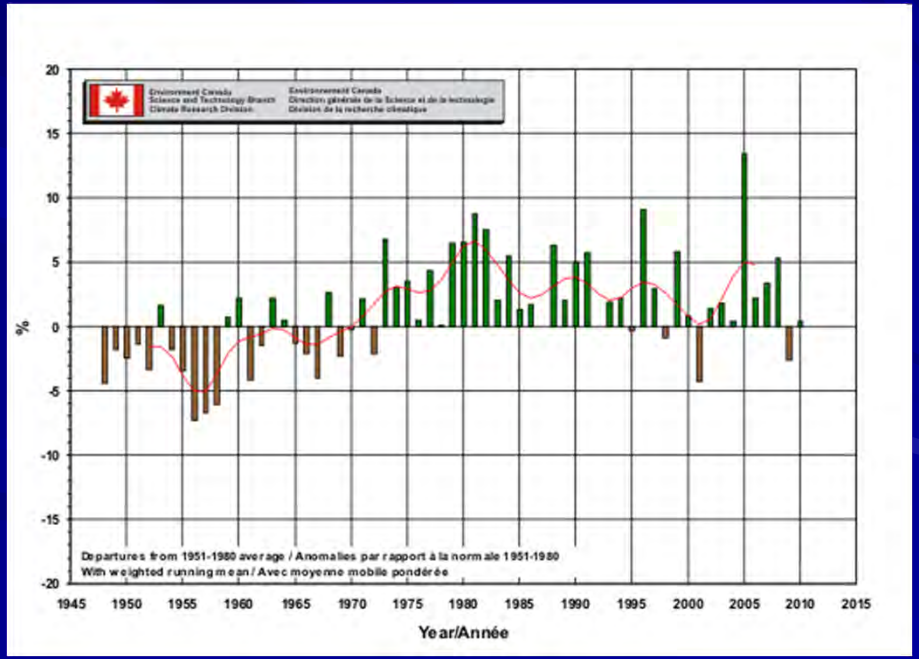
Oct 31, 2010

Fall DC values show extreme (dry) conditions throughout much of Western Canada and the Territories.

Precipitation Trends



Canada experienced a normal precipitation year in 2010, 0.4% above normal.

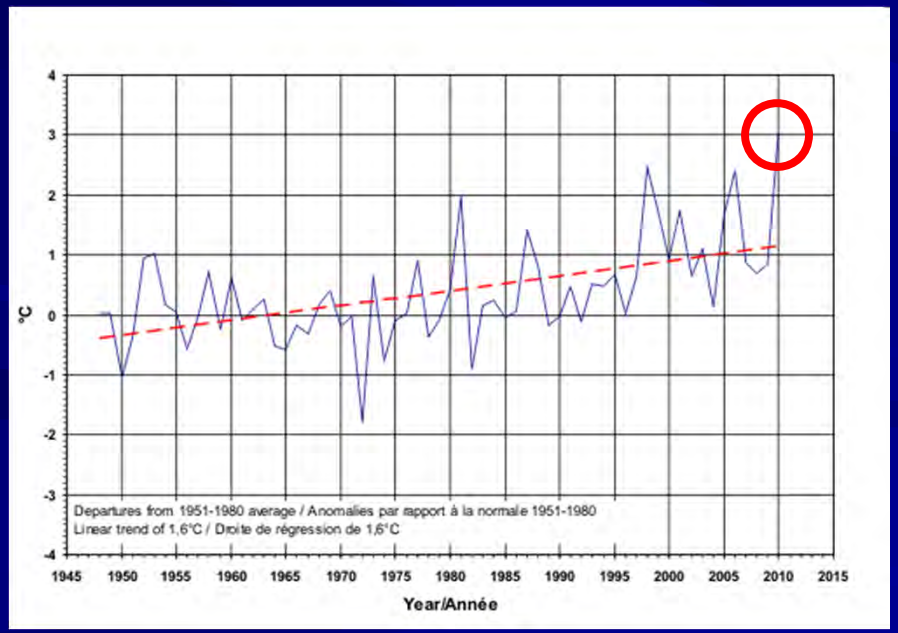


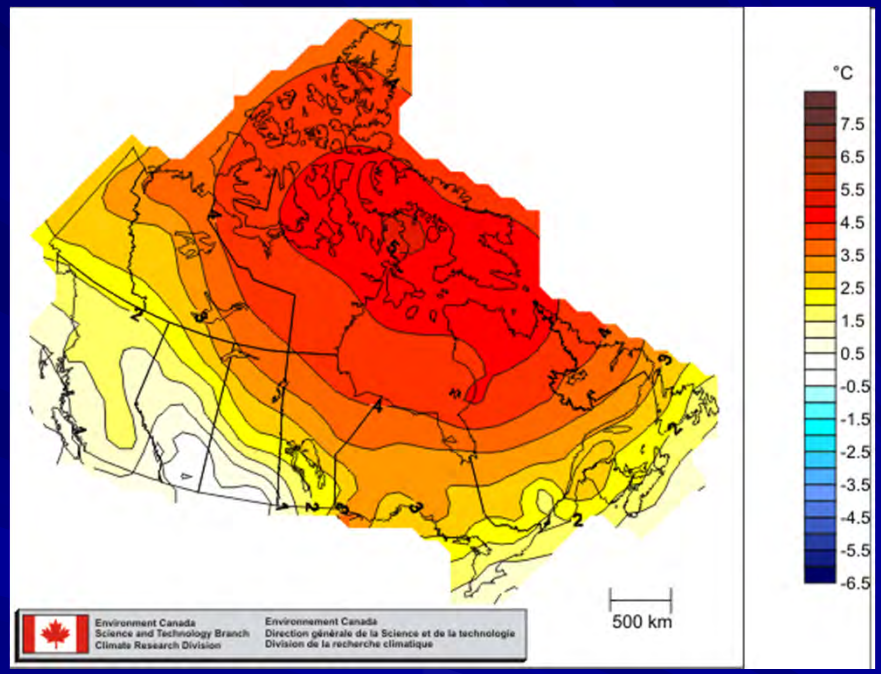
The Prairies experienced its wettest year on record, 26.9% above normal.

http://www.ec.gc.ca/adsc-cmda/

Temperature Trends

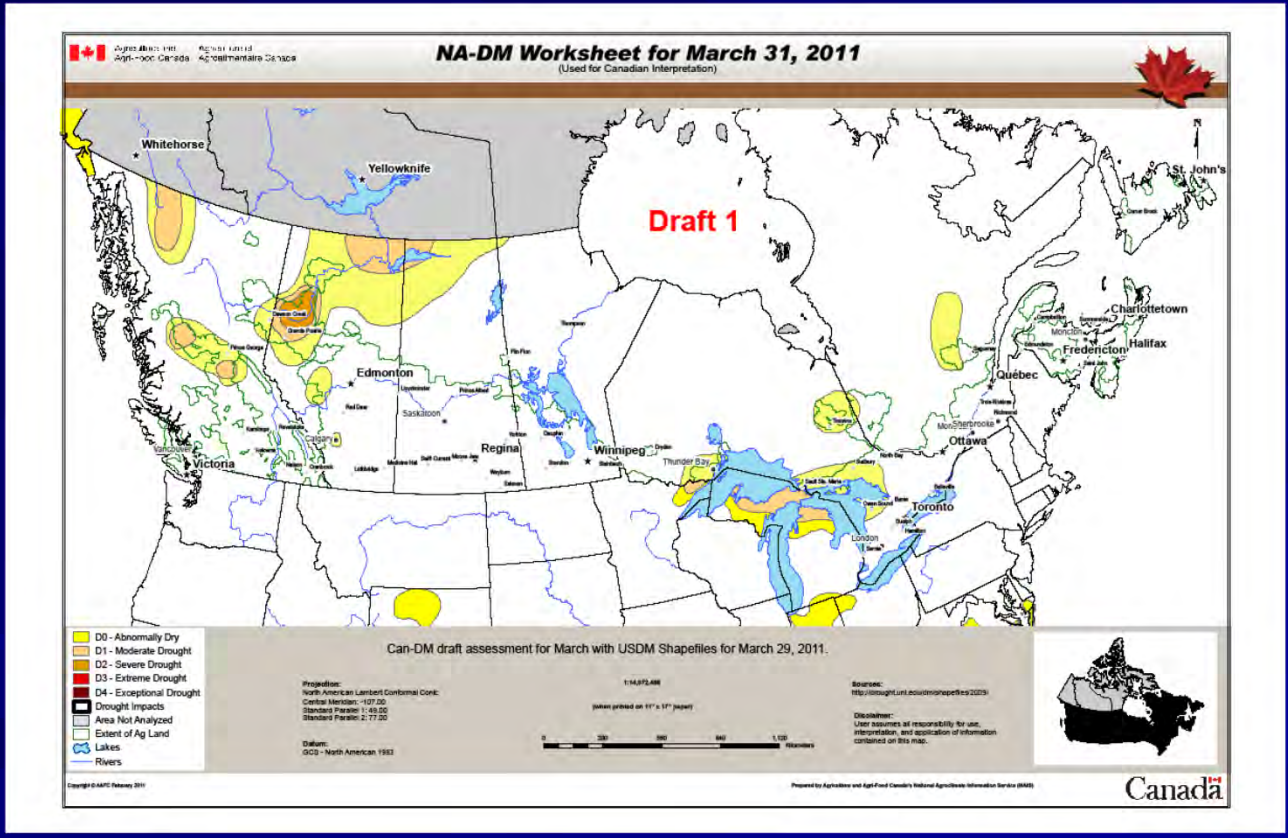
The national average temperature for the year 2010 was 3.0°C above normal.





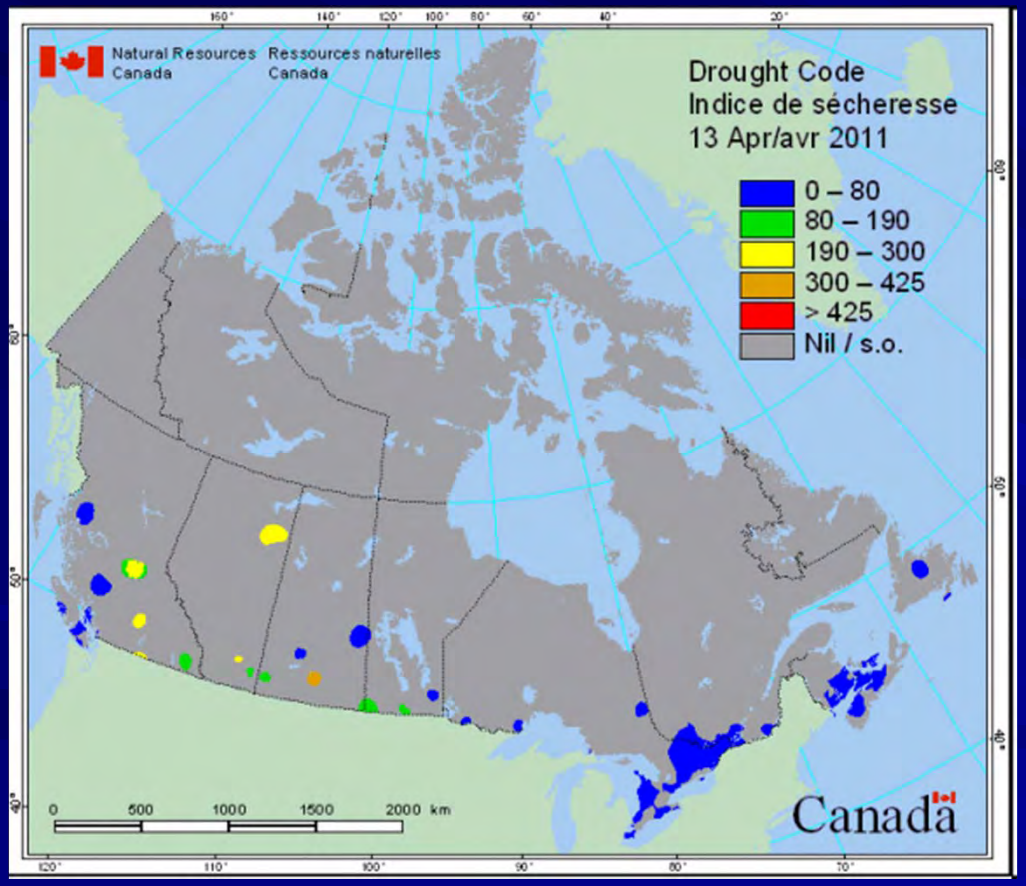
2010 was the warmest year on record since nationwide records began in 1948.

Spring Start-up Conditions



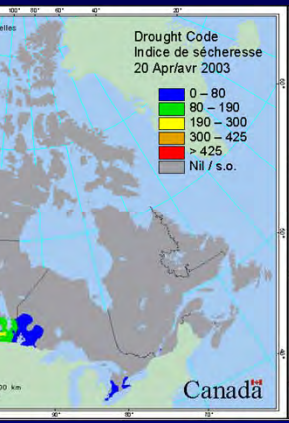
Canadian Drought Monitor indicates a relatively normal pattern with parts of Alberta described as in severe drought

Spring Start-up Conditions

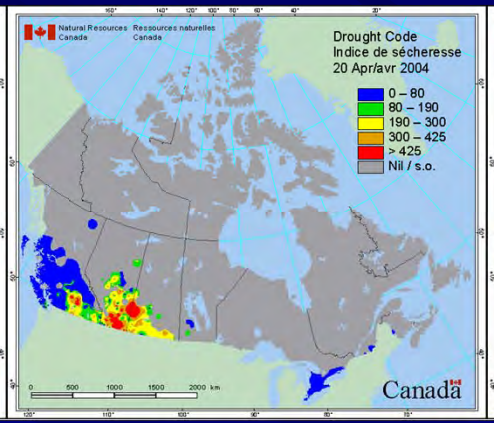


Late spring prevents us from seeing the starting DC values, though it appears that Eastern Canada has had total recharge of deep fuel moistures, while Alberta and the interior of BC are high (corresponding to the Canadian Drought Monitor).

