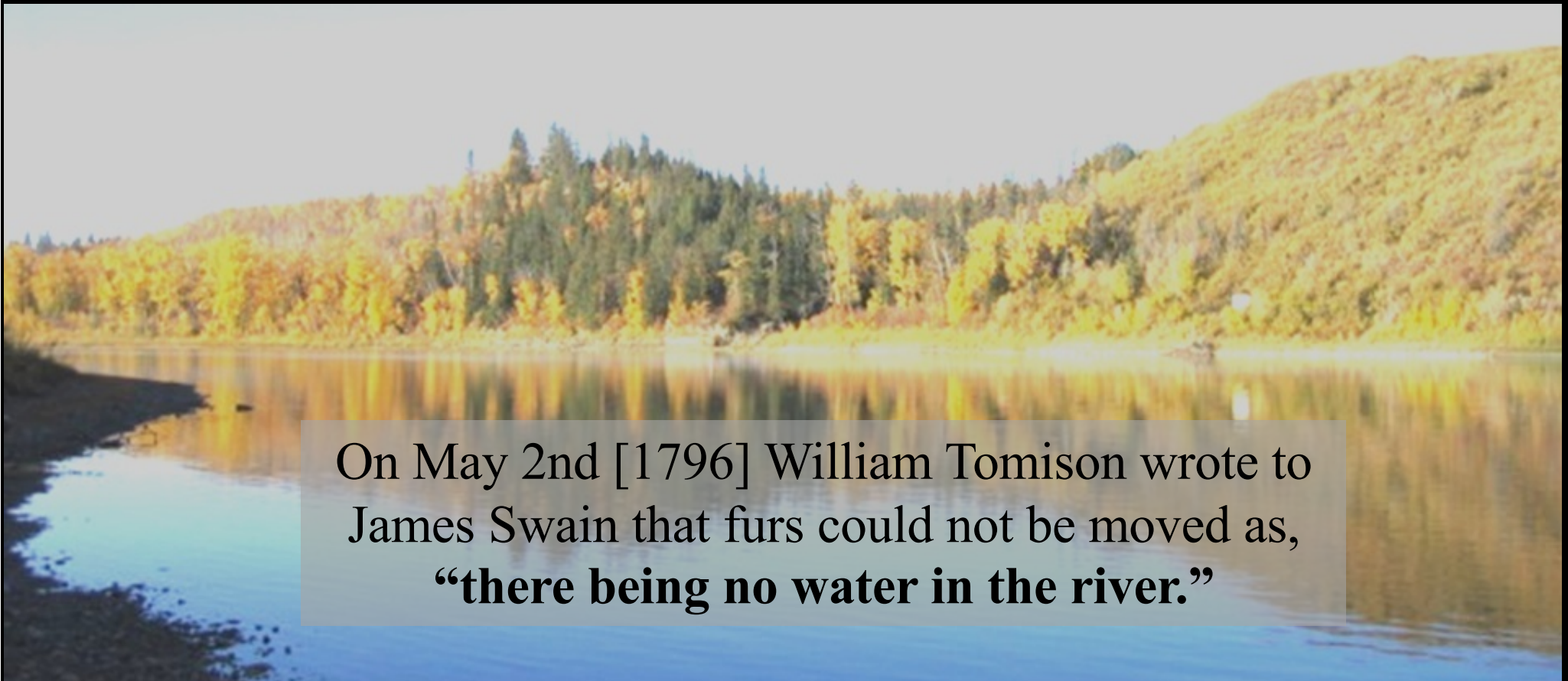


# Climate change: facts, forecasts and adaptation strategies related to watershed management and water resources

Dave Sauchyn, Prairie Adaptation Research Collaborative, U of R

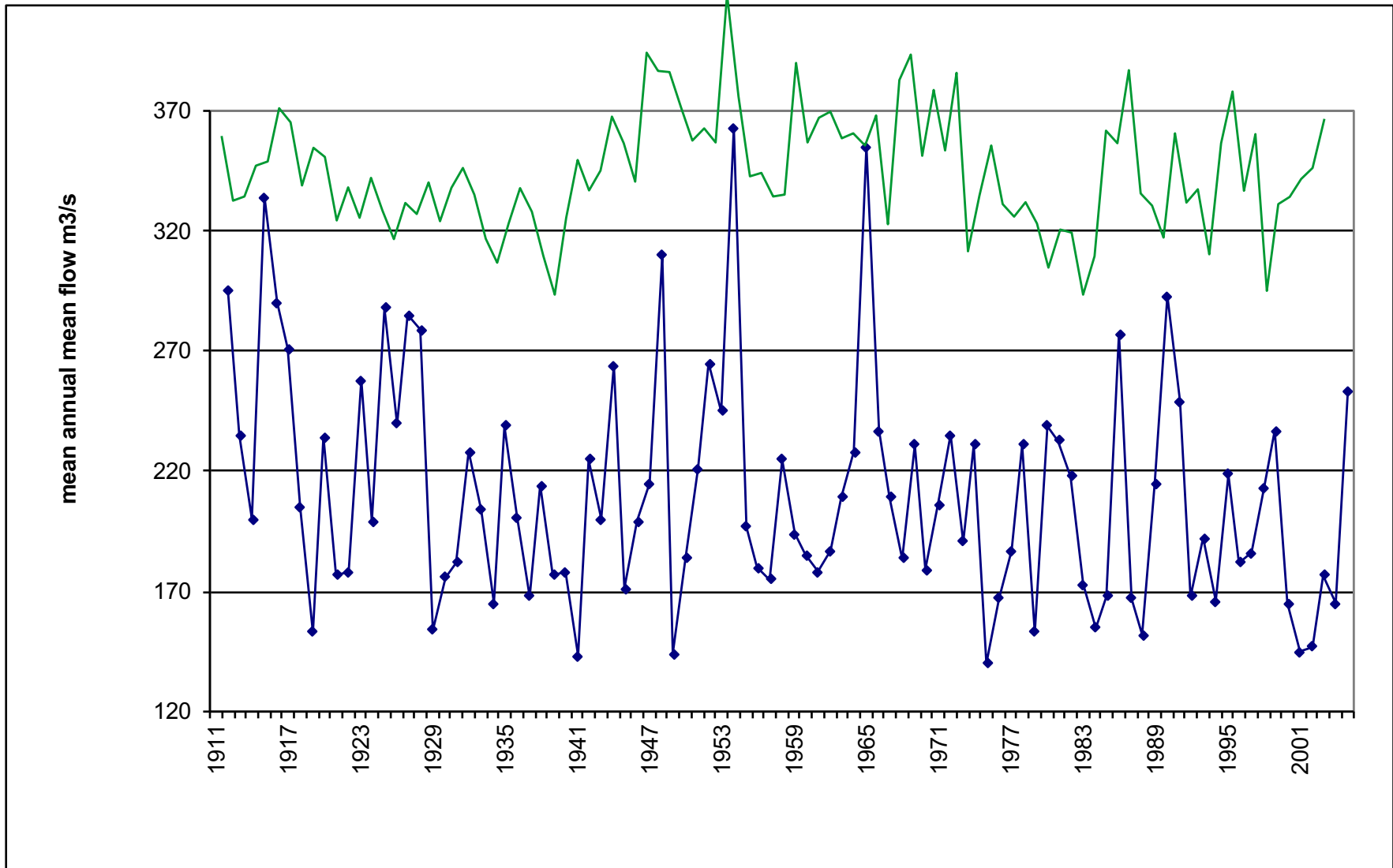


On May 2nd [1796] William Tomison wrote to James Swain that furs could not be moved as, **“there being no water in the river.”**

