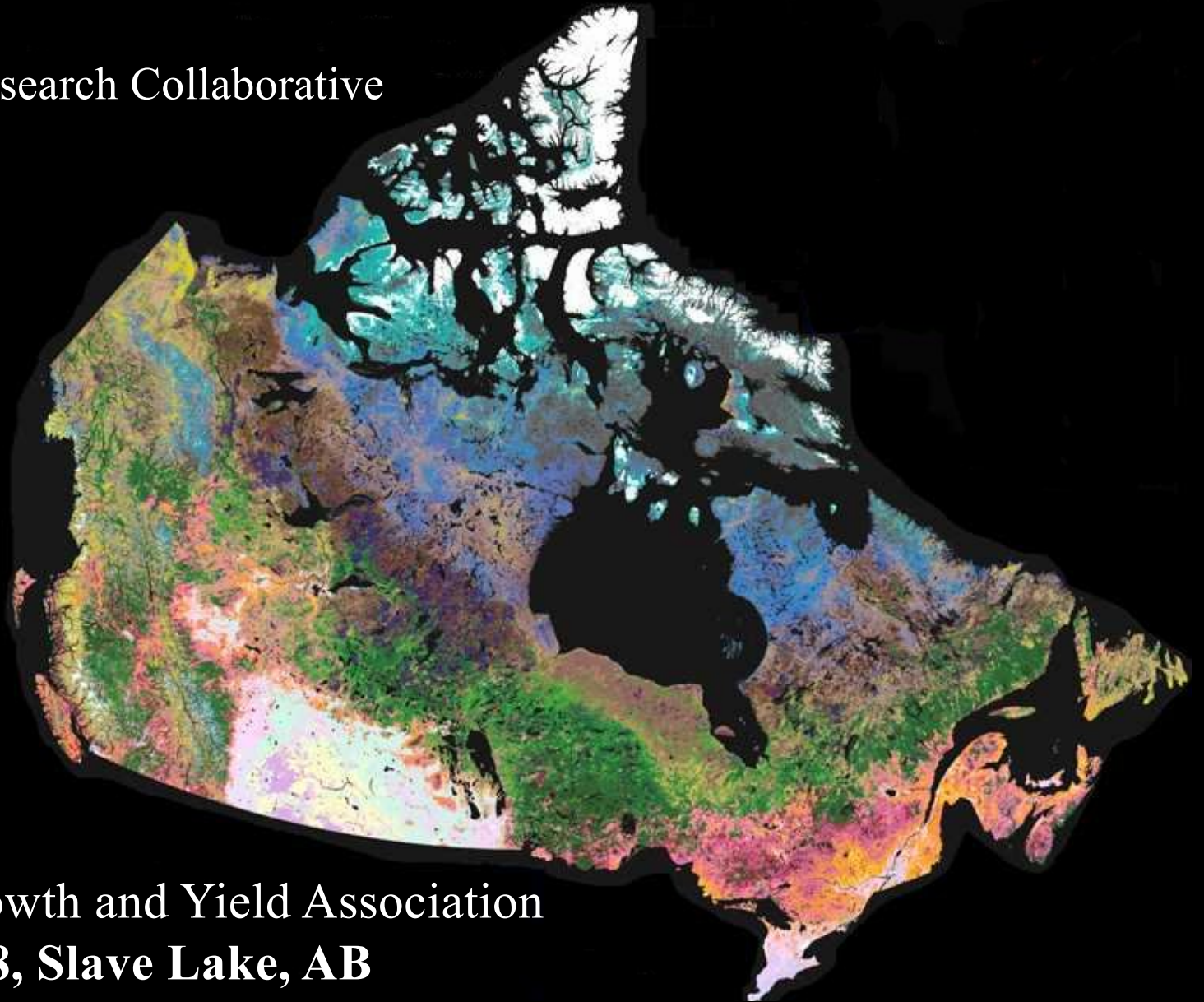


# From Impacts to Adaptation: The Prairies Chapter of the National Assessment of Climate Change

Dave Sauchyn

Prairie Adaptation Research Collaborative

University of Regina



Western Boreal Growth and Yield Association  
September 9, 2008, Slave Lake, AB



**The Prairie Adaptation Research Collaborative** is a partnership of the governments of Canada, Alberta, Saskatchewan and Manitoba mandated to pursue climate change impacts and adaptation research in the Prairie Provinces.