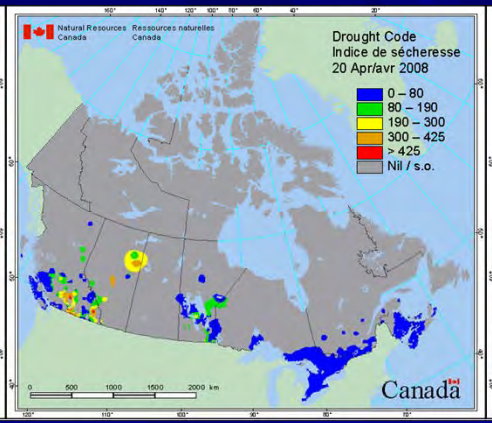
Spring Start-up Conditions



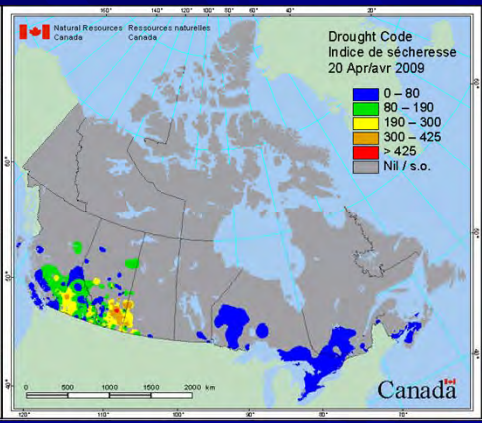
2003



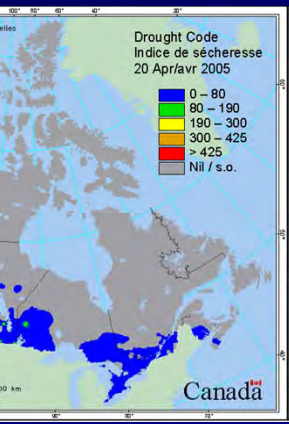
2004



2005



2006



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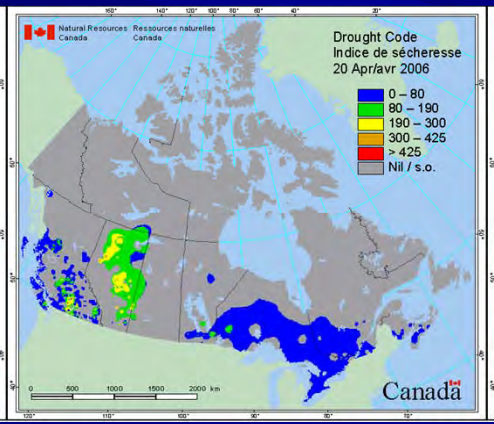
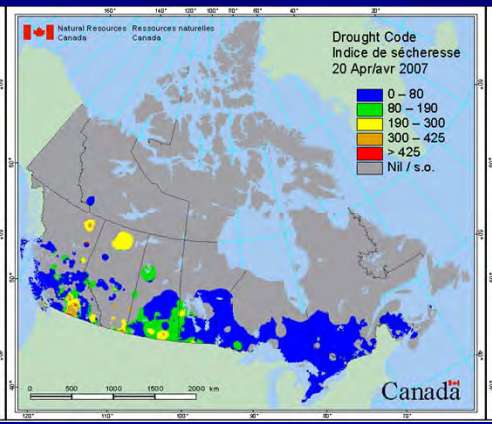
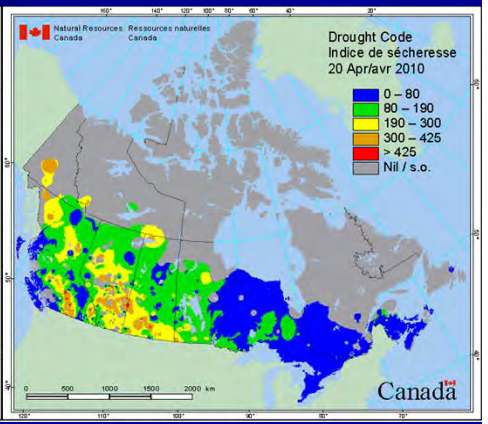


2008



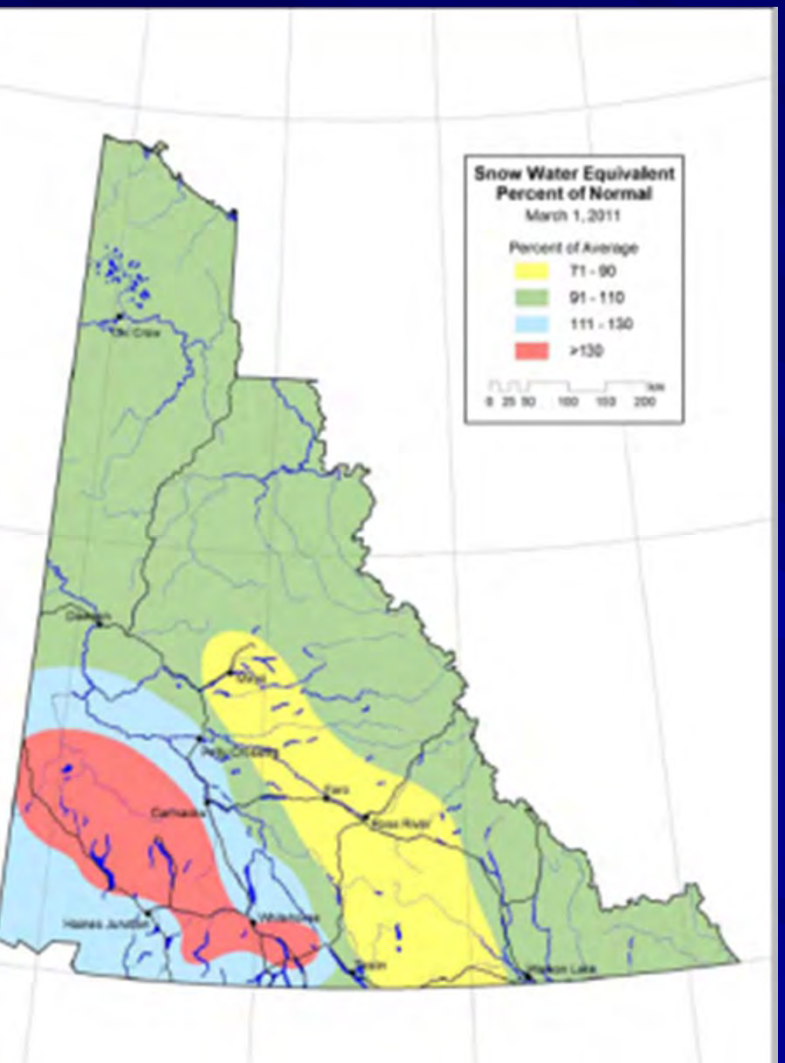
2009



2010

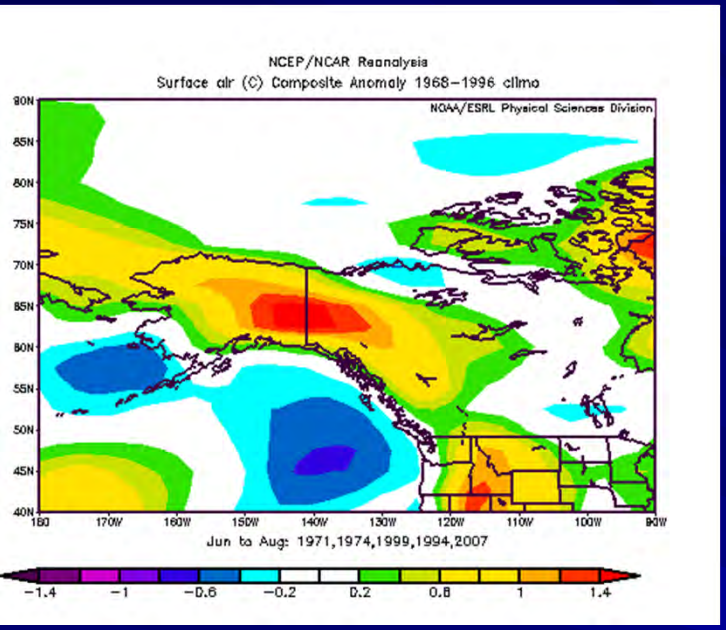
Provincial Reports

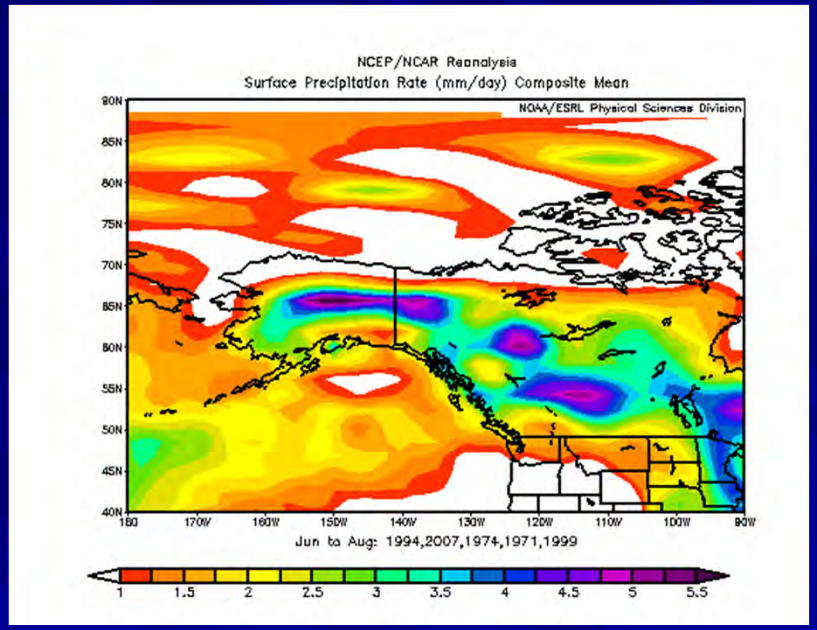
Yukon



Normal snowpack conditions throughout much of the Territory with above-average in the southwest and below-average in the central Yukon.

Yukon

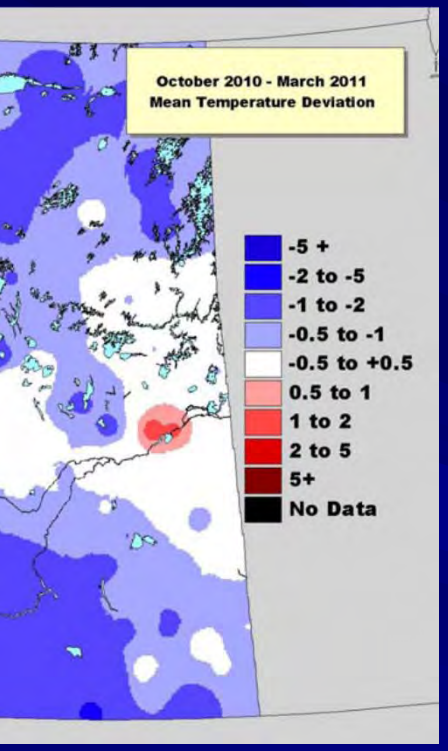


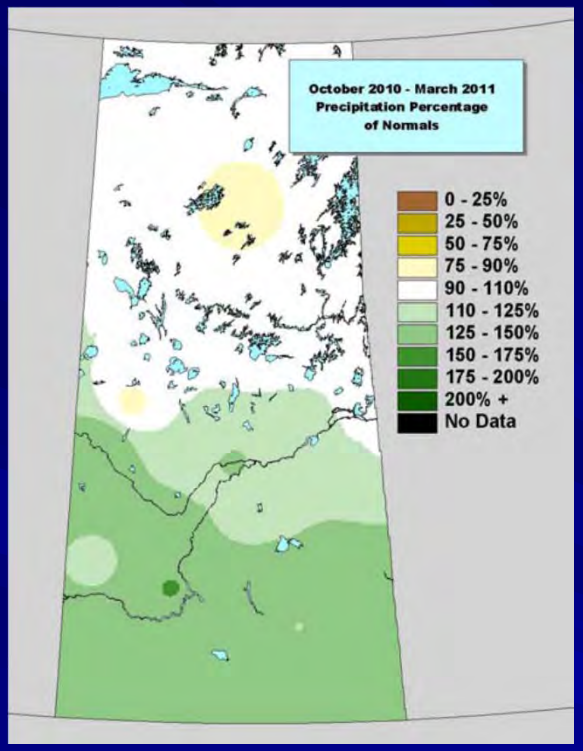


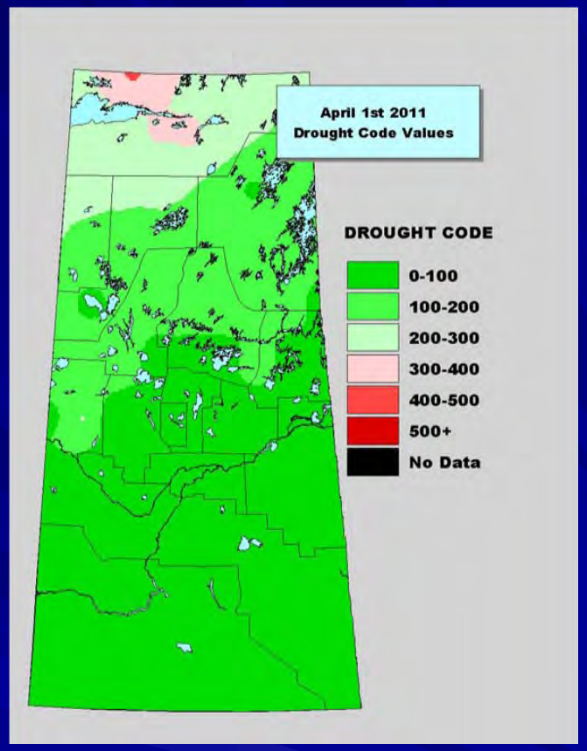
NSO pattern indicates conditions similar to 1971, 1974
d 1999.

is suggests warm conditions and high precipitation rates
central Yukon, pointing to an active lightning season.