PCAB Watershed Awareness Initiative  
February 23-25, 2010

# North Saskatchewan River at Edmonton, 1911-2005

— flow  
— PDO

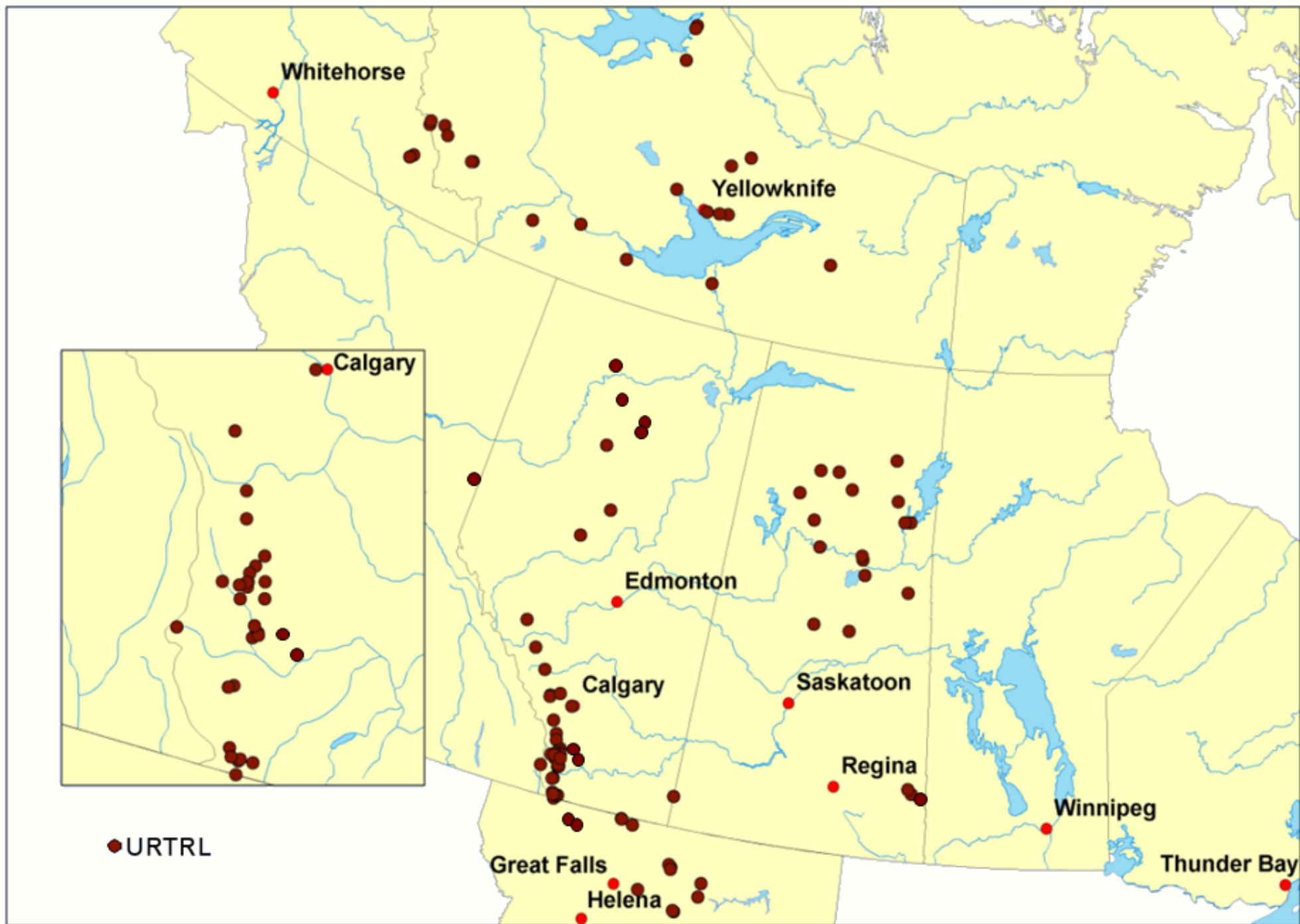




earlywood late wood

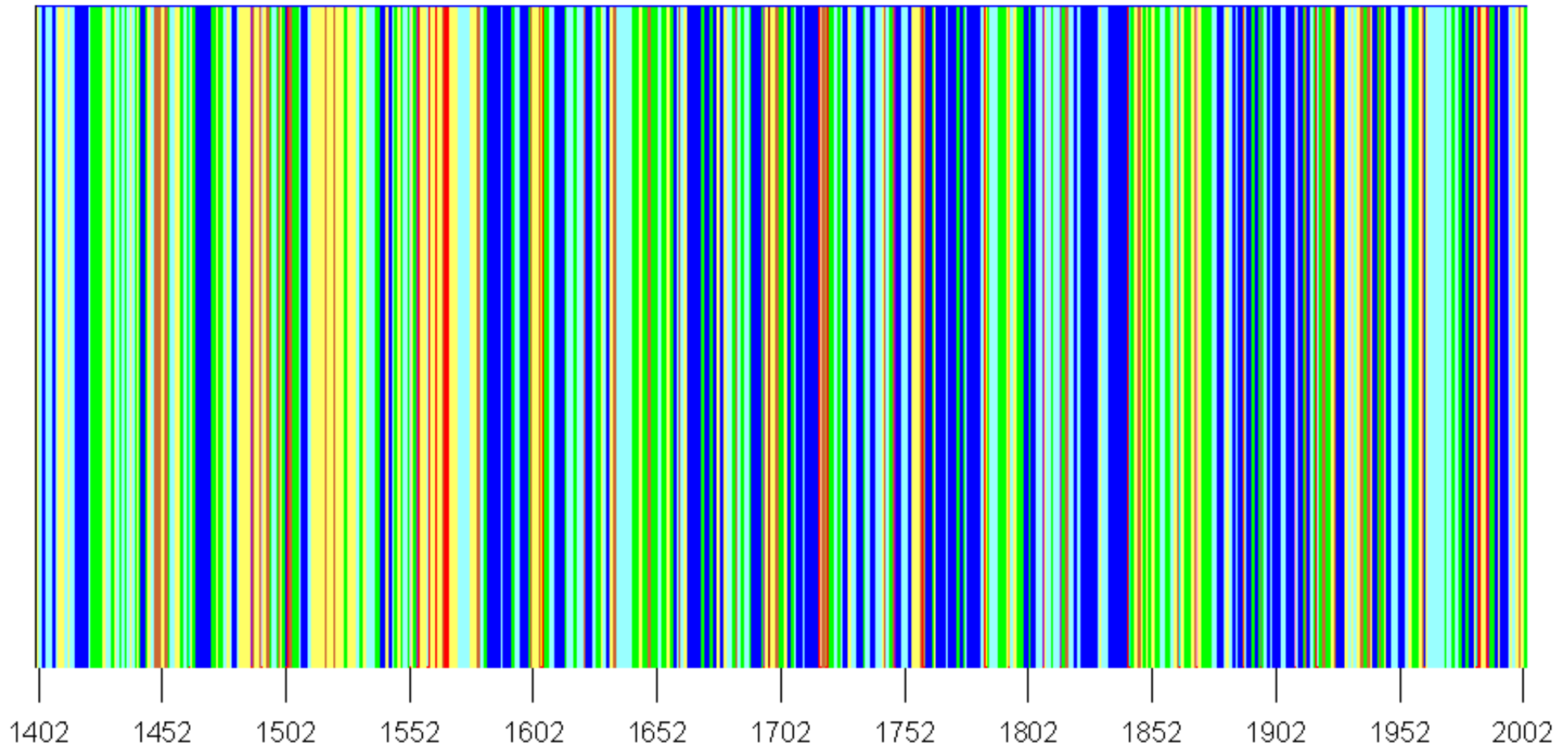
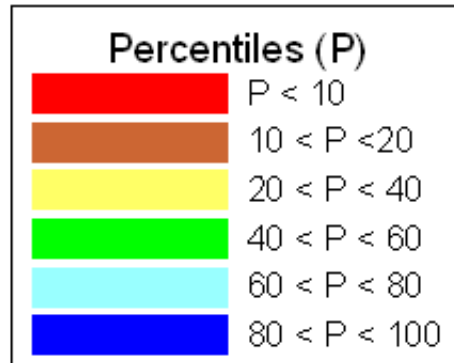
one tree ring

# Tree-Ring Sampling Sites





# South Saskatchewan River at Medicine Hat, 1402-2004





**NSERC  
CRSNG**



## **Past, recent and future hydroclimatic variability, North Saskatchewan River**

NSERC Collaborative Research and Development (CRD) project,  
2008-10

Principal Investigator: Dr. Dave Sauchyn, University of Regina  
Co-Investigators: Dr. James Byrne and Dr. Stefan Kienzle  
University of Lethbridge

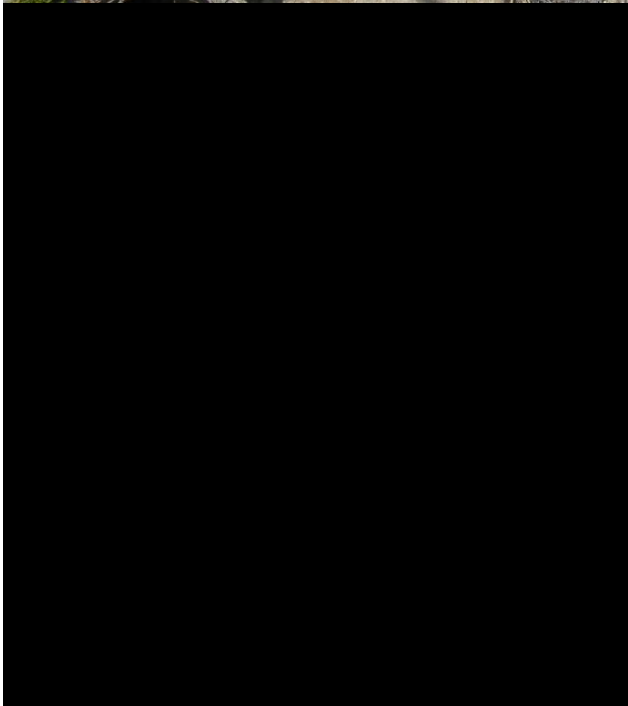


- EPCOR Water Services Inc. (EWSI) provides water, wastewater, and distribution services to over one million people in more than 50 communities across Western Canada.
- EWSI utilizes an Integrated Resource Planning (IRP) approach for the development of capital and operational plans for the Edmonton water system.
- Traditional planning would **consider flow characteristics of the raw water streams as “knowns”** in the system.

*Source: Climate Change – Potential IRP Impact areas*

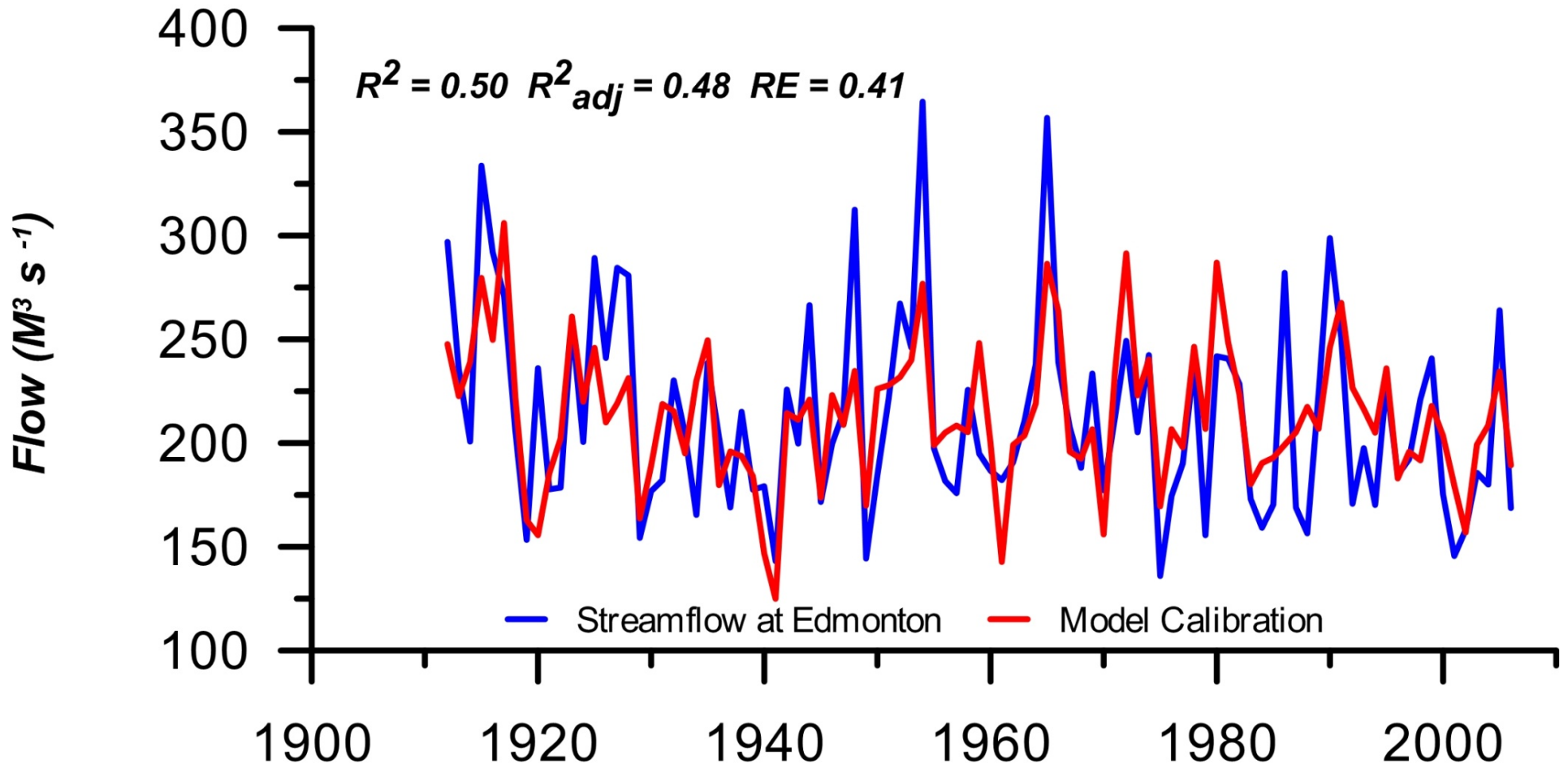


# Old Wood Headwaters, NSRB

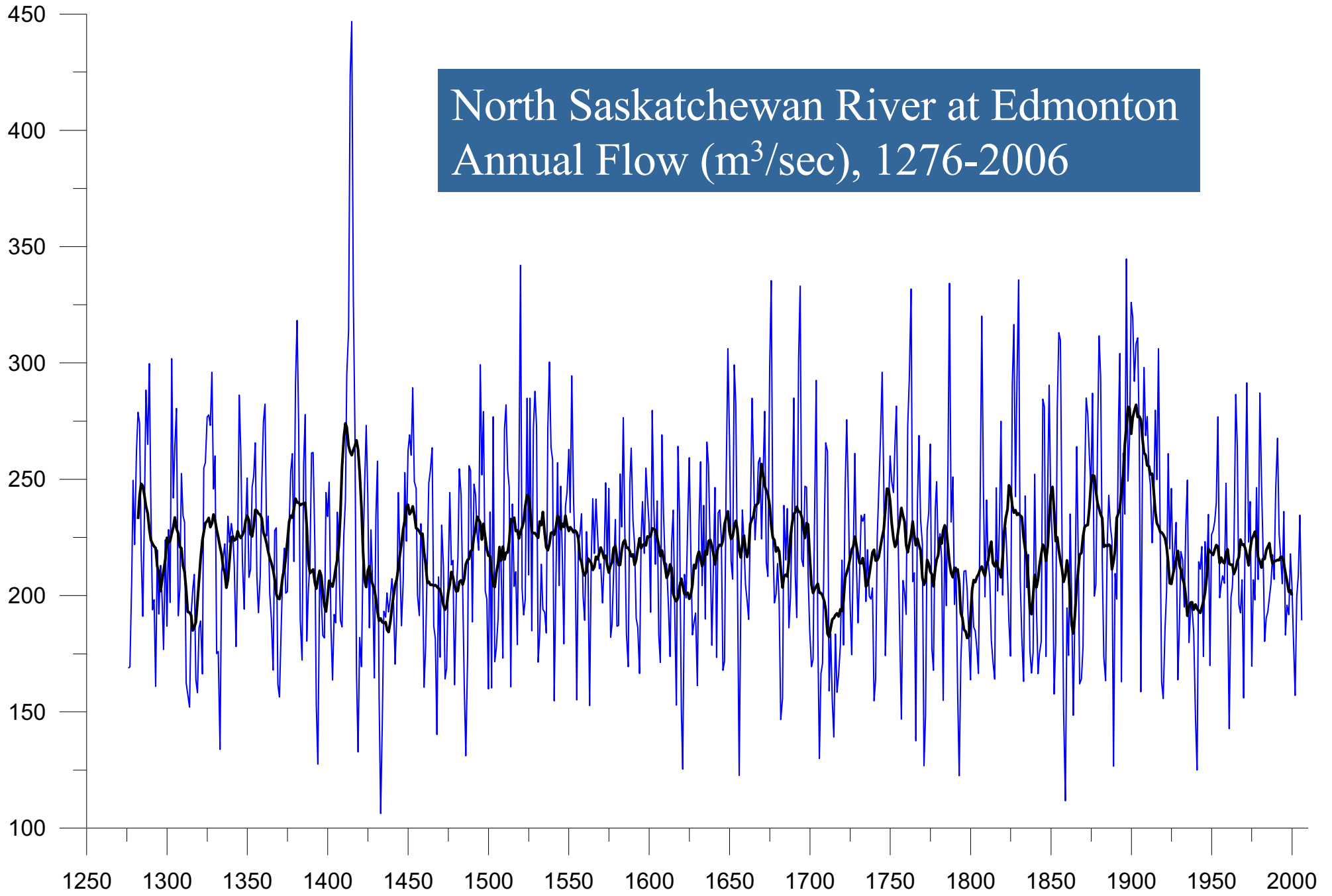




# North Saskatchewan River at Edmonton Annual Flow (m<sup>3</sup>/sec), 1912-2006



North Saskatchewan River at Edmonton  
Annual Flow (m<sup>3</sup>/sec), 1276-2006