FROM **IMPACTS**  
to **ADAPTATION**  
Canada in a Changing Climate 2007

LES **VIVRE AVEC**  
**CHANGEMENTS**  
climatiques au Canada : édition 2007



# CHAPTER 7

## Prairies



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<sup>1</sup> Prairie Adaptation Research Collaborative, University of Regina, Regina, SK

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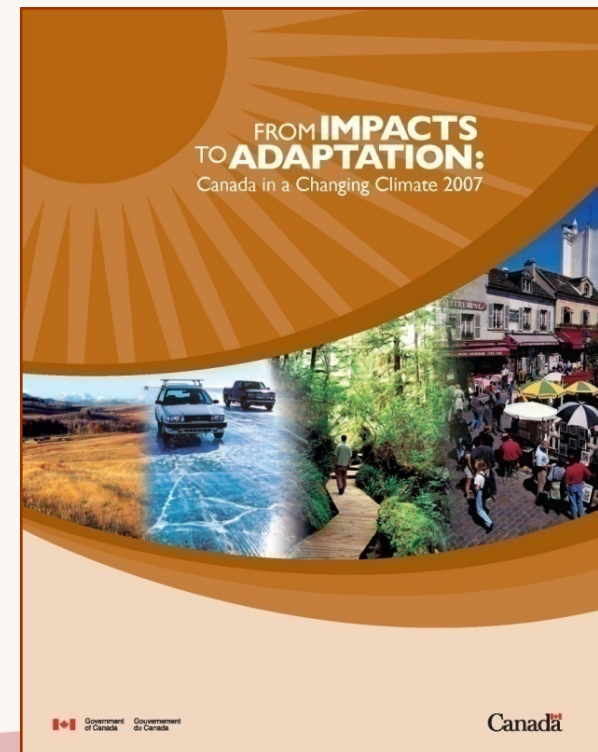
### Contributing authors:

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First national-scale assessment of climate change impacts and adaptation in Canada since the Canada Country Study (1997)

## GOALS

- Highlight advances made in understanding Canada's vulnerability to climate change in past decade
- Provide a knowledge foundation that informs adaptation decision-making and policy development in a non-prescriptive manner



## A robust, scientific process with many partners:

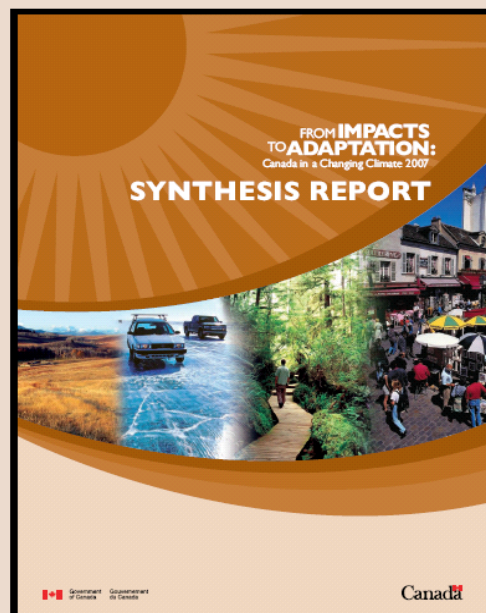
- The process was overseen by an advisory committee with representation from governments, academia, Aboriginal groups and the private sector.
- 145 authors from governments, universities and NGOs from across Canada participated, and over 3100 references were cited.
- Chapters were reviewed by 110 scientific experts and government (Federal, Provincial/Territorial) officials.