Saskatchewan







ril 1st start-up DC indicates the Northwest may be an
a of serious concern. Otherwise start-up values are low
er the remaining regions. Green-up will probably occur

Ontario

	April	April, May, June	June, July August
ENSO Effects	Cooler and Wetter	Slightly Cooler Becoming Drier	Diminishing Effects
NAO Effects	Cooler and Drier	Slightly Cooler and Drier	Diminishing Effects
Environment Canada	Near Normal Temps Slightly Wetter	Close to Normal (Low Confidence)	Possibly Warmer and Drier
UK Met Office		Cooler and Drier	
IRI Columbia		Warmer Normal Precipitation	Warmer Normal Precipitation
US ECPC		Cooler & Wetter North Warmer & Drier South	Warmer Everywhere. Drier North, Wetter Central/South
CFS	Low Severity	Becoming Moderate Severity	Moderate Severity
	April	Spring	Summer
Summary	Cooler and Slightly Wetter	Slightly Cooler and Becoming Drier	Likely Warmer and Drier

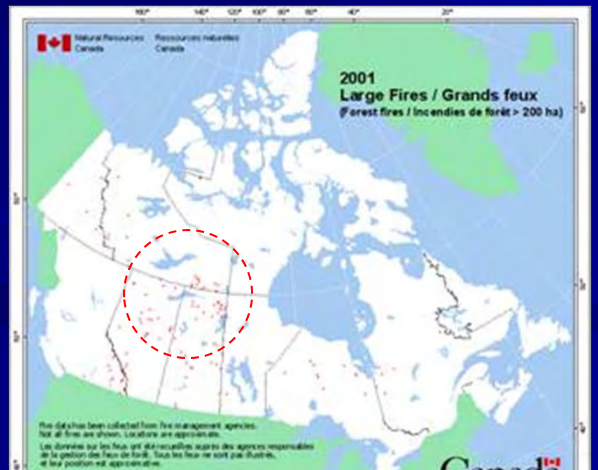
Parks Canada

e Climate Prediction Center (NOAA) on ENSO status
ntinues to forecast La Nina weakening and going neutral
June. A similar pattern preceded the following fire
asons – 2008, 2001, 2000(?), 1996, 1989, 1976.

e large fire database was considered for these years to
dict what this year will bring.

r recent persistence, maybe like 2008? Although with
rent conditions out west, not much will happen for a
nth or two.

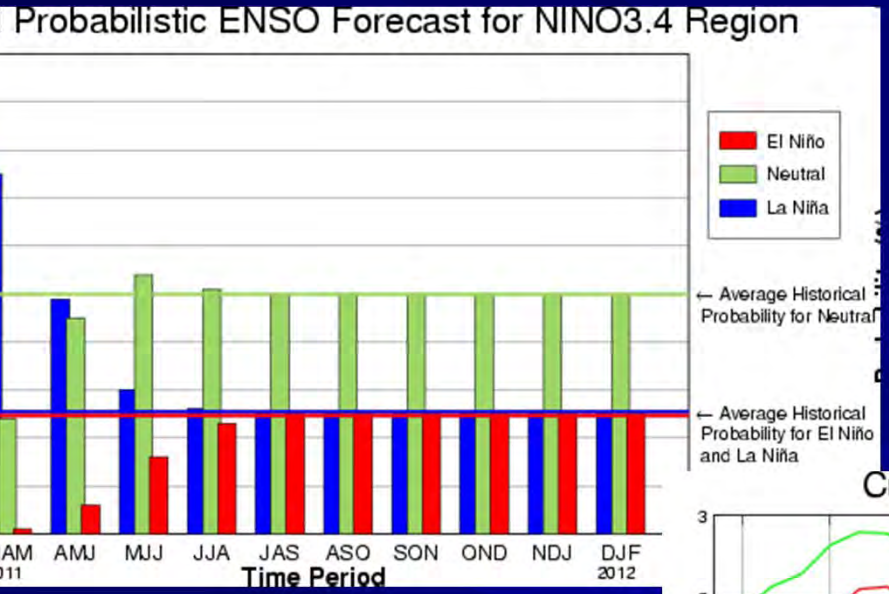
Parks Canada

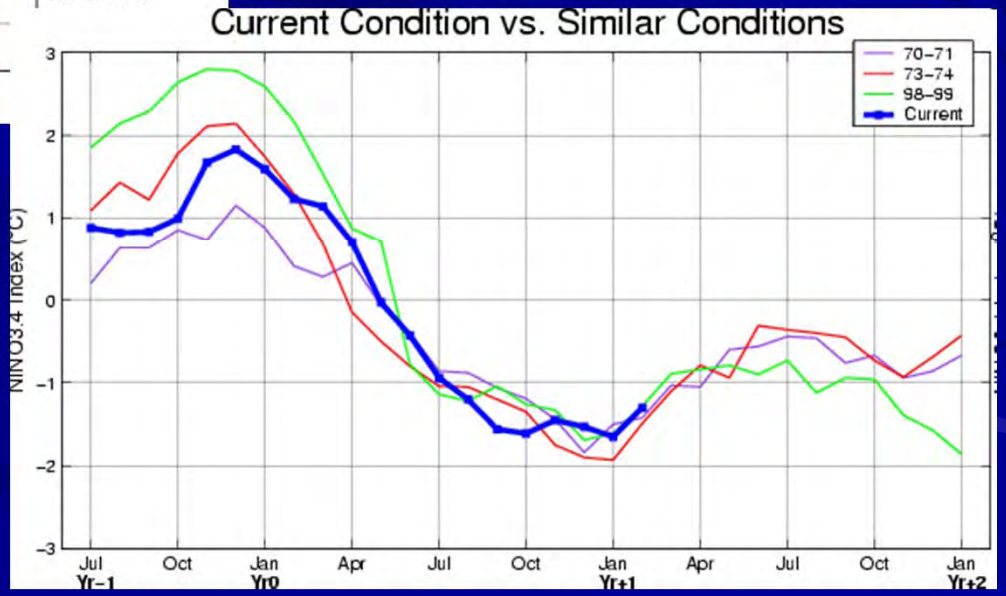


ENSO Pattern

International Research Institute for Climate and Society

ENSO Quick Look





International Research Institute for Climate and Society

Summary of ENSO Model Forecasts

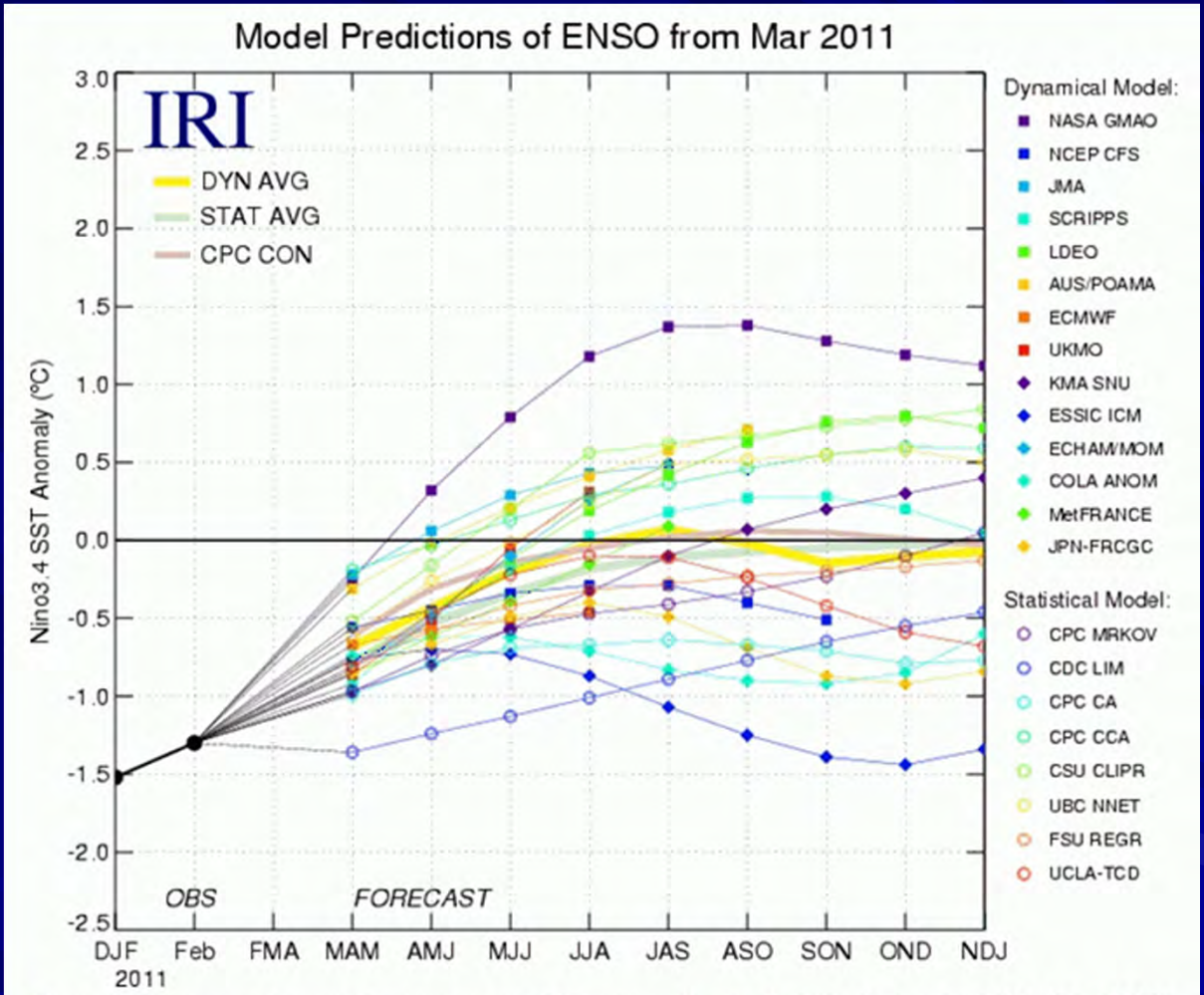
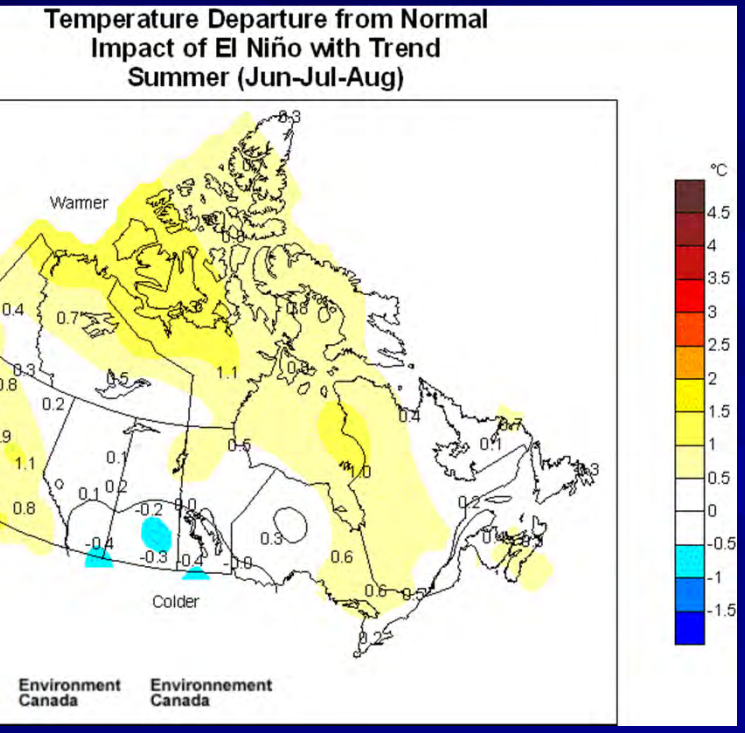


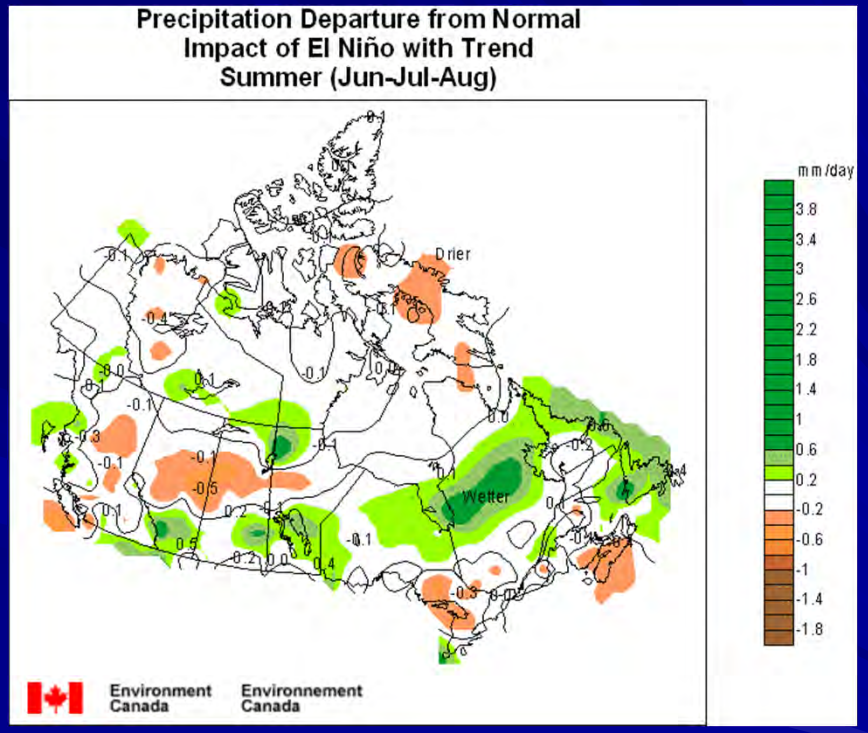
Figure 6. Forecasts of sea surface temperature (SST) anomalies for the Niño 3.4 region (5°N-5°S, 120°W-170°W). Figure courtesy of the International Research Institute (IRI) for Climate and Society. Figure updated 16 March 2011.