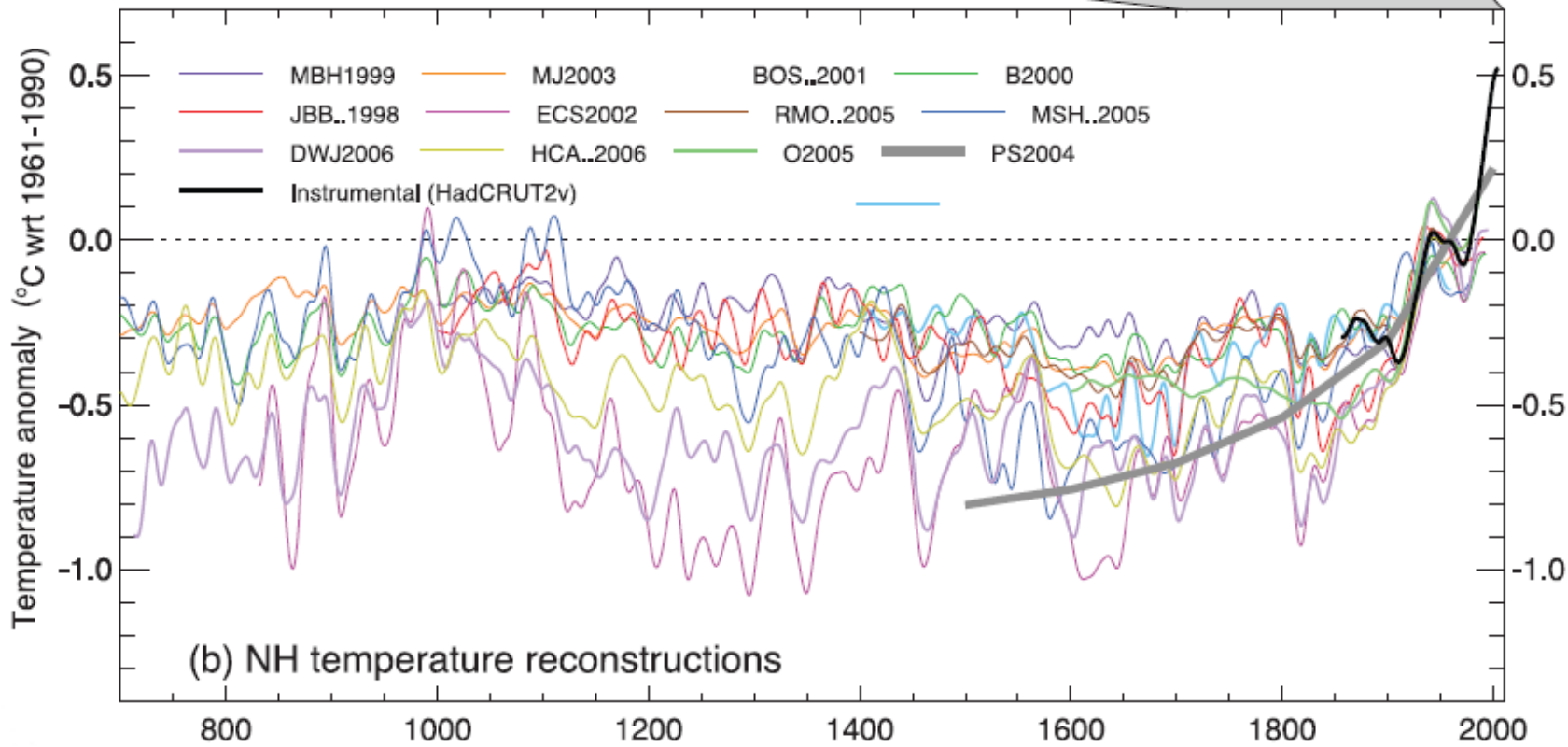
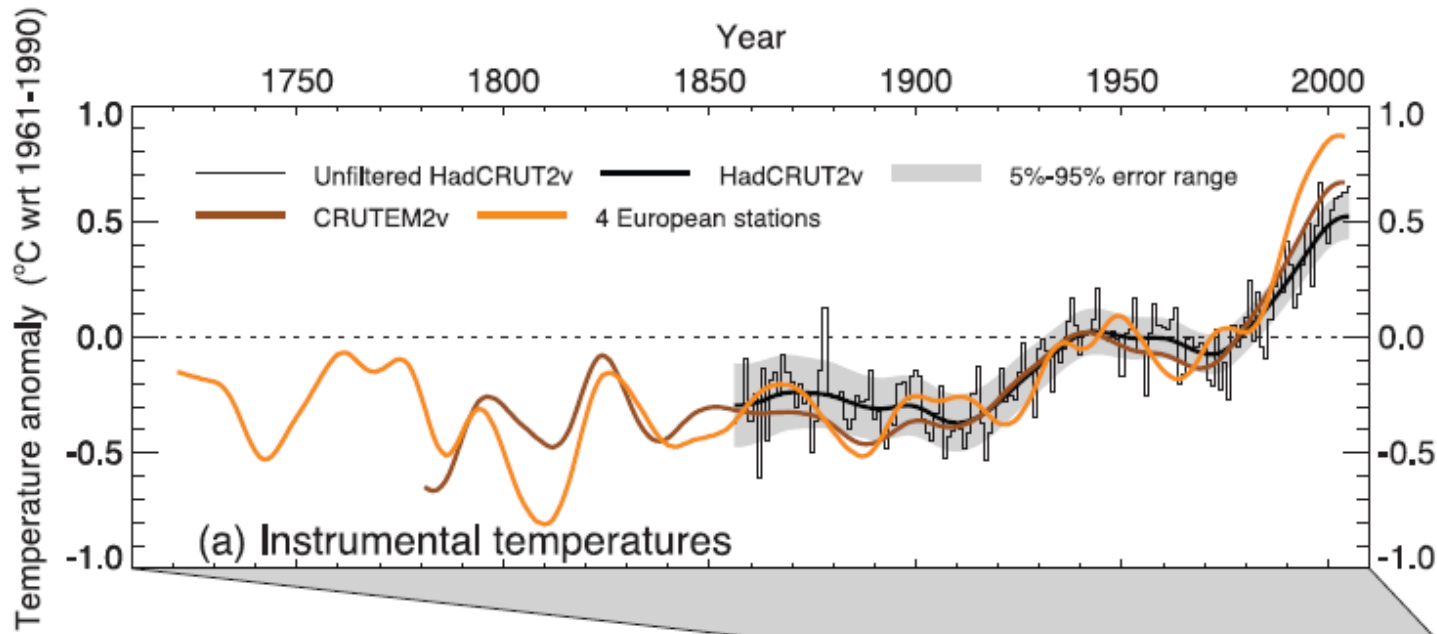
## Climate Variability

many regional climate changes can be described in terms of **preferred patterns of climate variability**

changes in the strength and phase of these patterns can lead to **larger-amplitude regional responses to forcing** than would otherwise be expected

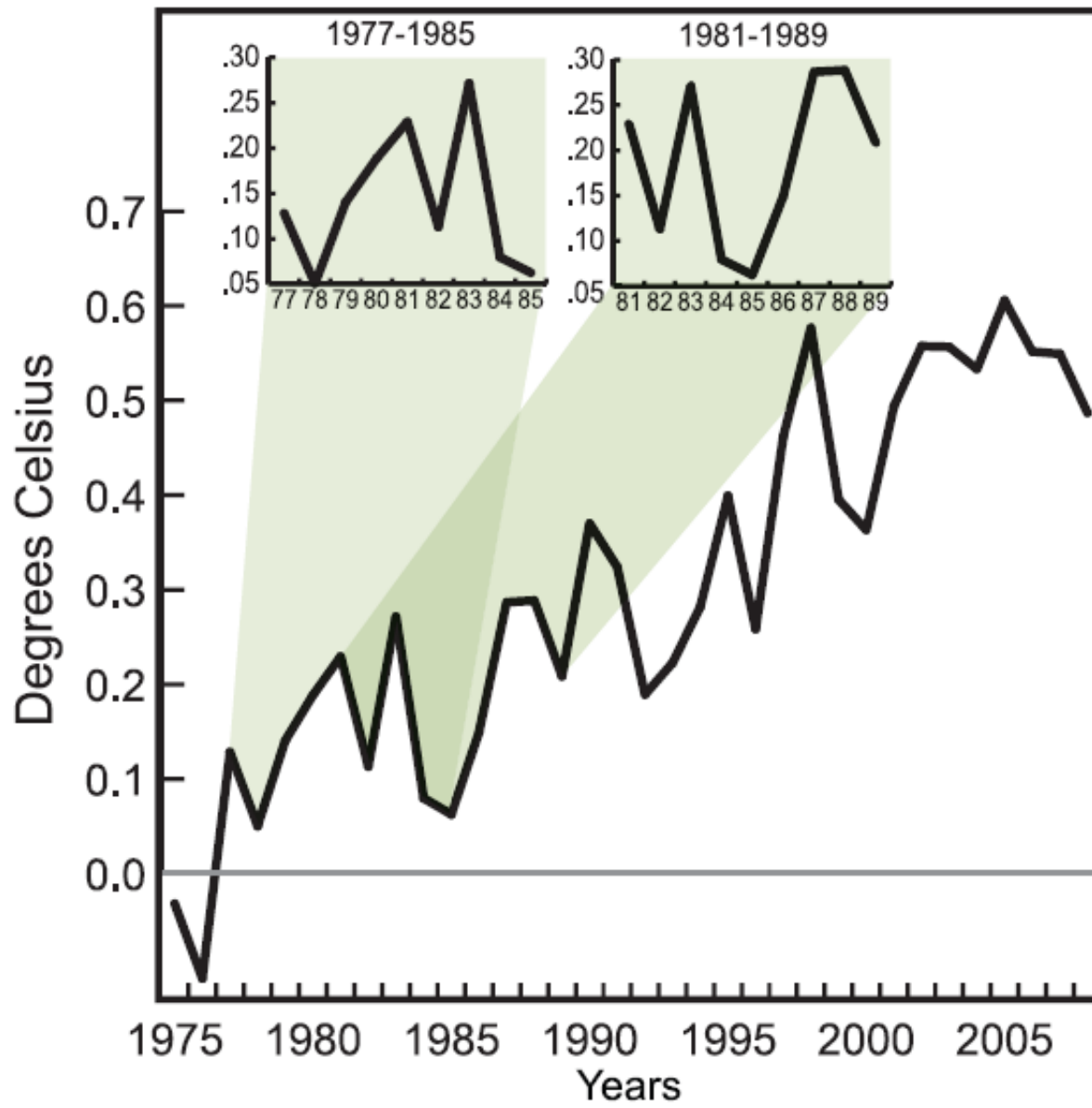
it is therefore important to consider the extent to which **observed changes are linked to internal variability or to anthropogenic climate change**