# FROM IMPACTS to ADAPTATION

Canada in a Changing Climate 2007

## Synthesis Report and Highlights



# MORE INFORMATION

FROM IMPACTS  
to ADAPTATION  
Canada in a Changing Climate 2007

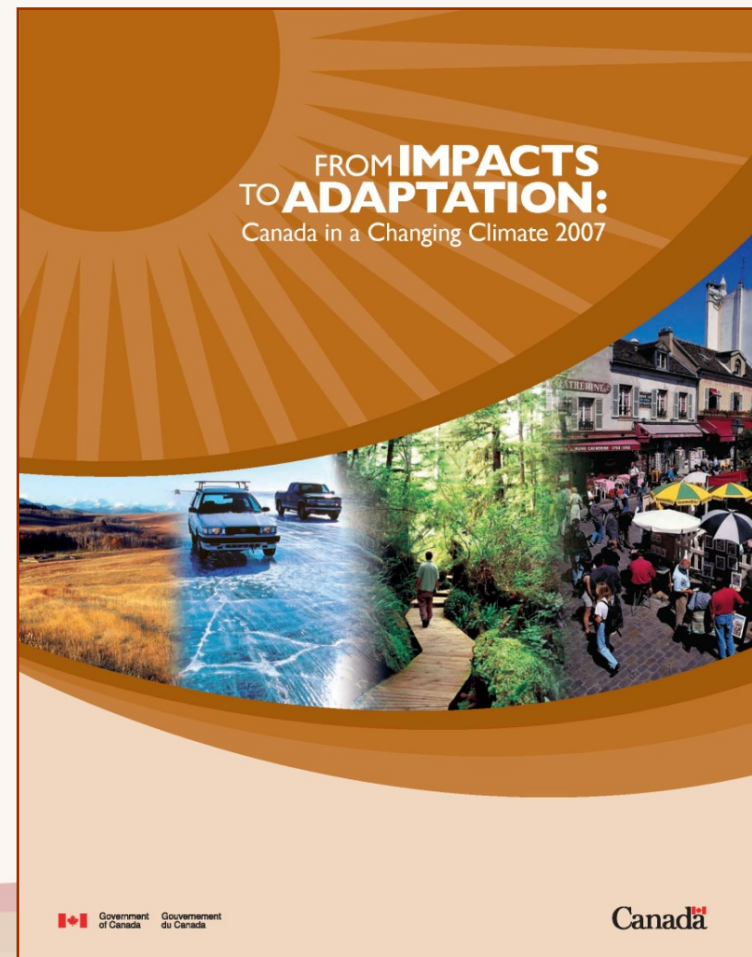
VIVRE AVEC  
LES CHANGEMENTS  
climatiques au Canada : édition 2007

Available on-line on March 7:

**<http://adaptation2007.nrcan.gc.ca>**

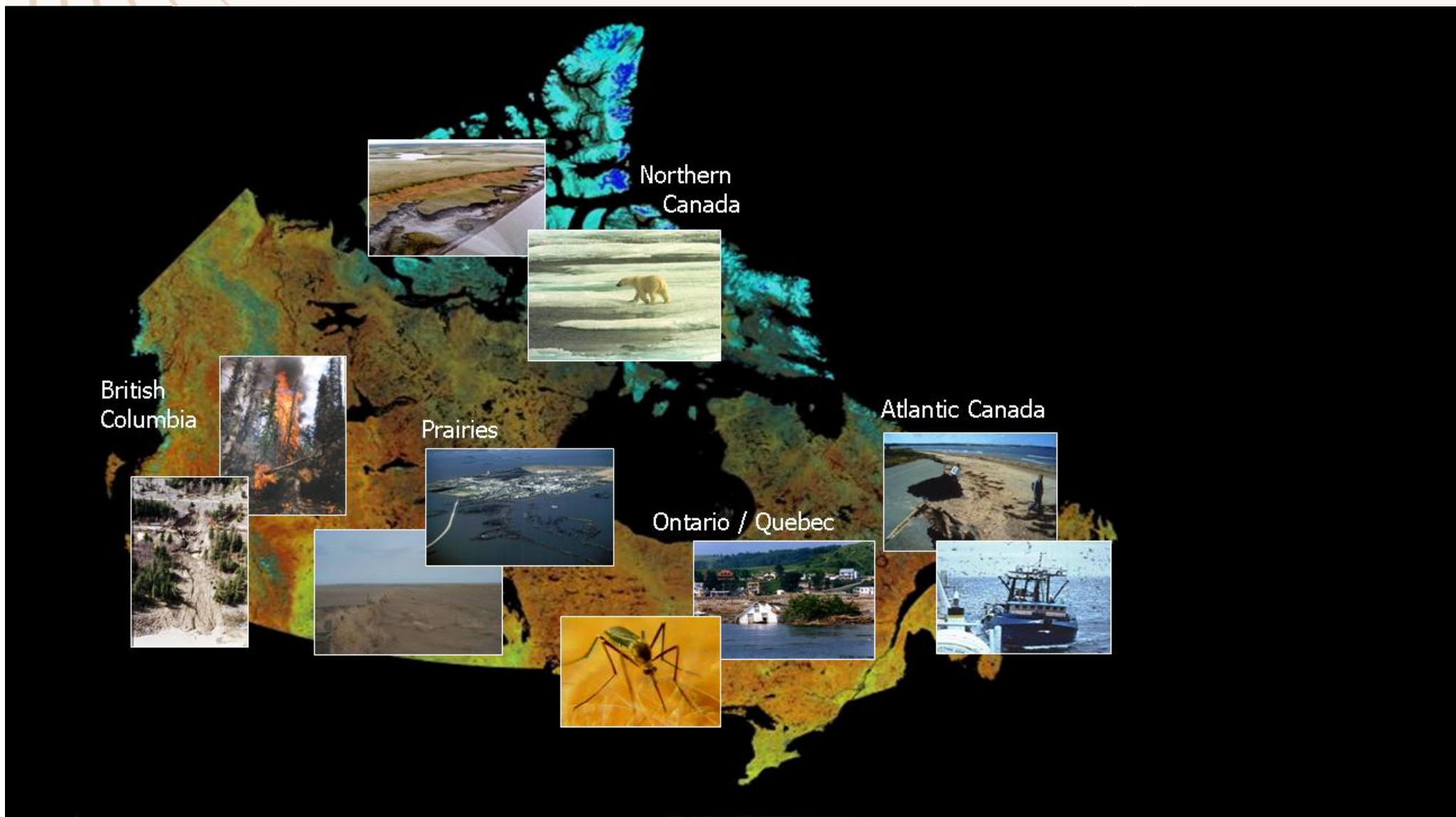
- Download pdfs
- Author biography
- Order CDs

Questions? Contact us at:  
**[adaptation@nrcan.gc.ca](mailto:adaptation@nrcan.gc.ca)**





## Impacts of greatest concern vary between regions



# Chapter 7 Prairies

## 1 INTRODUCTION

- 1.1 Description of the Prairies Region
- 1.2 Environment and Economy by Ecozone

## 2 REGIONAL CLIMATE AND SOCIOECONOMIC CHARACTERISTICS

- 2.1 Demographics
- 2.2 Economic Activities and Employment
- 2.3 Economic and Social Trends and Projections
- 2.4 Past Climate
- 2.5 Scenarios of Future Climate

## 3 SENSITIVITIES AND KEY VULNERABILITIES: NATURAL CAPITAL

- 3.1 Water Resources
- 3.2 Ecosystems
- 3.3 Soil Landscapes

## 4 RISKS AND OPPORTUNITIES: SOCIOECONOMIC SECTORS

- 4.1 Agriculture
- 4.2 Forestry
- 4.3 Transportation
- 4.4 Communities
- 4.5 Health
- 4.6 Energy
- 4.7 Tourism and Recreation