http://iri.columbia.edu/climate/ENSO/currentinfo/SST_table.html

El Nino Effects

Summer





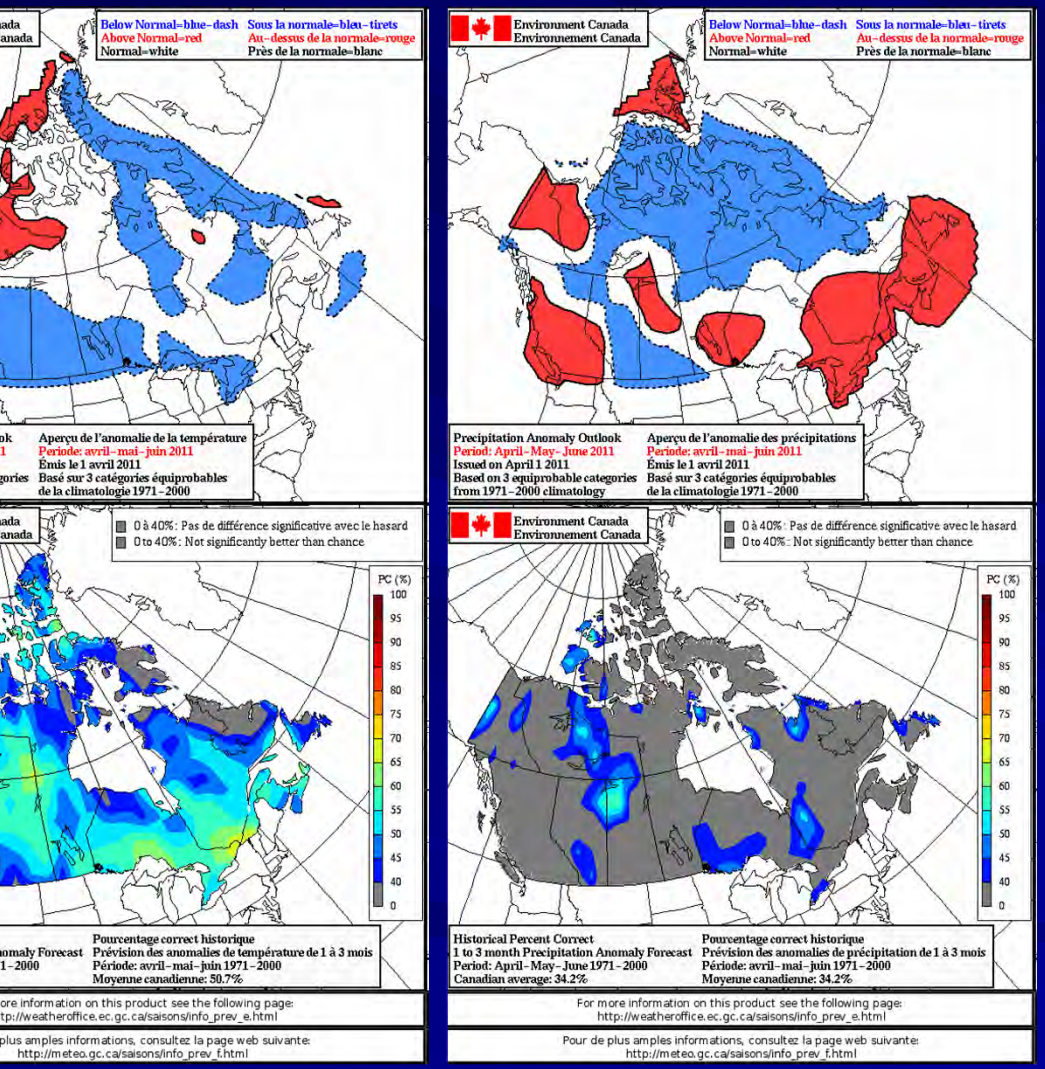
Temperature

Precipitation

lino leads to below-average precipitation in central Alberta and

2011 Seasonal Prediction

Seasonal Forecasts



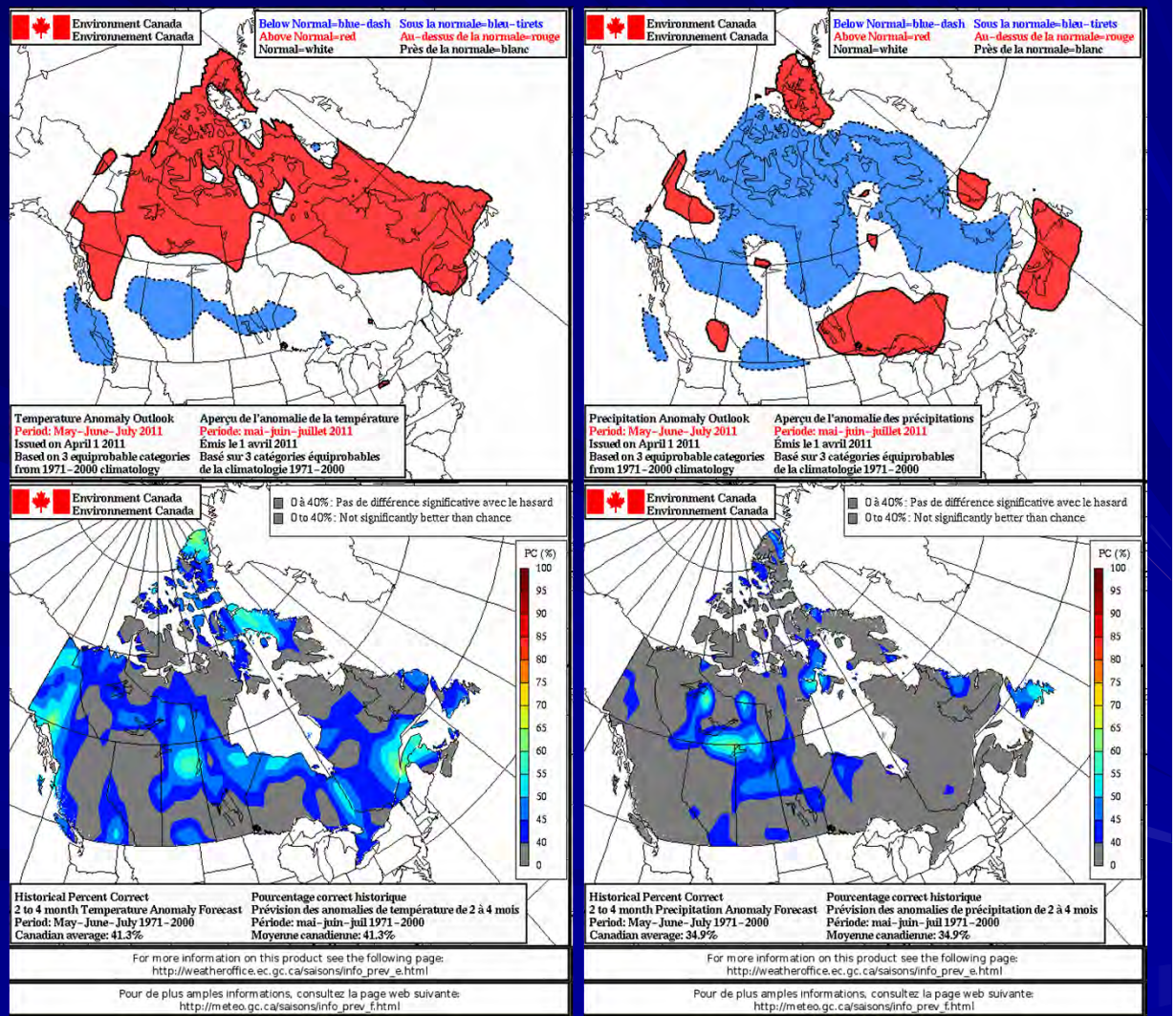
Spring temperature anomalies are low for much of Canada.

Precipitation anomalies are high for BC and eastern Canada and mixed for the west and north.

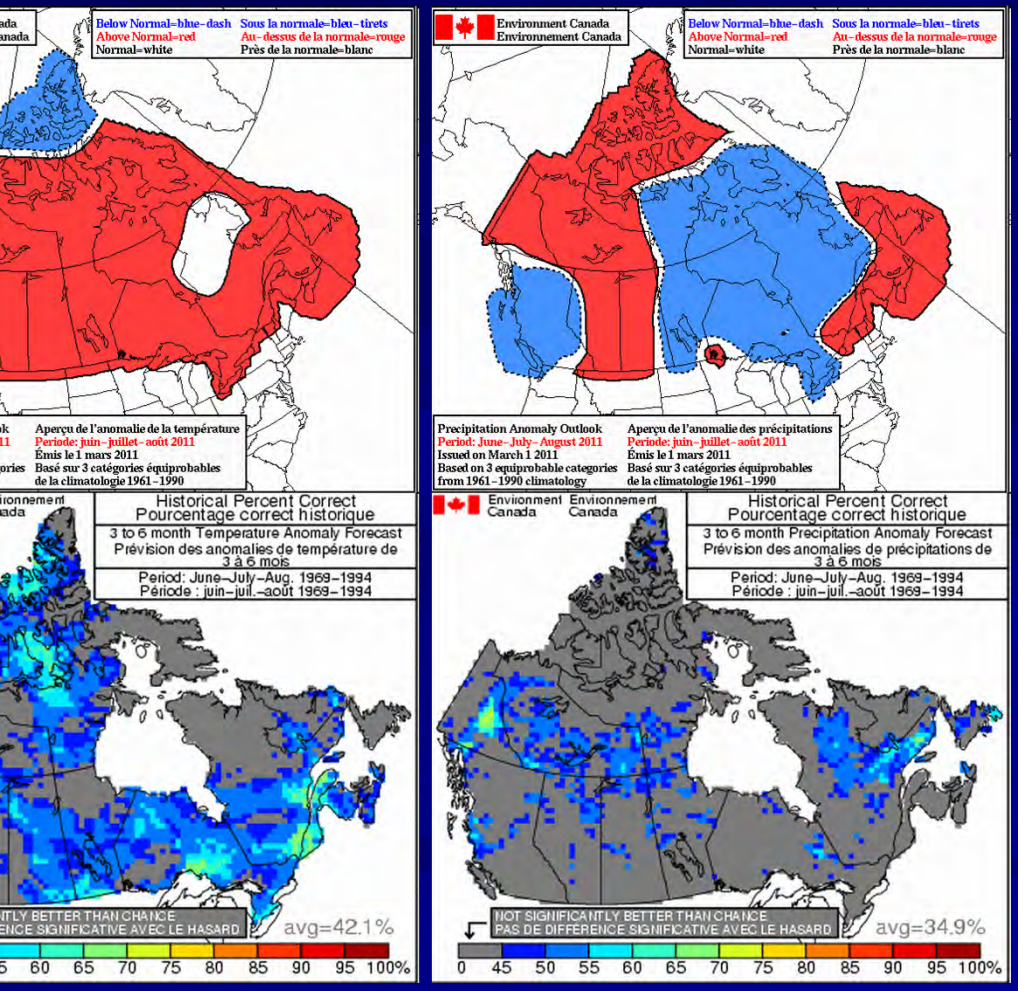
Seasonal Forecasts

rly summer sees above-normal temperatures in ern Canada and the Maritimes.

Below-normal precipitation is cted for the north above-normal in Ontario and the Maritimes.



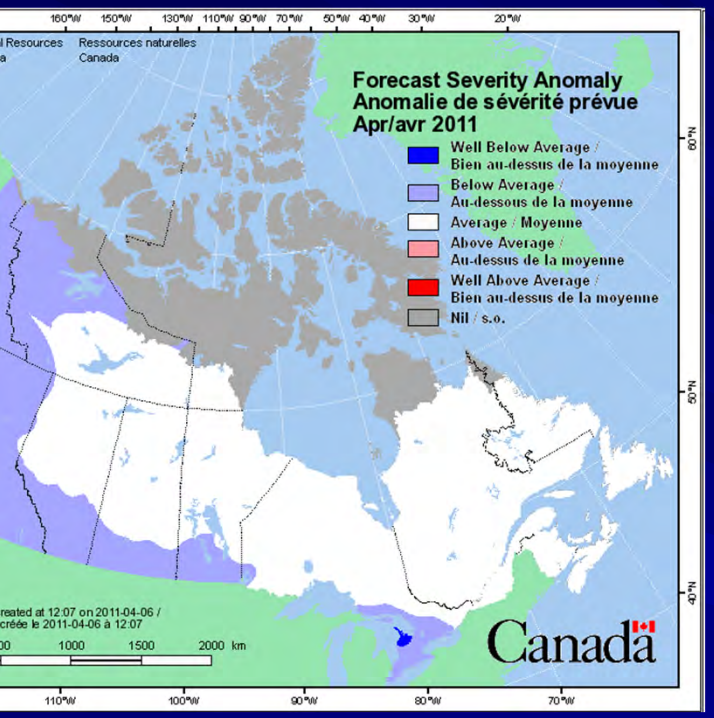
Seasonal Forecasts



Summer temperature anomalies are high for most of Canada.

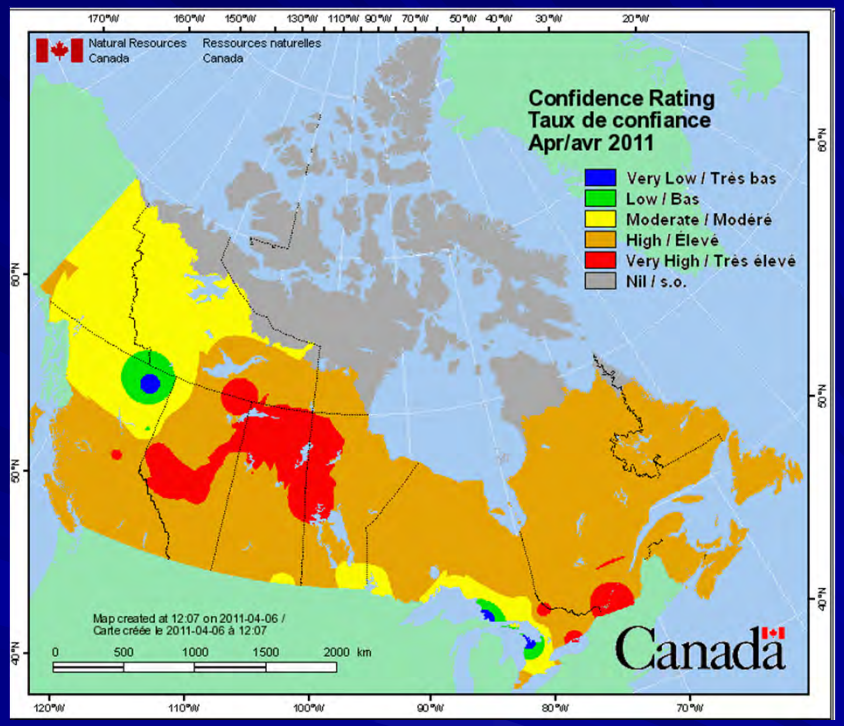
Below-normal precipitation is predicted for BC and the Hudson's Bay region, while above-normal precipitation is predicted for the remaining portions of Canada.