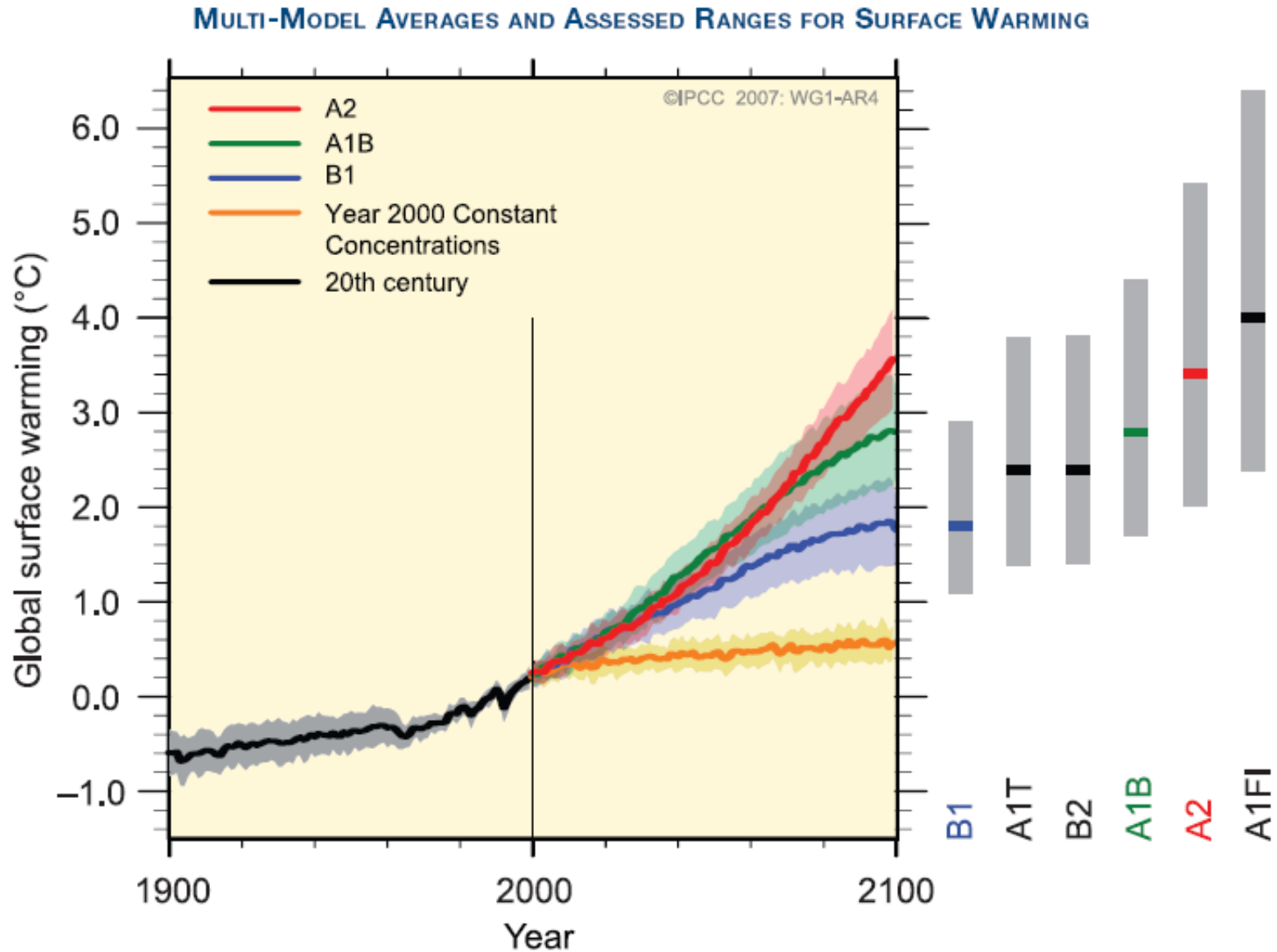


# Is the climate warming or cooling?

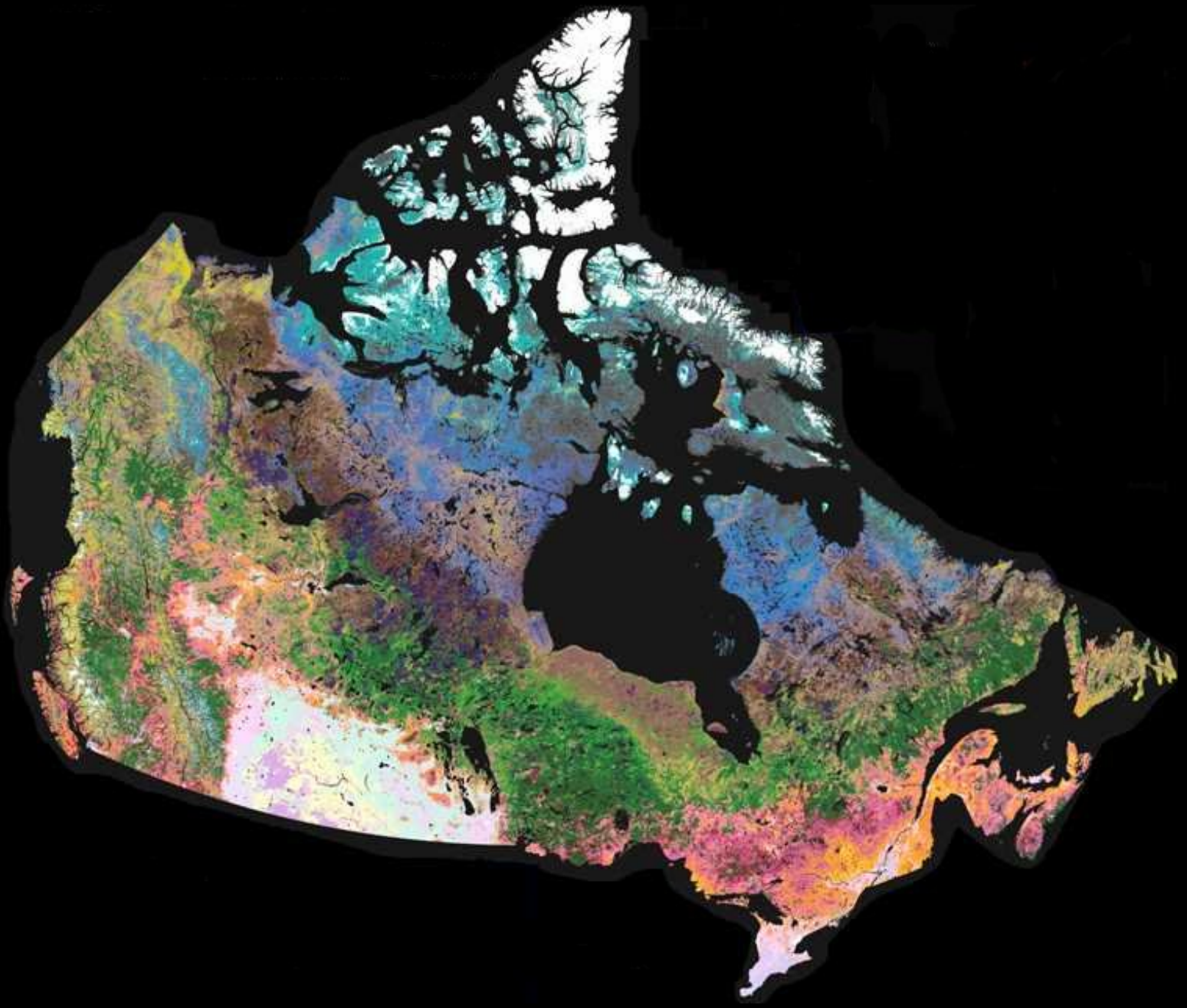


Easterling and Wehner, 2009

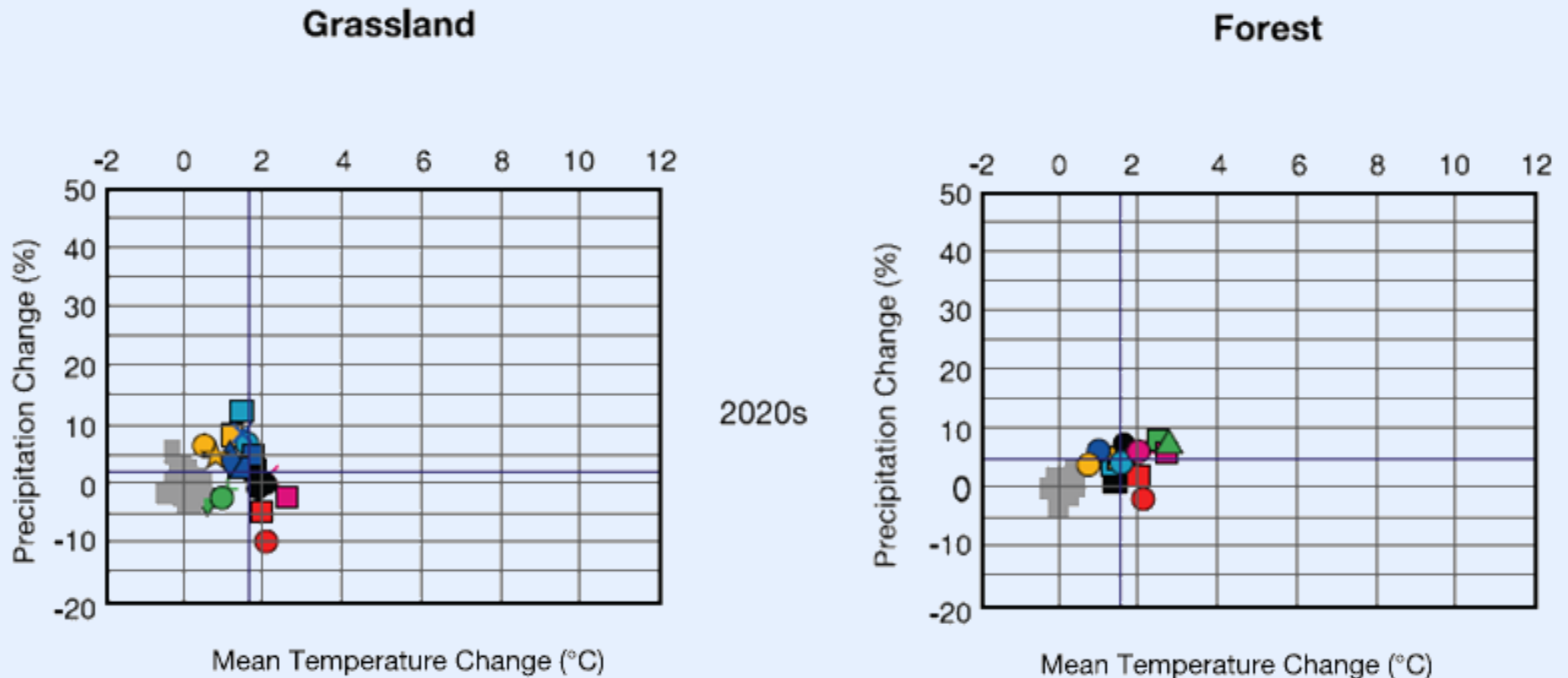
# Climate Projections (IPCC 2007)



Anthropogenic warming and sea level rise would continue for centuries, even if greenhouse gas concentrations were to be stabilized.