## 5 ADAPTATION AND ADAPTIVE CAPACITY

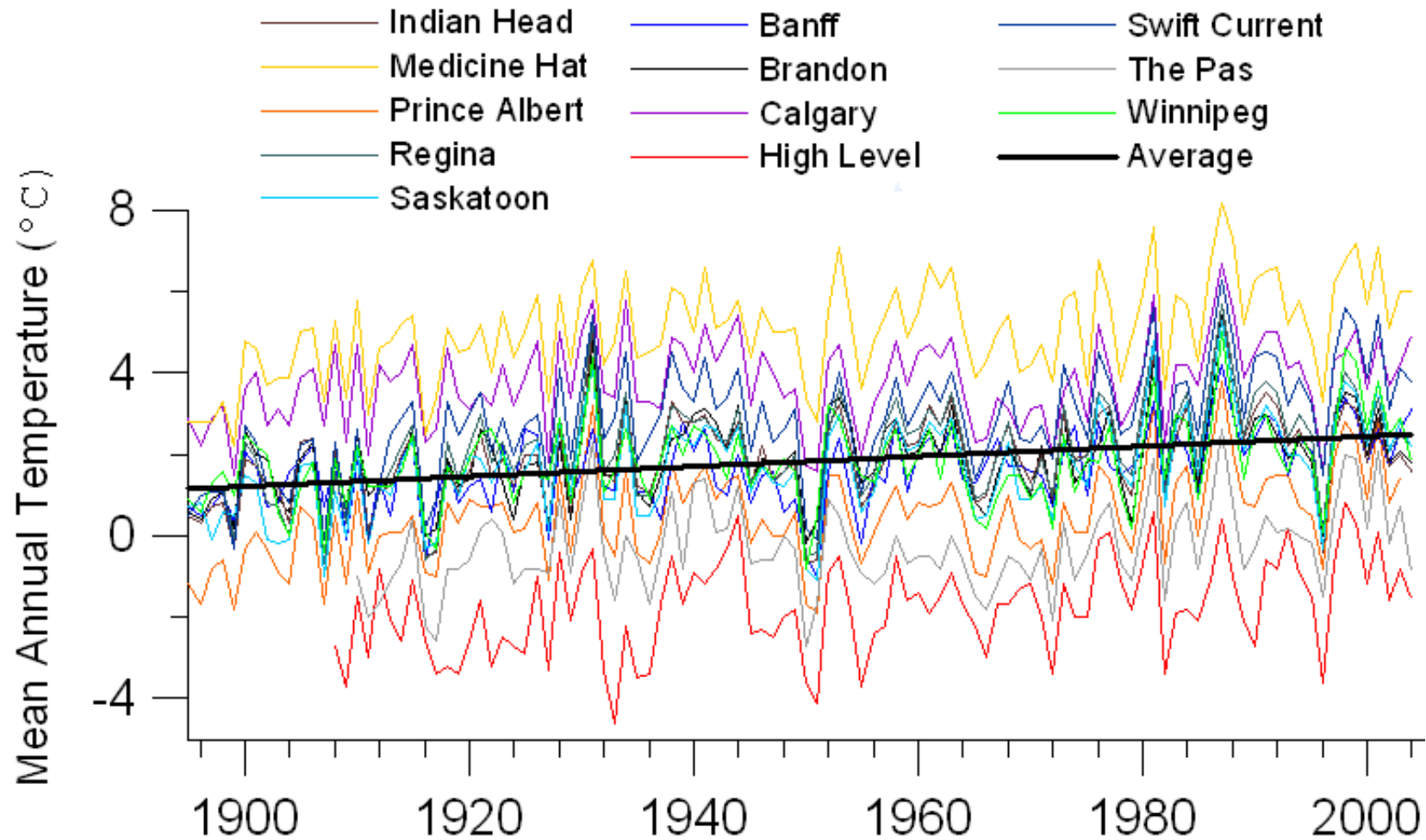
- 5.1 Formal Institutions and Governance
  - 5.1.1 Water Resource Management
  - 5.1.2 Ecosystem Management
  - 5.1.3 Agriculture
  - 5.1.4 Forestry
  - 5.1.5 Health and Well-Being
- 5.2 Local Adaptation, Informal Institutions and Social Capital

## 6 SYNTHESIS

The recent warming exceeds the global average.  
Future climates are outside the range of natural variability.