April 2010



Prediction

ed values normalized against average weather)



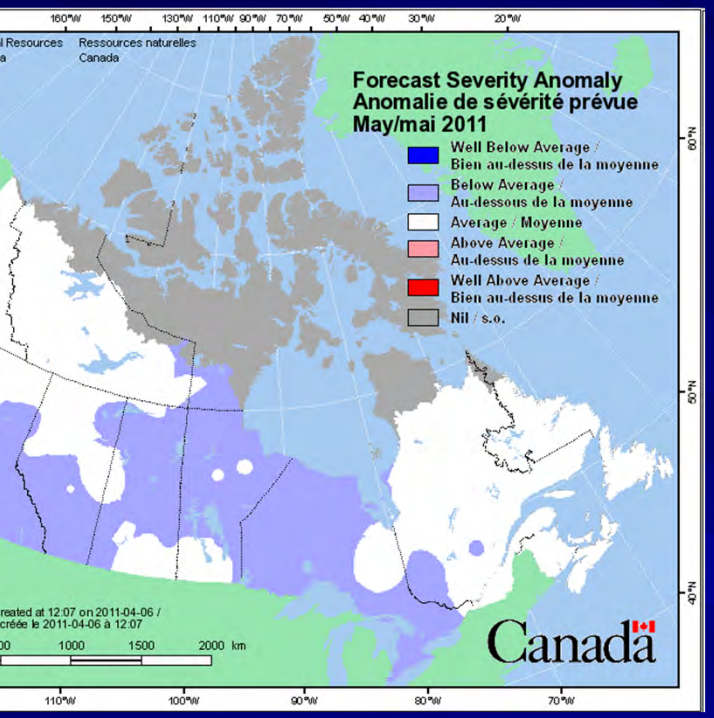
Confidence

(standard deviation normalized against average weather)

ow conditions in western Canada and southern Ontario.

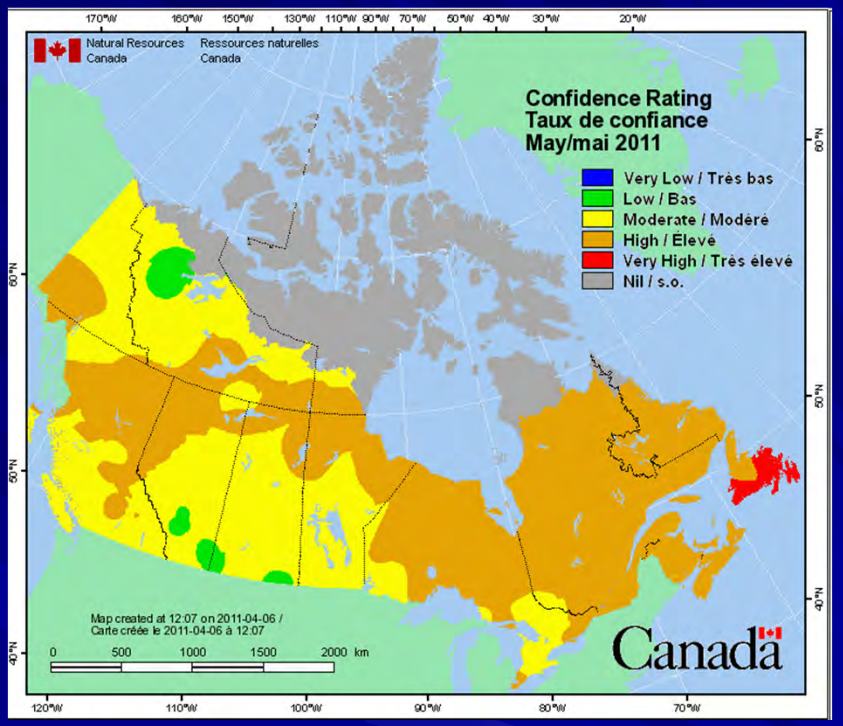
High confidence in all but the northwest.

May 2010



Prediction

ed values normalized against average weather)

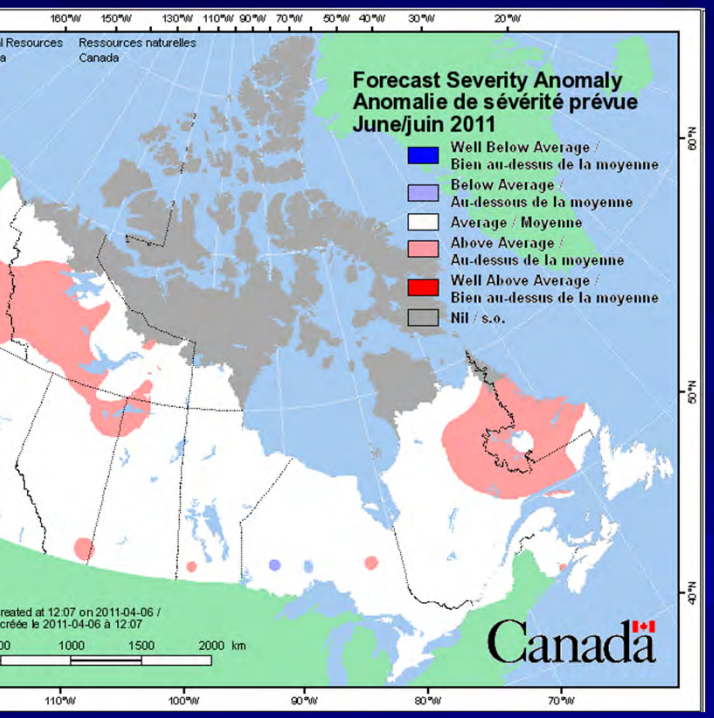


Confidence

(standard deviation normalized against average weather)

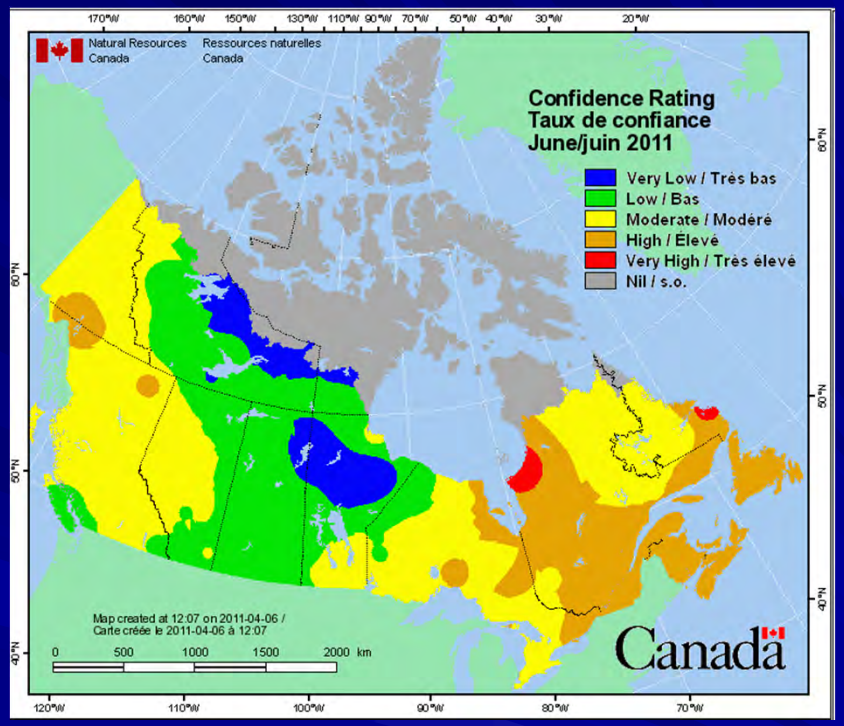
Below average condition continue in much of Western anada, while fire weather conditions remain average in

June 2010



Prediction

ed values normalized against average weather)

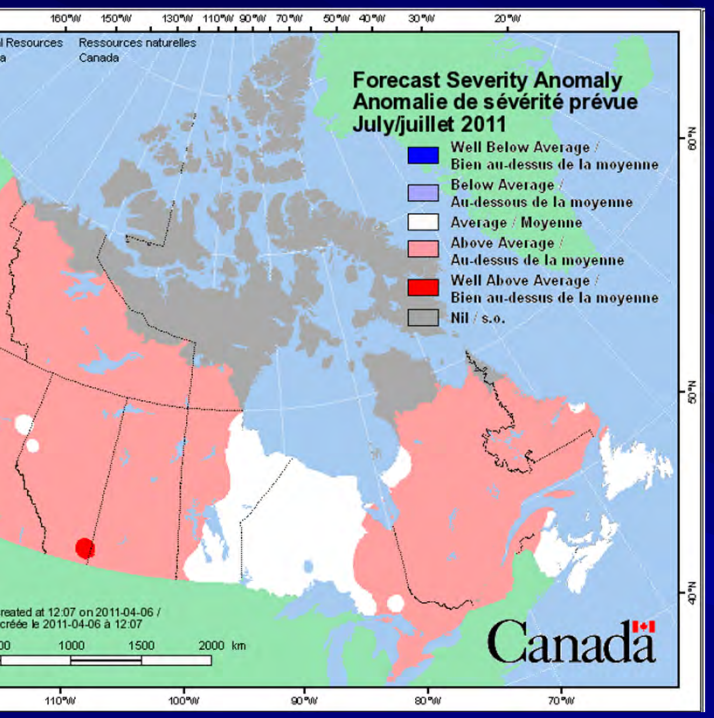


Confidence

(standard deviation normalized against average weather)

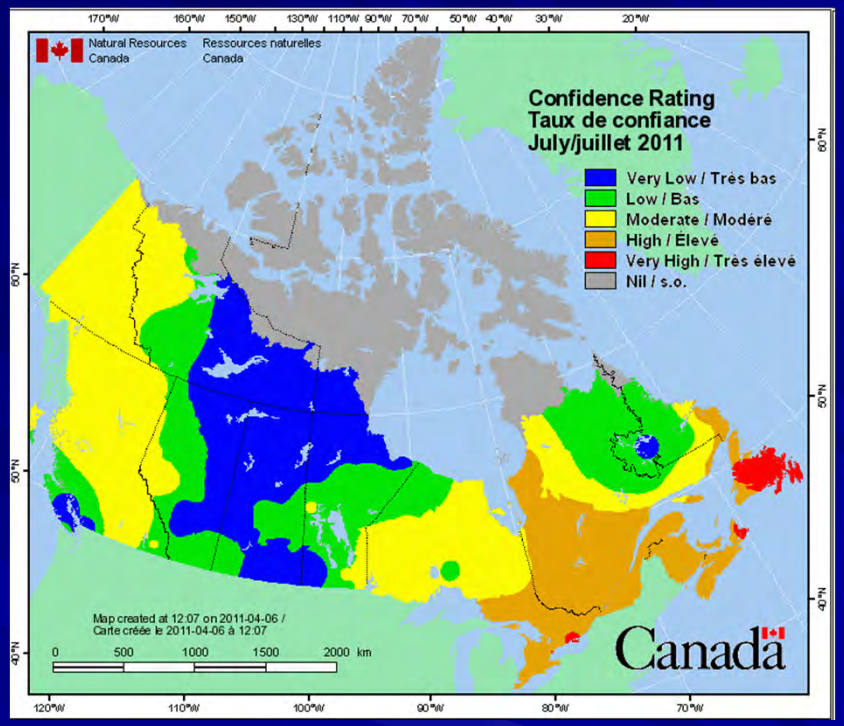
he Yukon, NWT, northern Alberta and Quebec may see
re activity. Confidence in the forecast drops in central

July 2010



Prediction

ed values normalized against average weather)

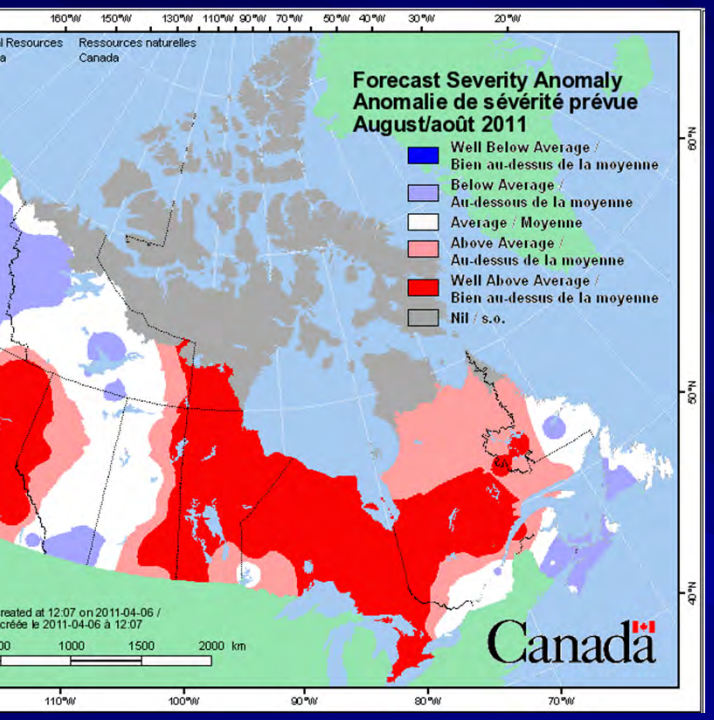


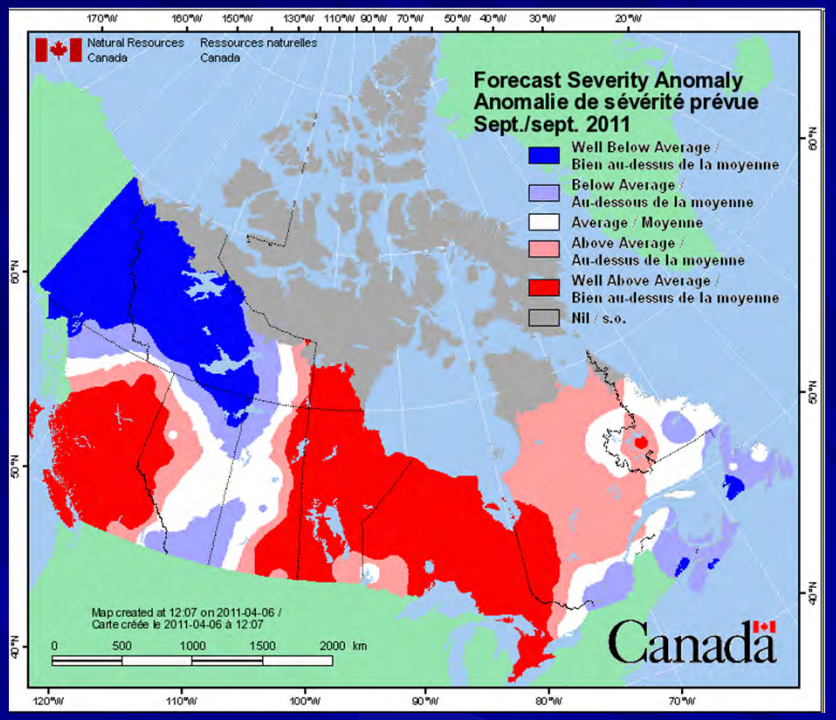
Confidence

(standard deviation normalized against average weather)

y sees an significant increase in fire weather conditions
in western and eastern Canada. Low confidence in