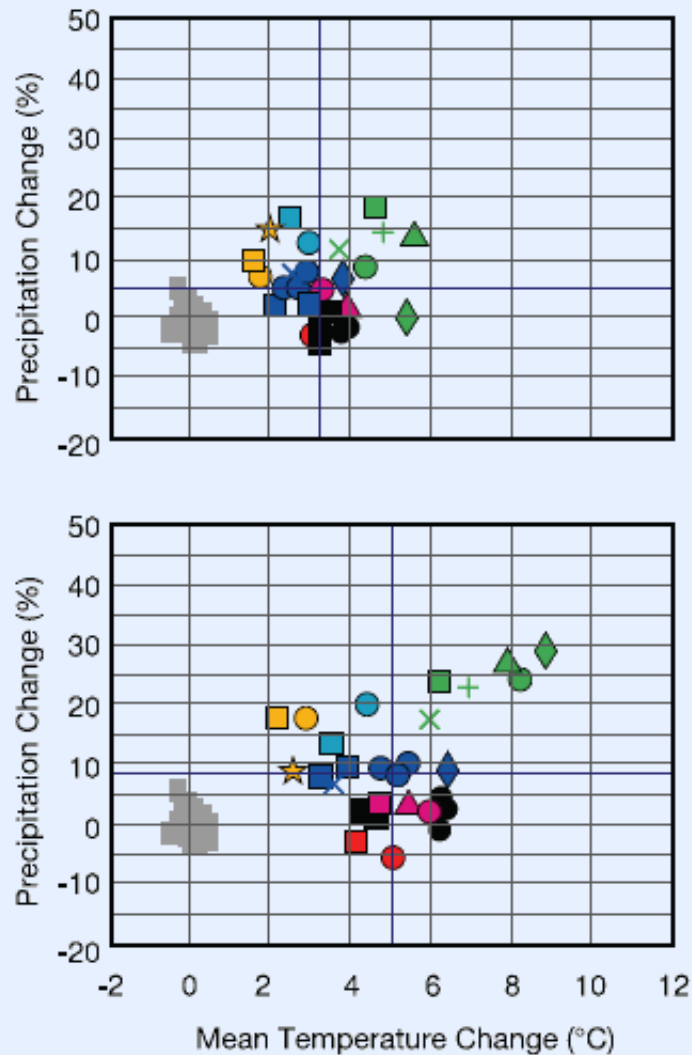
# Projected changes in mean annual temperature and precipitation



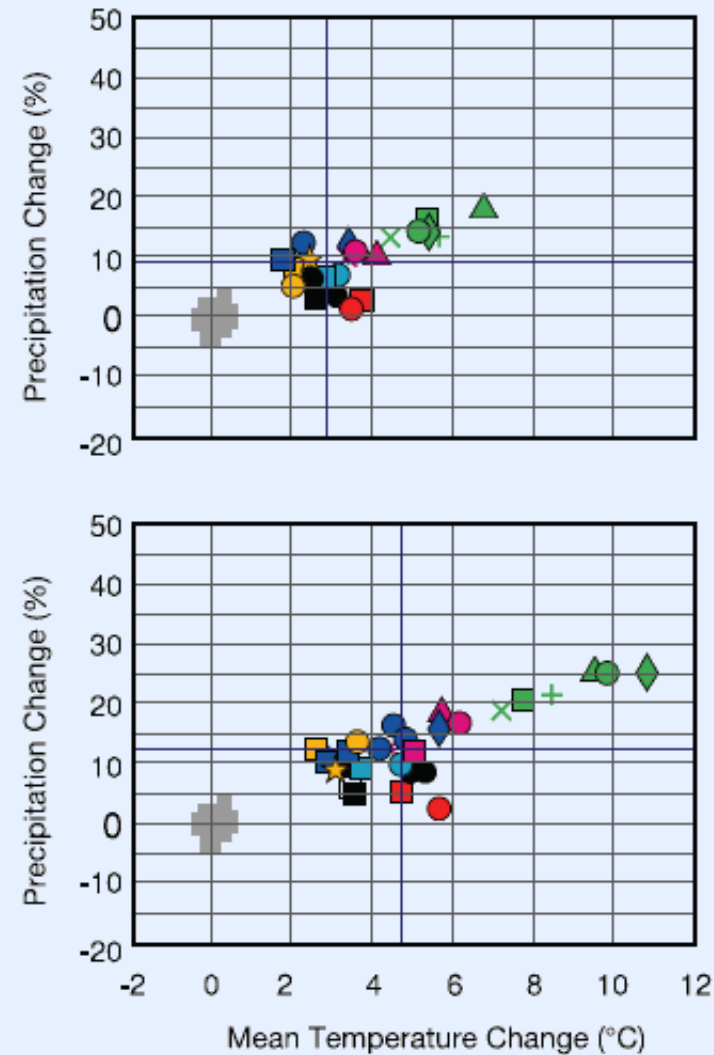
The grey squares indicate the ‘natural’ climate variability simulated by a long control run of the CGCM2.



# Projected changes in mean annual temperature and precipitation



2050s



2080s

The recent warming exceeds the global average



Future climates are outside the range of natural variability

Longer, warmer, frost-free growing season and warmer winters provide opportunities to diversify production including greater use of more winter crops



## **Global warming -- it's not all bad**

In fact, for people living in places like Edmonton, a warmer climate has plenty of benefits

**David Staples**, The Edmonton Journal

*Sunday, November 23, 2008*

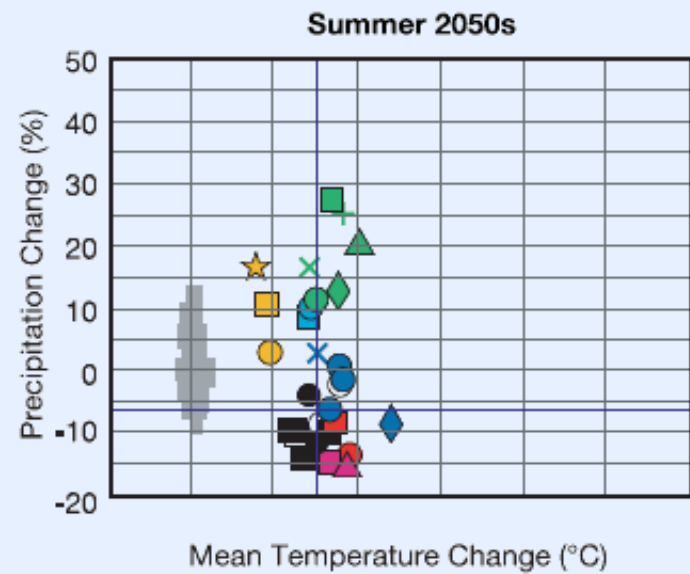
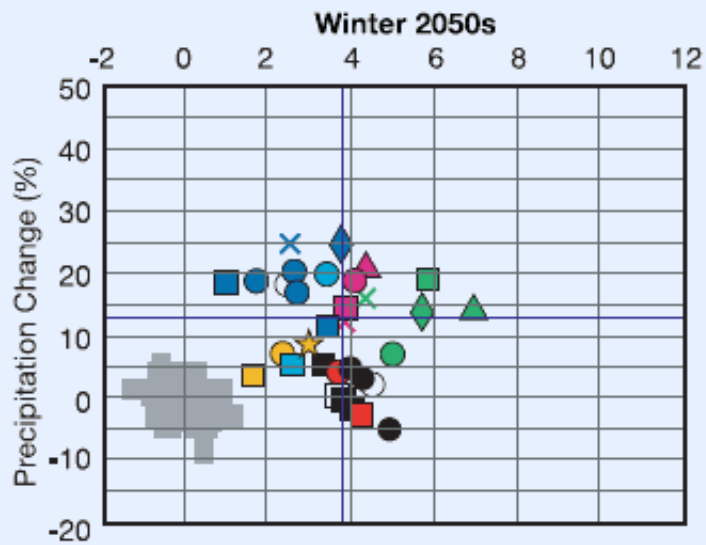
**Robert Mendelsohn**, an economics professor at Yale University, who says the benefits of global warming for Canada will be substantial and will outweigh the negative effects. "You're lucky because you're a northern latitude country, Mendelsohn says. **"If you add it all up, it's a good thing for Canada."**

There will be opportunities for Canadian farmers going forward, **Sauchyn says ...** "The most challenging impact of climate change is not going to be a shift in average conditions ..."

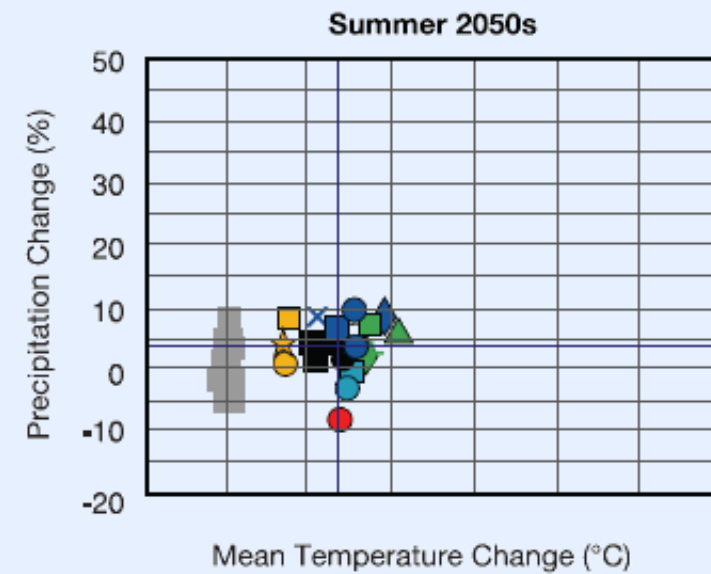
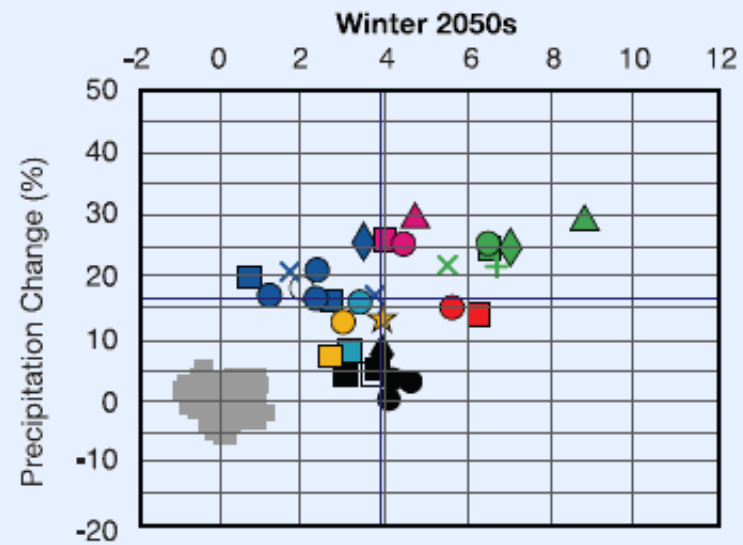