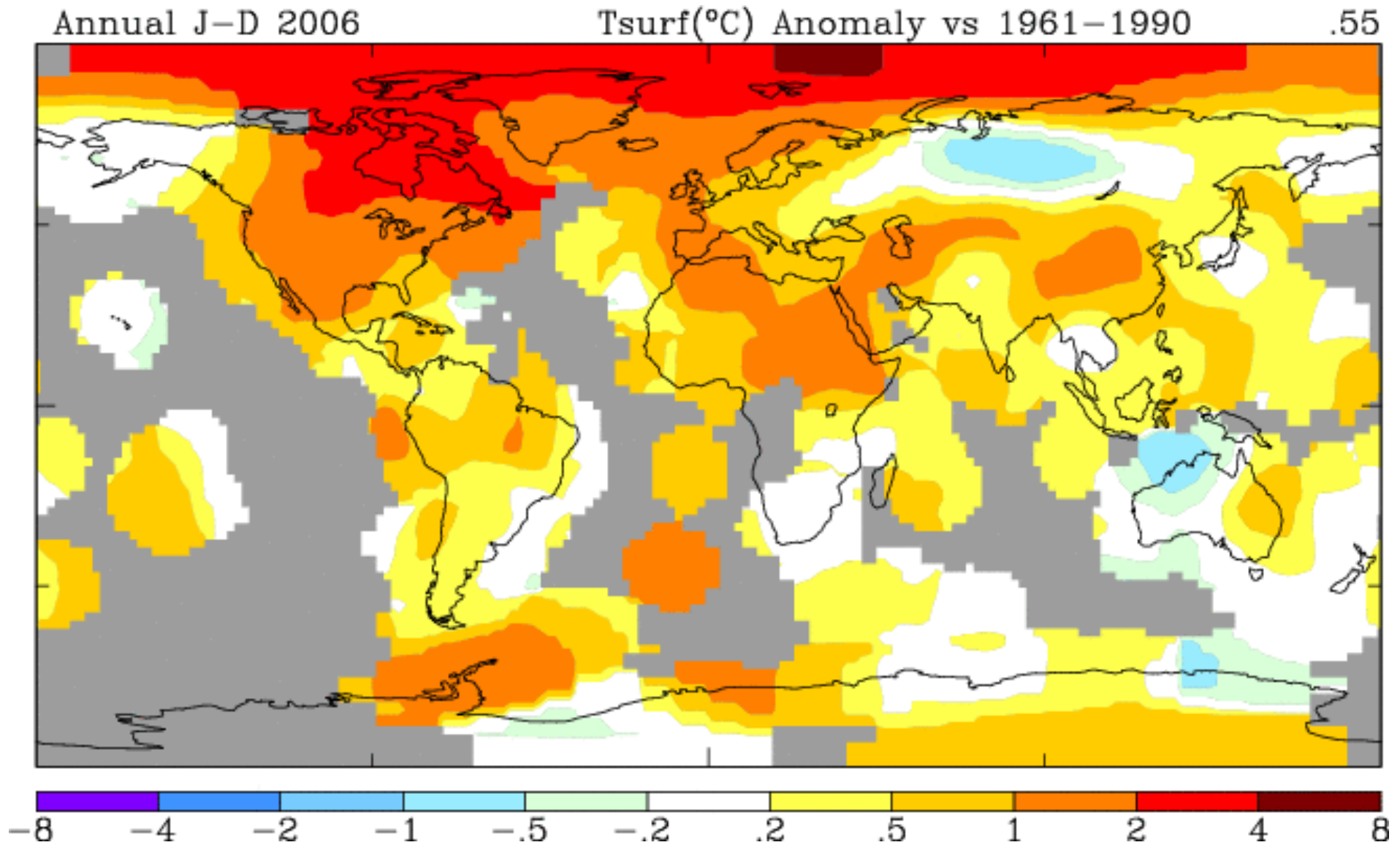


Paleoclimate records include longer droughts before the Prairies were settled



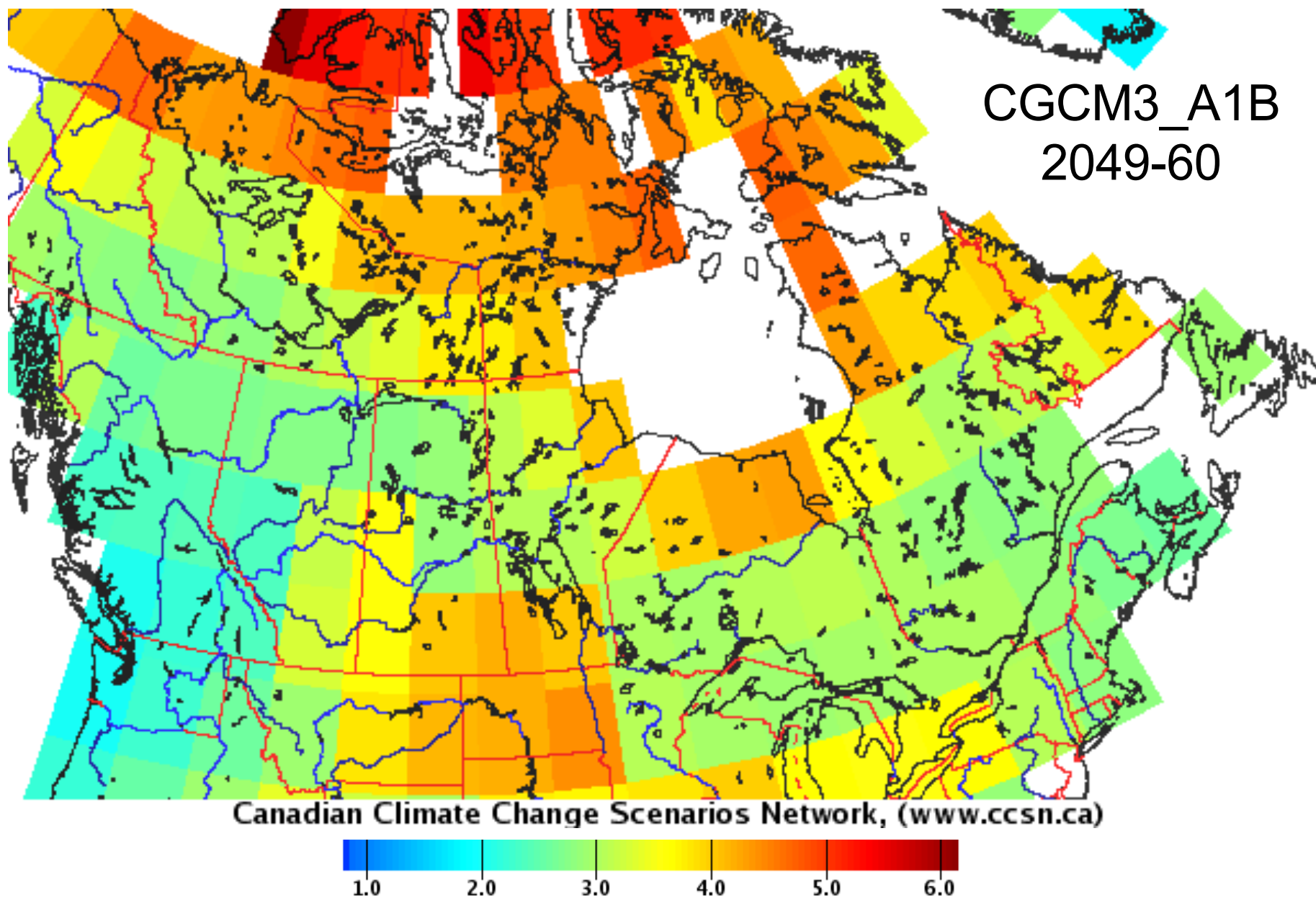
Trends in mean annual temperature since 1895 for 12 climate stations spread across the Prairies. The average increase in mean annual temperature for the 12 stations is  $1.6^{\circ}\text{C}$ .