August, September 2010

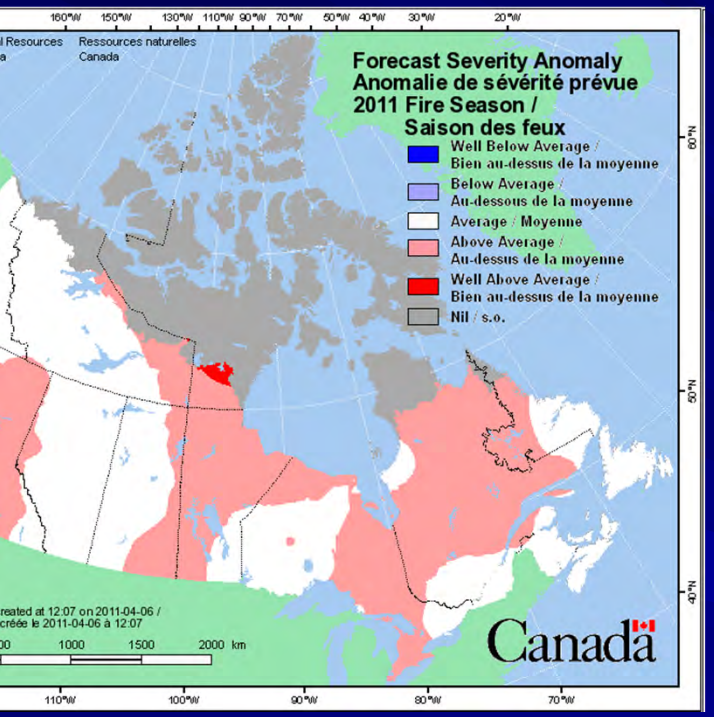




Predictions
(predicted values normalized against average weather)

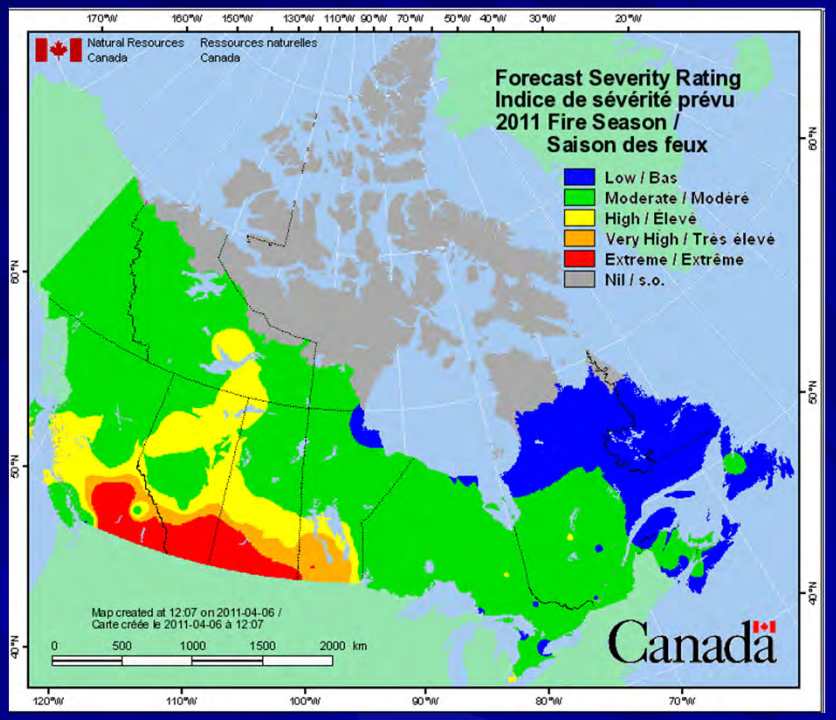
dictions show high fire weather in BC and central Canada.
Confidence in these extended forecasts are low.

May-Aug 2011



Prediction

ed values normalized against average weather)



Confidence

(standard deviation normalized against average weather)

e 2011 fire season could be above-average for BC and
stern Canada. Confidence in the above-average region

The End

Fire Danger Rating in Canada

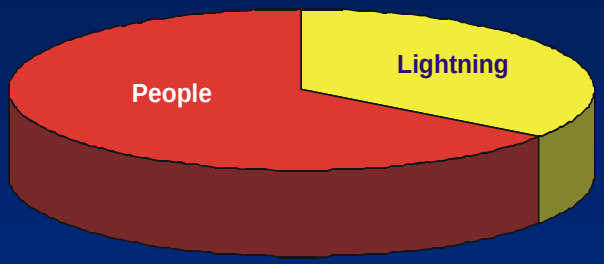
Kerry Anderson
Canadian Forest Service

Each Year in Canada

- 7,000 forest fires,
- 2 million hectares burned,
- Quarter of a billion dollars spent fighting fire.

Forest Fires in Canada

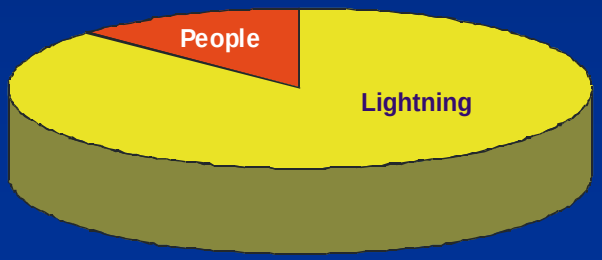
Fire cause



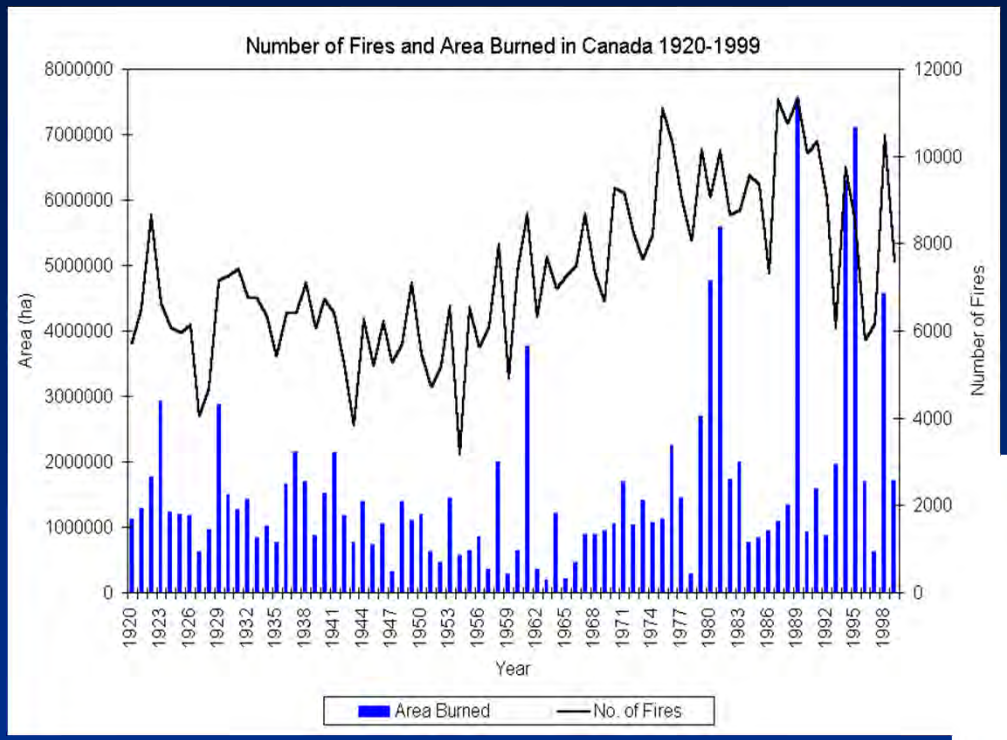
35% of fires are caused by lightning while 65% are caused by people.

Area burned

87% of the area burned is from lightning-caused fires.



Large Fire Occurrence in Canada



There is large annual variation in the fire numbers and area burned

with most fire activity occurring in the boreal forest.

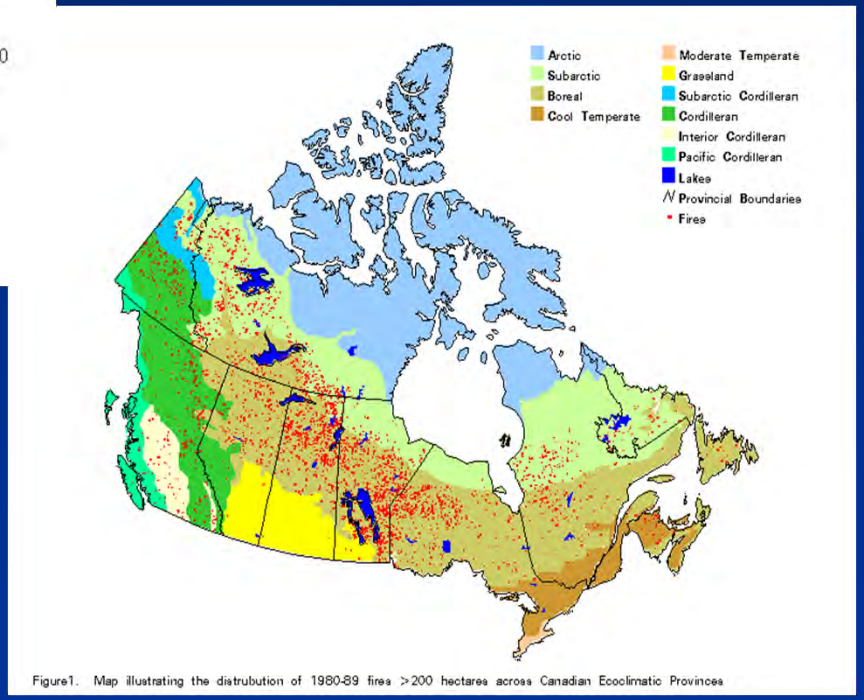
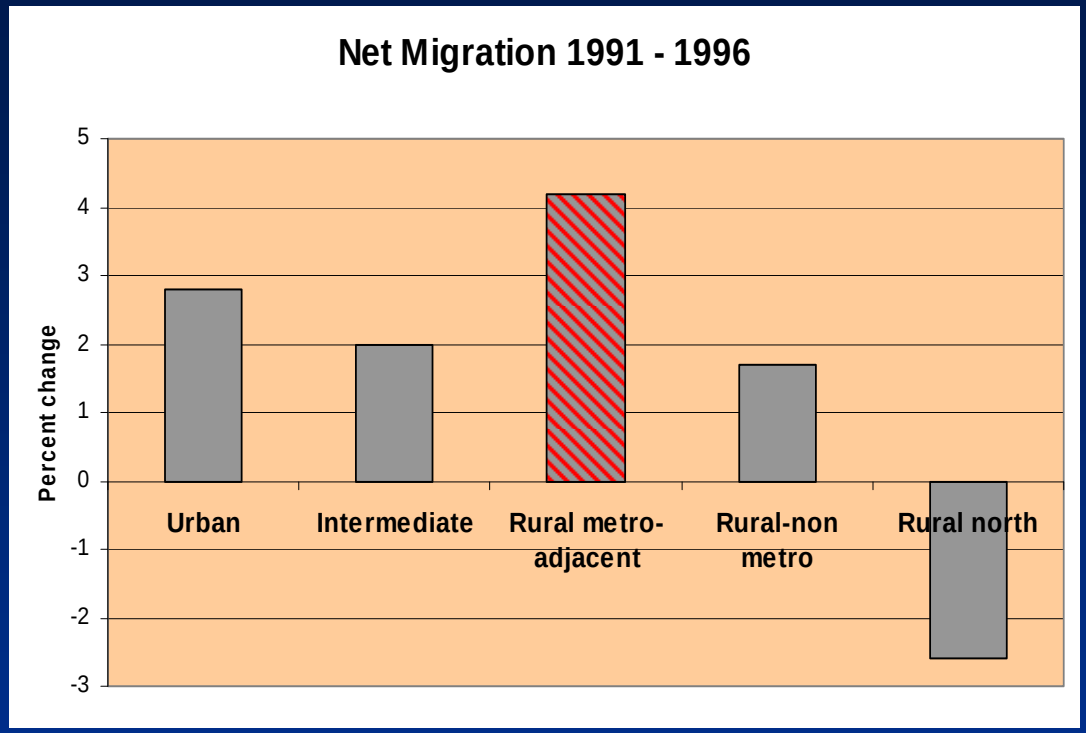


Figure1. Map illustrating the distrubution of 1980-89 fires >200 hectares across Canadian Ecoclimatic Provinces