# Seasonal Scenarios

## Grassland

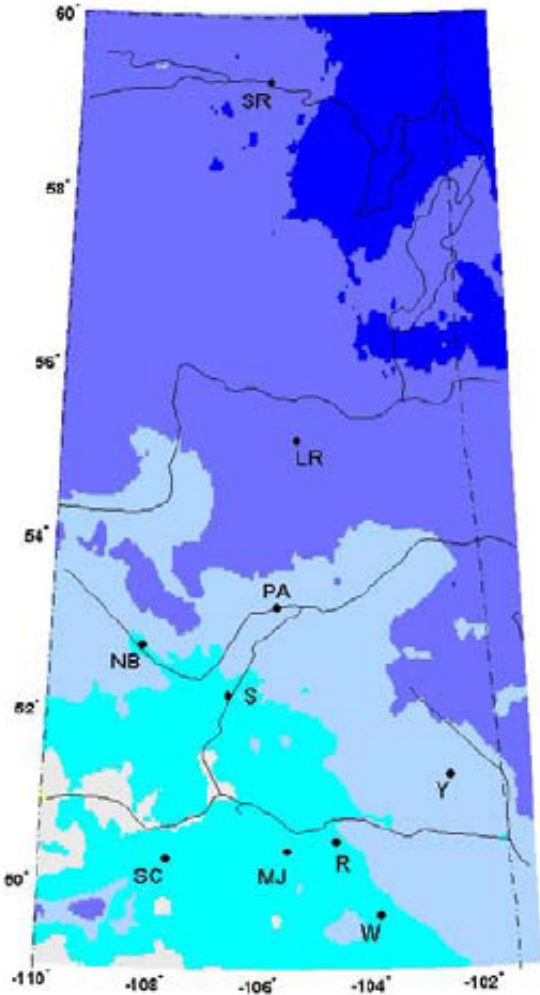


## Forest

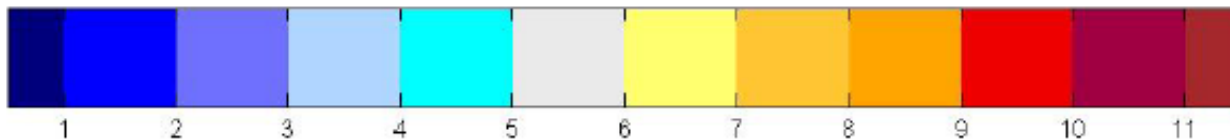
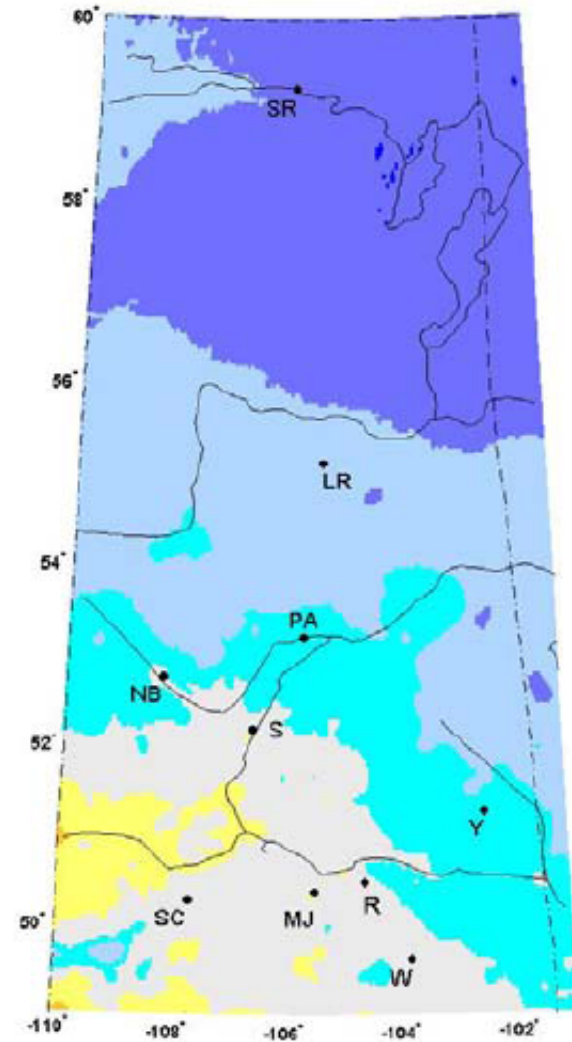


# Annual moisture index, 1961-90 to 2040-69

1961-1990



Median change: MIMR B1



degree days / mm

One of the most certain projections is that extra water will be available in winter and spring, while summers generally will be drier



On average, there will be slightly to significantly less surface and soil water

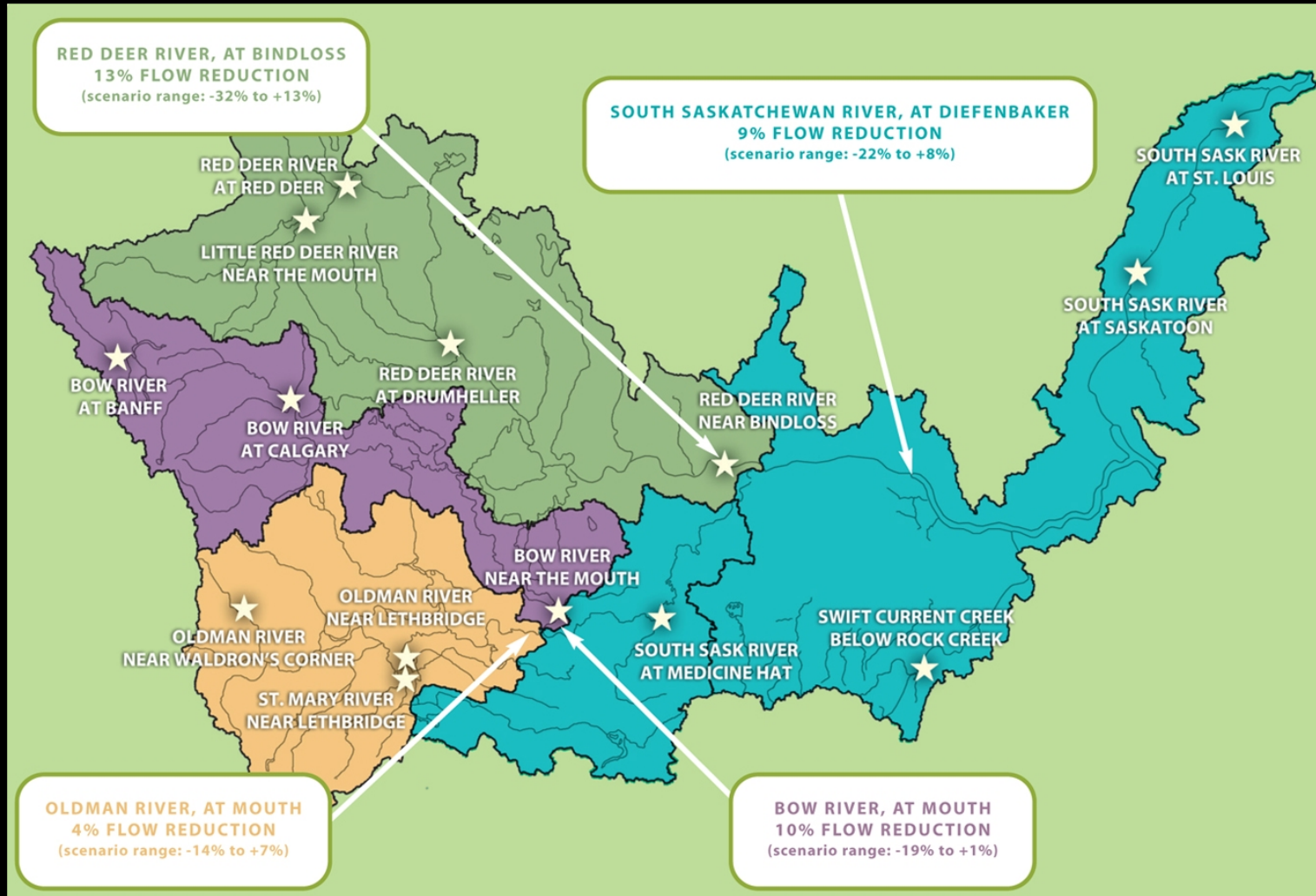


We are losing the advantage of a cold winter





# Future River Flow



Average flow reductions range from 4 to 13% based on six GCM scenarios (2039-70), Martz et al, 2007; Map by: D. Perrick and D. Campbell

There will be greater variation in hydroclimate



Both drought and unusually wet years could occur with greater frequency and severity





Extreme weather and climate are “wild cards” because the effects of increasing frequency and severity are generally not considered well or at all in climate change impact assessments.

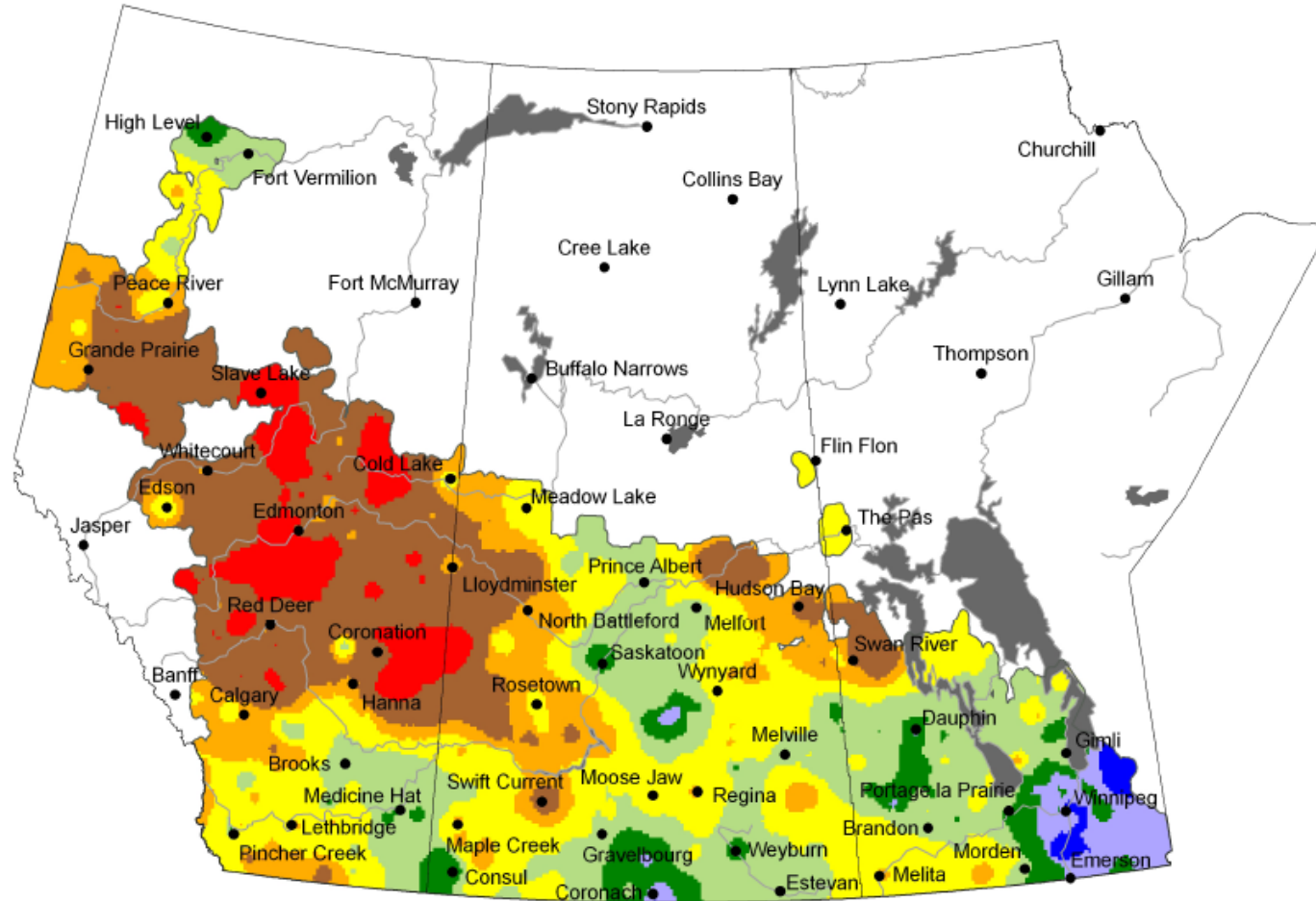






Precipitation Compared to Historical Distribution (Prairie Region)

September 1, 2008 to August 31, 2009



- Record Dry
- Extremely Low (0-10)
- Very Low (10-20)
- Low (20-40)
- Mid-Range (40-60)
- High (60-80)
- Very High (80-90)
- Extremely High (90-100)
- Record Wet
- Extent of Agricultural Land
- Lakes and Rivers

Produced using near real-time data that has undergone initial quality control. The map may not be accurate for all regions due to data availability and data errors.