Social Trends

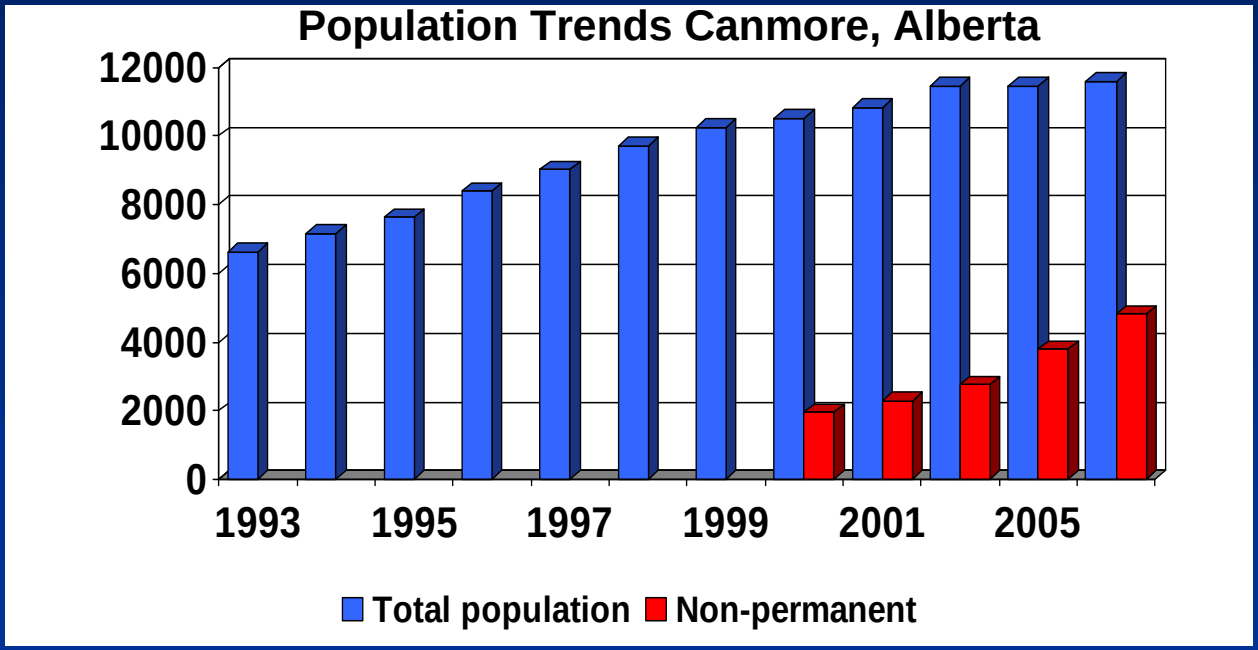


From: Beshiri & Bollman 2001

The rural metro-adjacent region is seeing the largest net increases in population. This corresponds to the ***wildland-urban interphase***.

Social Trends

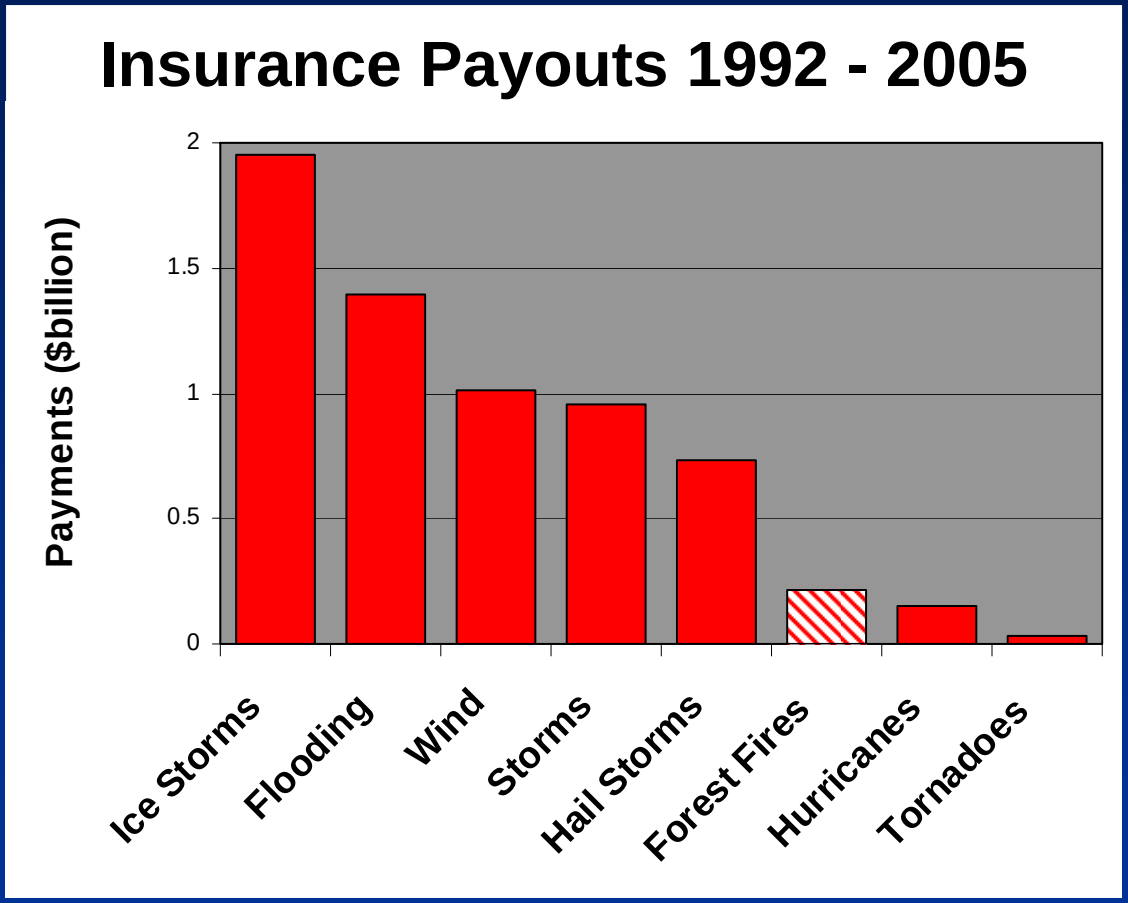
Much of this new population consists of non-permanent residents as people buy recreational properties.



Source: Town of Canmore 2006 Census

The Insurance Industry

Though insurance payouts are low compared to other categories, these may increase with social trends and climate change.



Source: Insurance Bureau of Canada 2006

Fire is a Natural Part of the Landscape

Many coniferous tree species are fire dependent.

Fire opens the understorey to new seedlings and foraging animals.

Frequent fires prevent a build up of a dangerous flammable understorey.

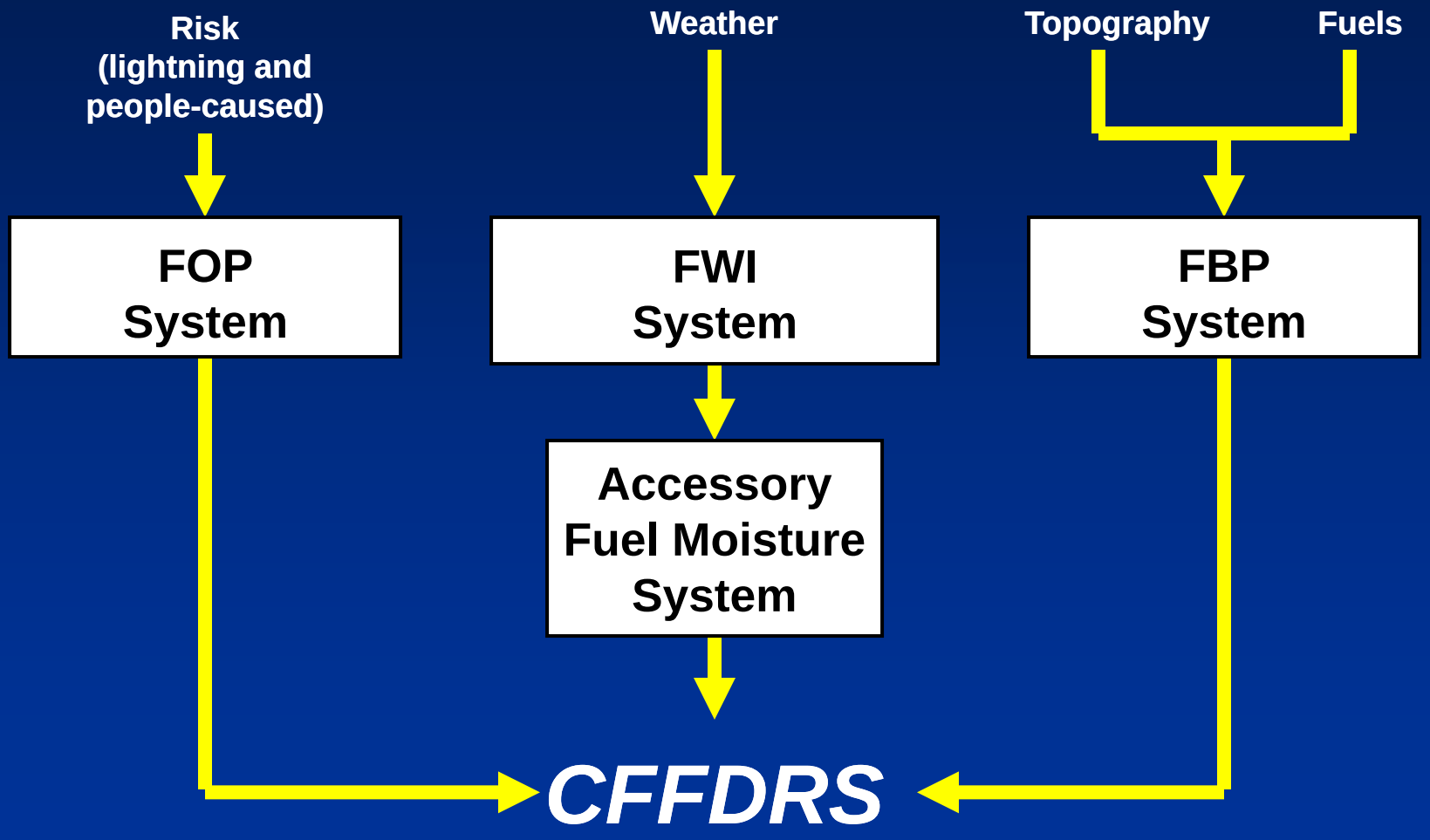
The Dilemma

How do we balance the ecological benefits with the loss of valuable timber and the threat to human habitation?

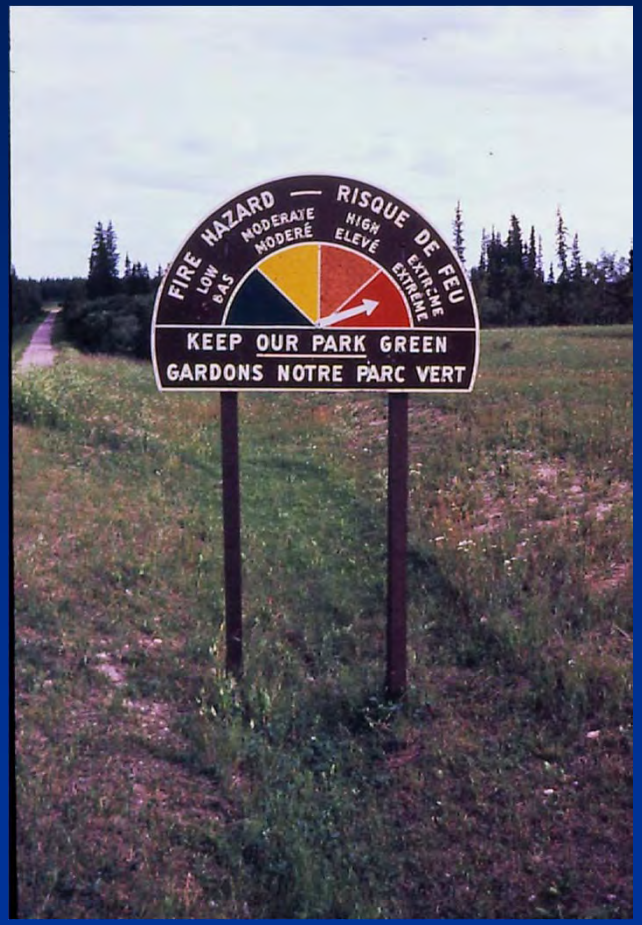
The Canadian Forest Fire Danger Rating System

The CFS has developed the **CFFDRS** to predict fire danger in Canada.

The Canadian Forest Fire Danger Rating System



Canadian Forest Fire Weather Index (FWI) system



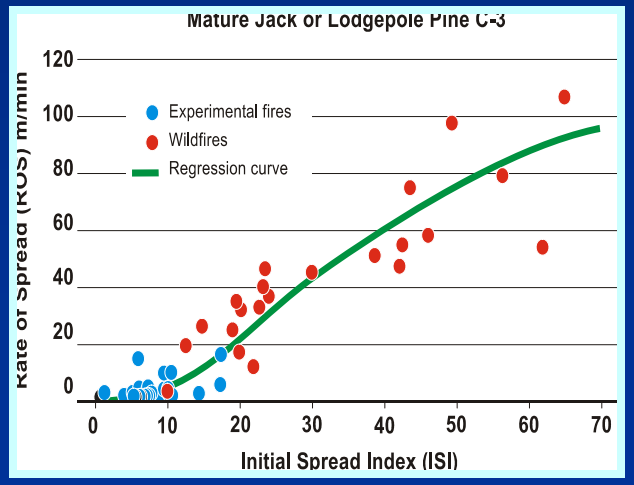
The **FWI** system was developed thirty years ago by the CFS

Based upon noon weather readings, the system predicts:

- *Fuel moisture at three depths*
- *Potential fire behaviour.*

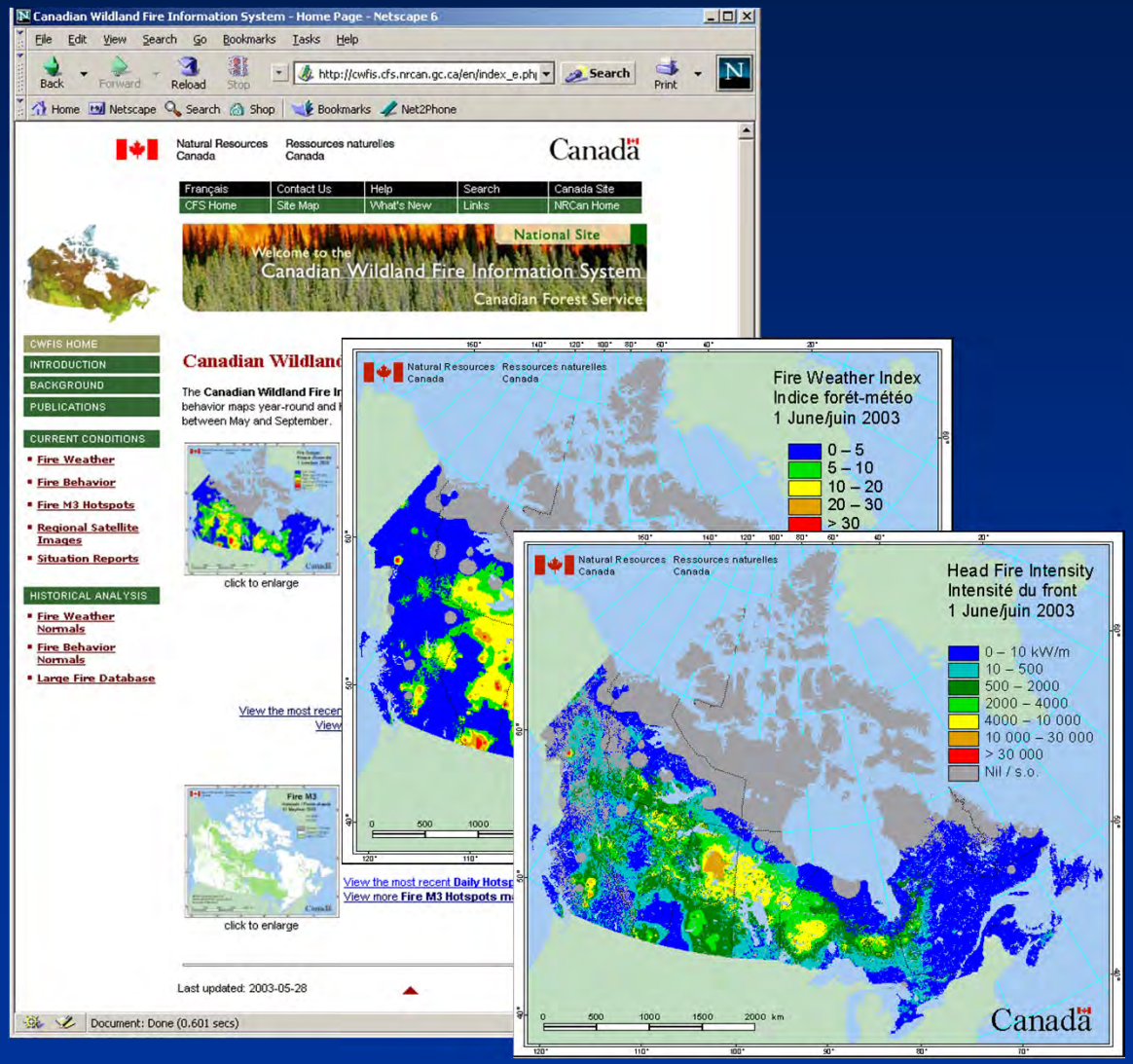
Canadian Forest Fire Behavior Prediction (FBP) system

The **FBP** system was developed over the last twenty years.



Based upon empirical studies, the system predicts physical fire parameters in a variety of fuel types.

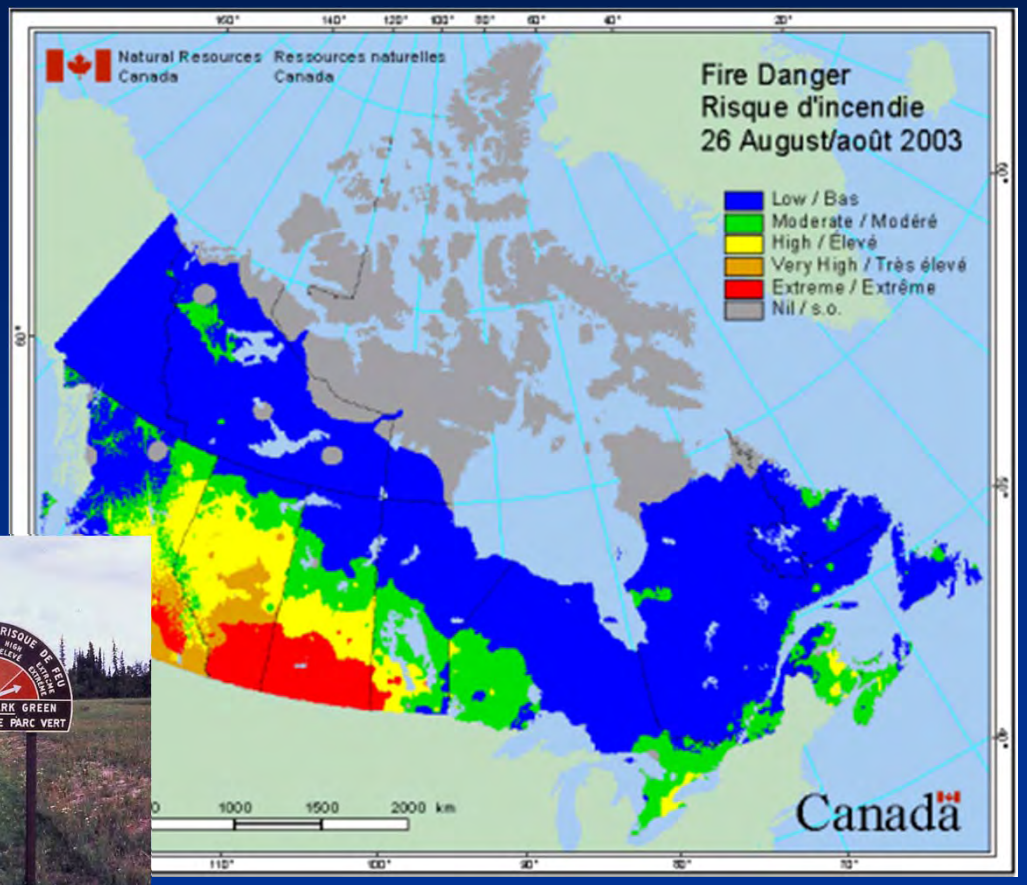
Canadian Wildland Fire Information System



The Canadian Wildland Fire Information System calculates the fire weather and fire behaviour conditions across the country.

Maps are displayed over the Internet.

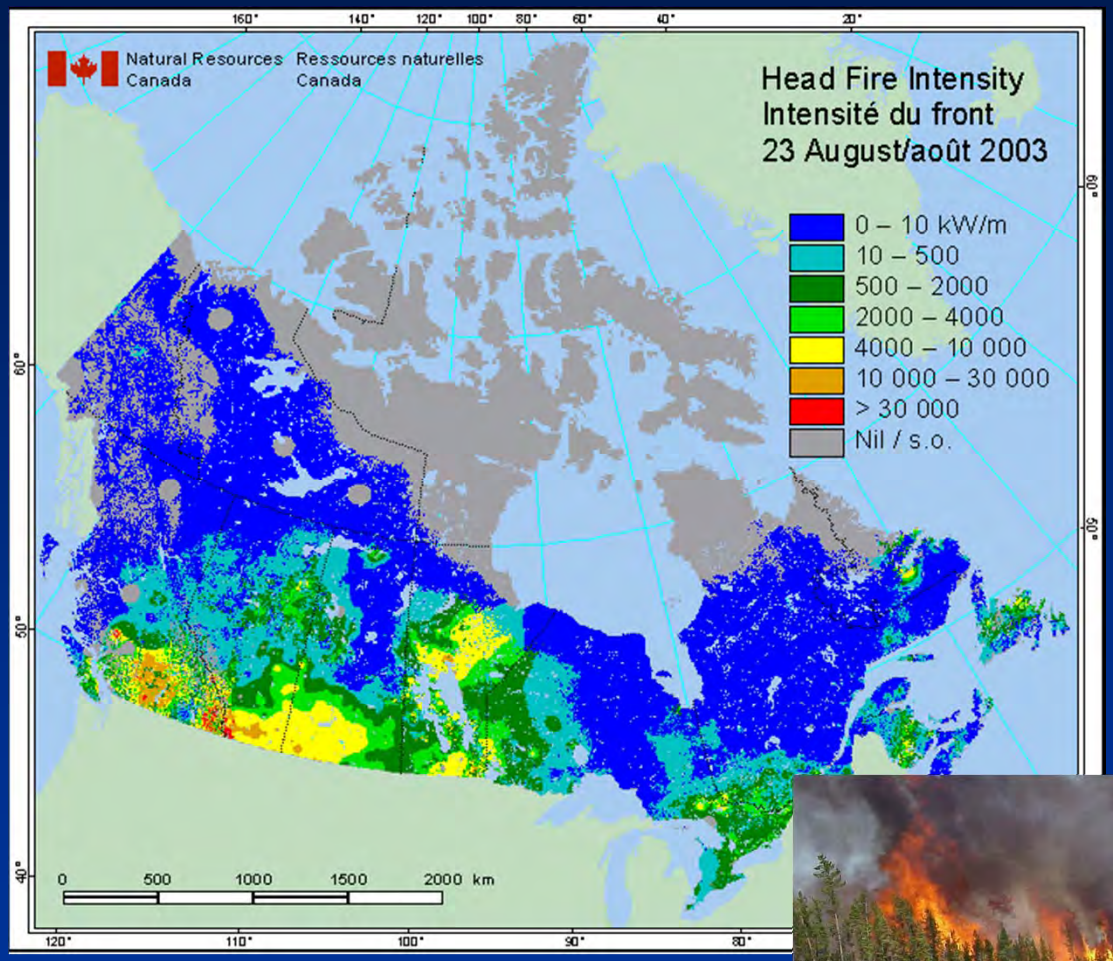
Fire Weather



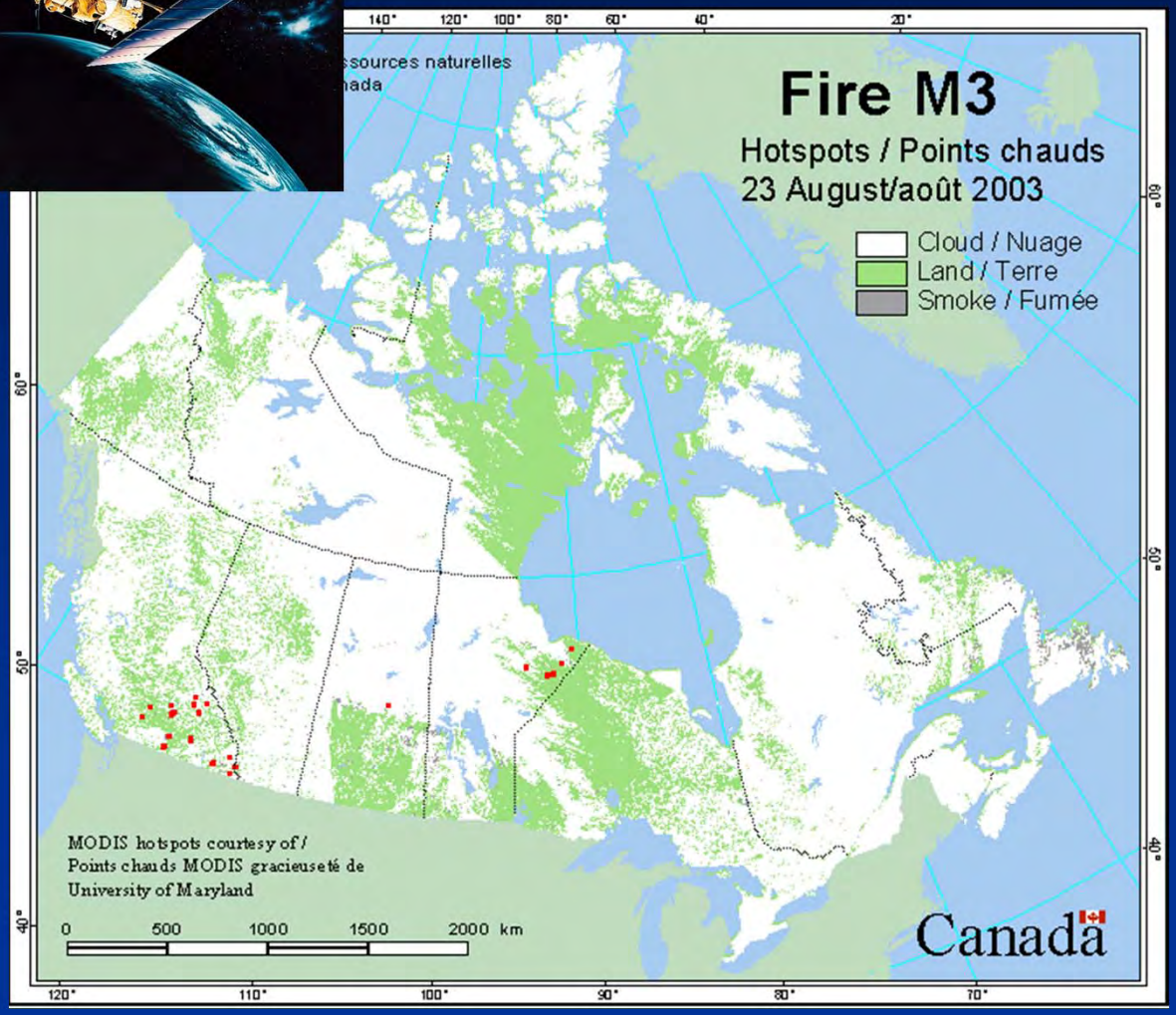
Weather observations are interpolated and then used as inputs for the **FWI** system to produce fire danger maps.

Fire Behaviour

Using the **FBP** system, potential fire behaviour maps are produced based on fuels, topography and weather.



Hotspots



Large fires are detected and mapped using NOAA/AVHRR and MODIS satellite imagery in near real time.

Summary

Summary

The **Canadian Forest Fire Danger Rating System** is a national system that has been used successfully in Canada for over forty years.

The **Canadian Wildland Fire Information System** presents the current national fire situation to fire suppression agencies and to the general public.