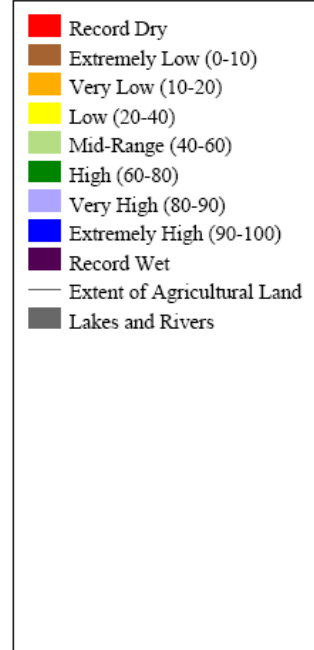
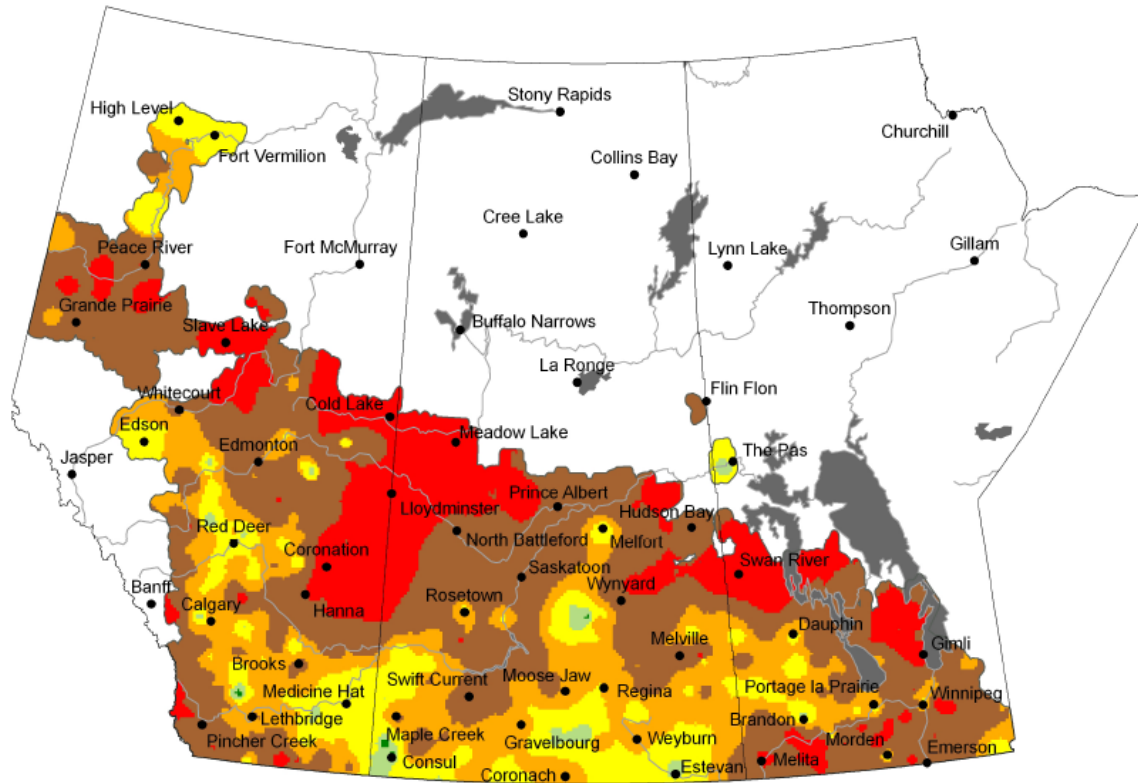
Agriculture and Agri-Food Canada

Agriculture et Agroalimentaire Canada

# Canada

## Precipitation Compared to Historical Distribution (Prairie Region)

November 1, 2009 to February 16, 2010



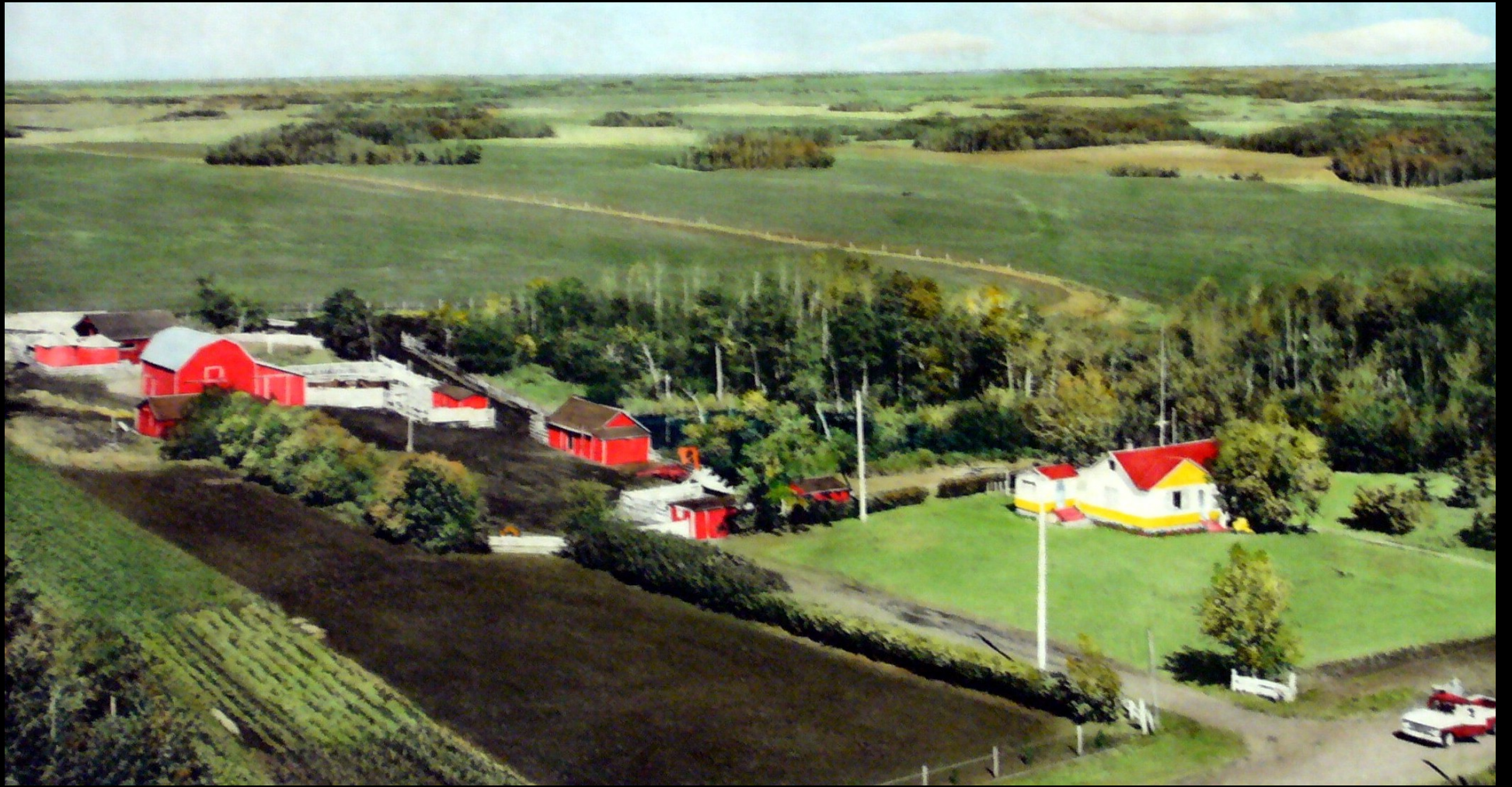
Produced using near real-time data that has undergone initial quality control. The map may not be accurate for all regions due to data availability and data errors.

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Prepared by Agriculture and Agri-Food Canada's National Agroclimate Information Service (NAIS). Data provided through partnership with Environment Canada, Natural Resources Canada, and many Provincial agencies.

Created: 02/17/10  
[www.agr.gc.ca/drought](http://www.agr.gc.ca/drought)







# Aspen Parkland, east-central Alberta

mid 1970s



mid 2000s

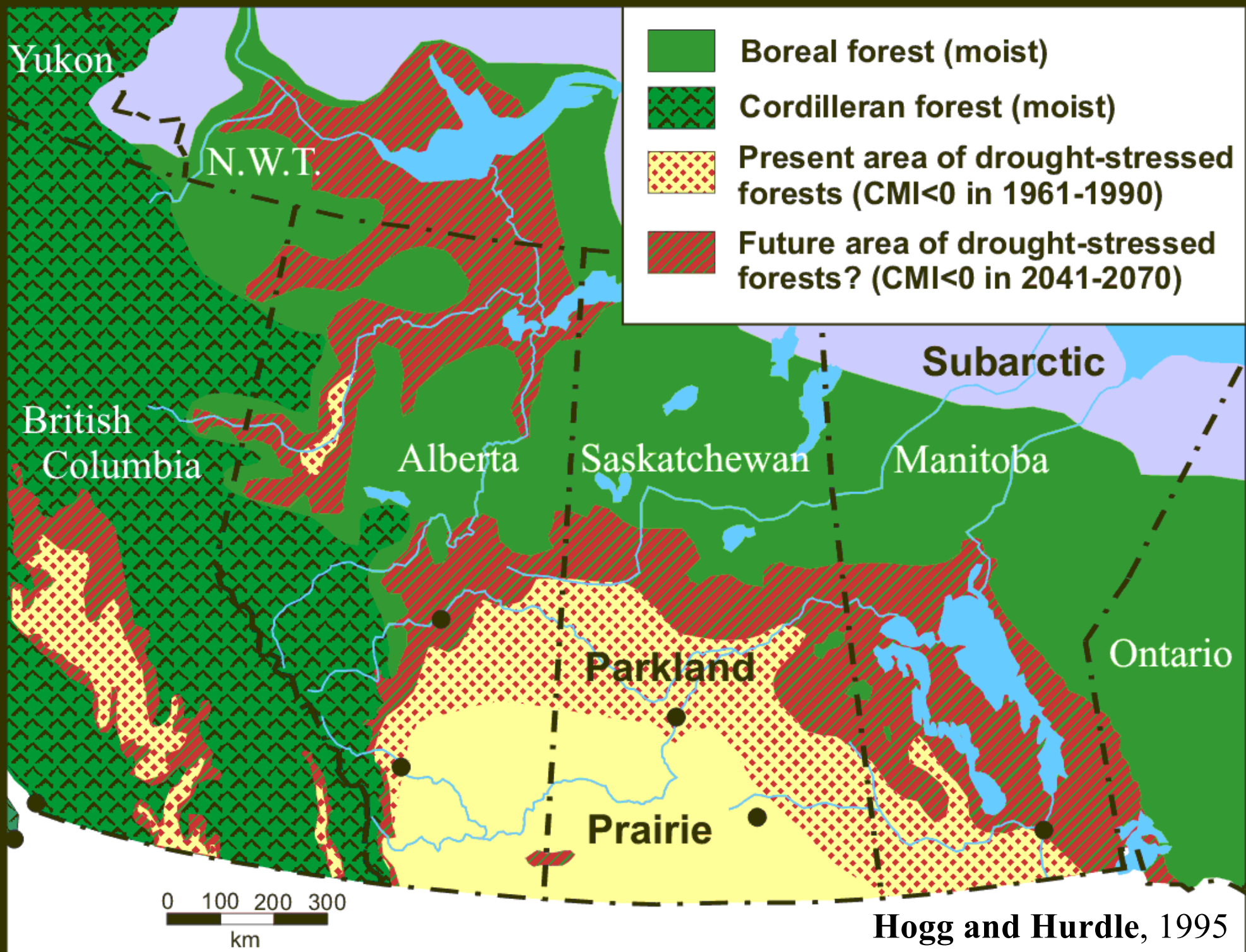




Major ecological changes are expected.







Estimates of climate change impacts on crop production are converging on increasing trends in the near-term until certain thresholds of climate change are reached. This the trend is decreases in yield interrupted by large losses from severe climatic events.





Although warming winters are generally favorable for livestock production and management, this will be offset increasing stresses related to heat, water deficits, insects and diseases.

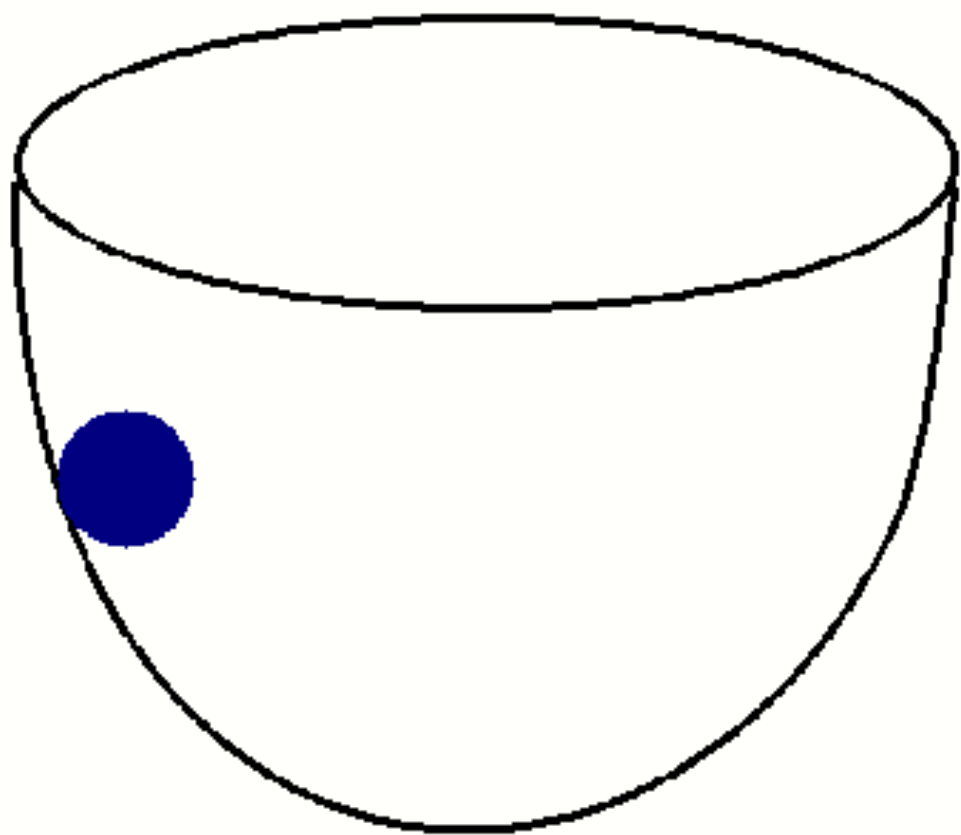


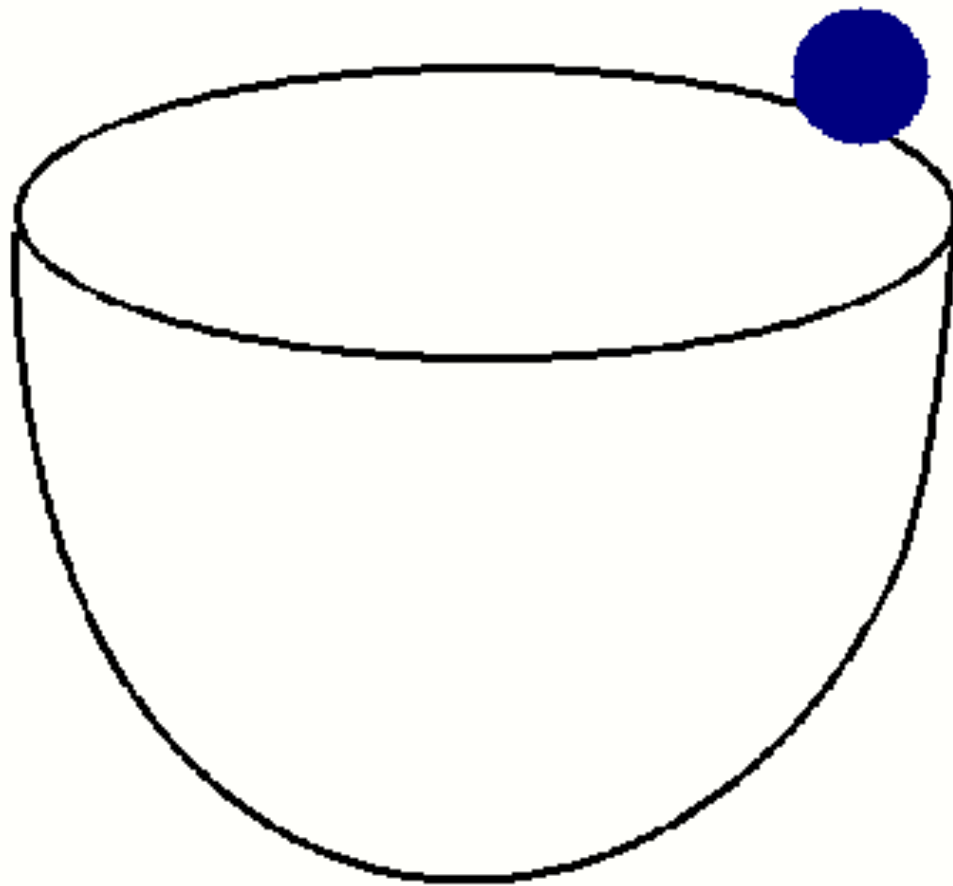


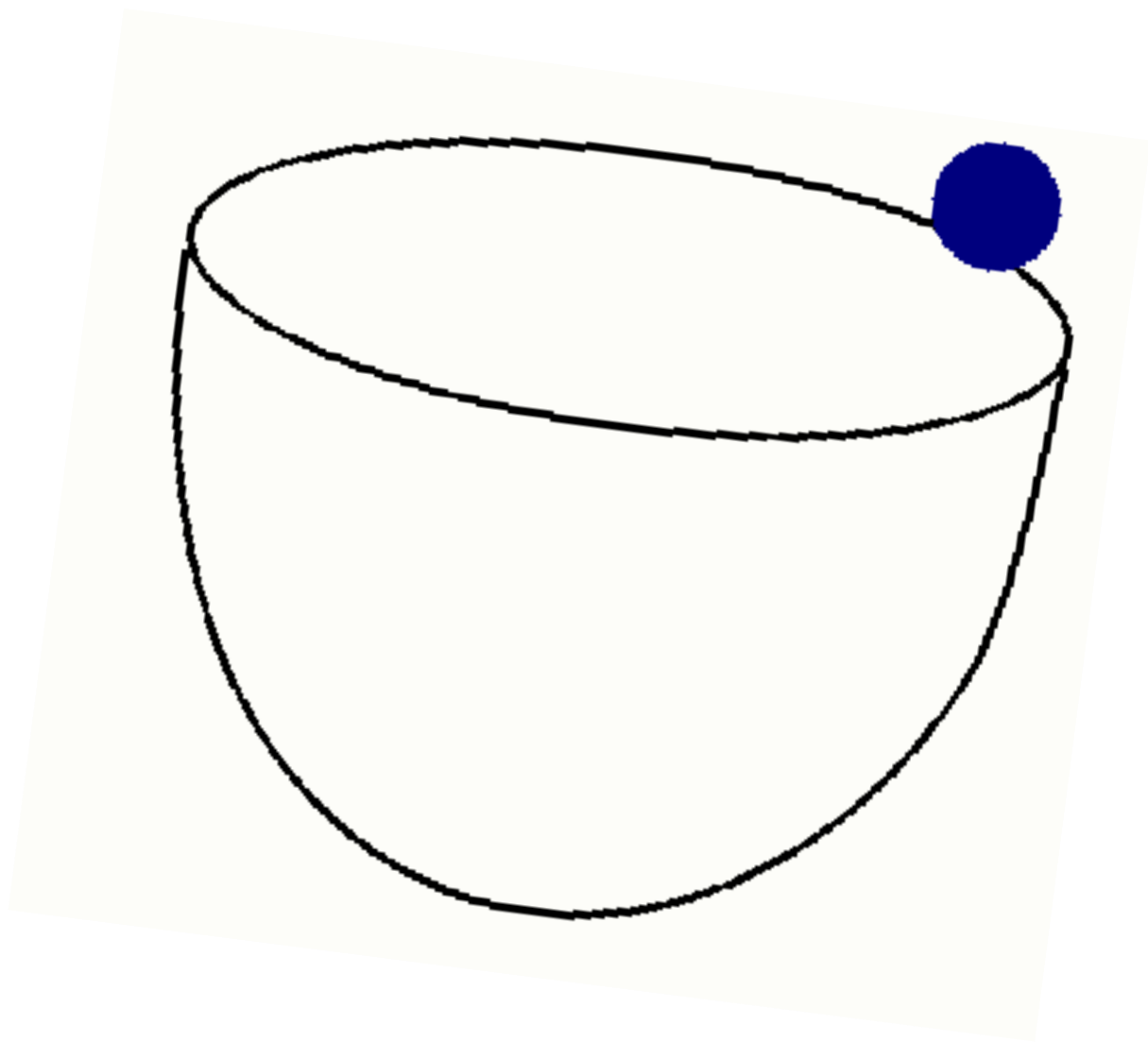
The net impacts of climate change are not clear; they depend on rates of climate change and adaptation strategies.



The impacts of climate change will depend on how well we adapt and how much adaptation is required.









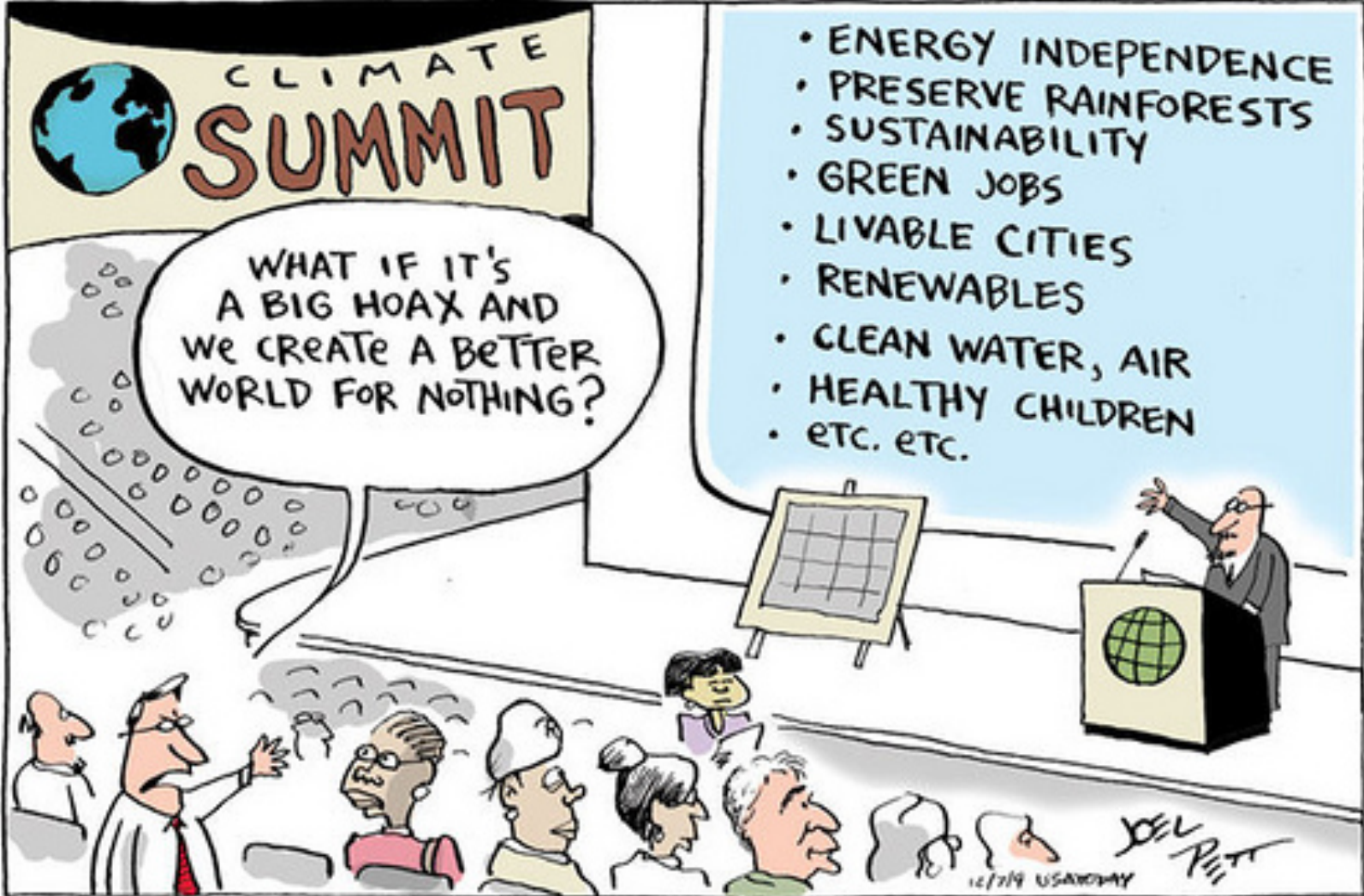
## Source Water Protection

There are steps we can take to ensure our activities do not have negative impacts on our water sources. Then we are not only protecting water for ourselves and each other but for future generations.

- Water Conservation
- Environmental Farm Plan
- Canada-Saskatchewan Farm Stewardship Program.
- Healthy riparian areas
- Lakes and forests



[http://www.nsrbc.ca/source\\_water\\_protection.html](http://www.nsrbc.ca/source_water_protection.html)



CLIMATE  
SUMMIT

WHAT IF IT'S  
A BIG HOAX AND  
WE CREATE A BETTER  
WORLD FOR NOTHING?

- ENERGY INDEPENDENCE
- PRESERVE RAINFORESTS
- SUSTAINABILITY
- GREEN JOBS
- LIVABLE CITIES
- RENEWABLES
- CLEAN WATER, AIR
- HEALTHY CHILDREN
- ETC. ETC.

12/19 USA TODAY

JOE PITT