# 2006 Temperatures: Departures from Normal (1961-90)

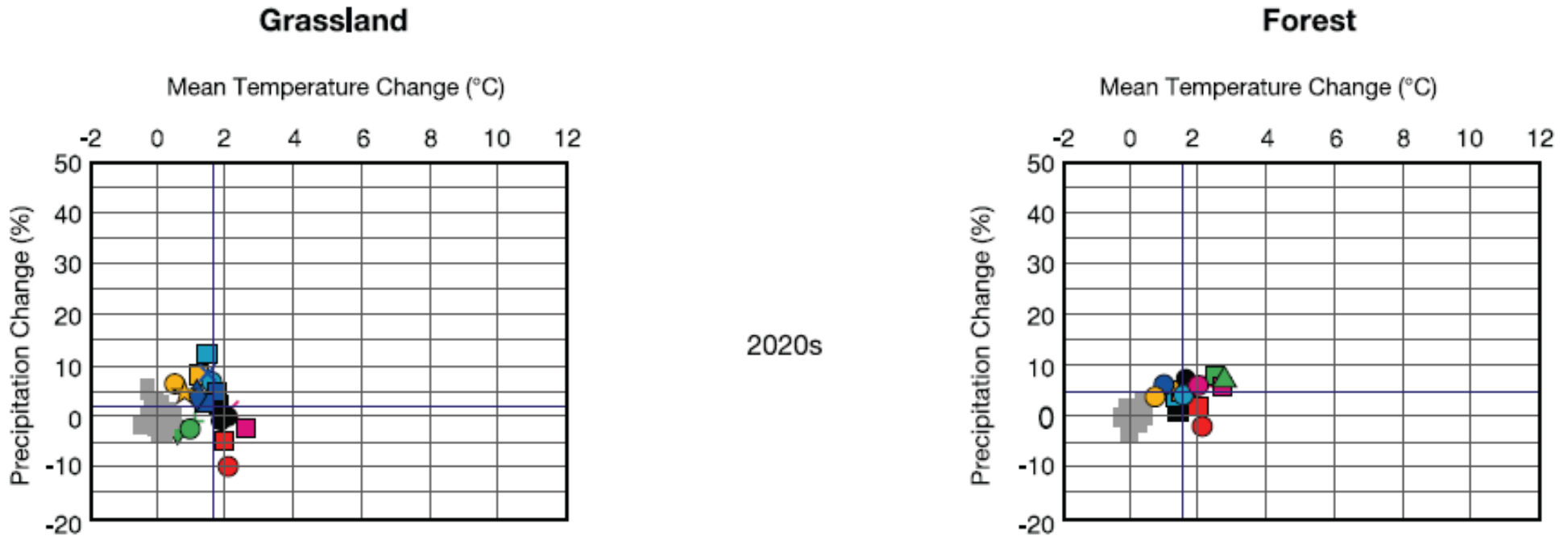


<http://data.giss.nasa.gov/gistemp/>

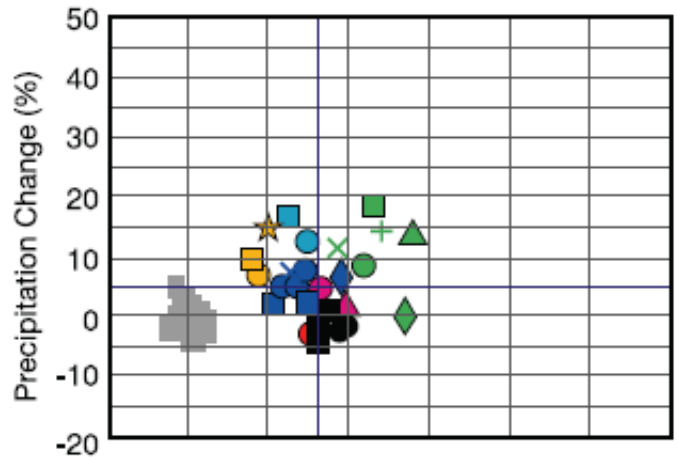
# Mean Annual Temperature ( $^{\circ}$ C) 2049-60 versus 1961-90



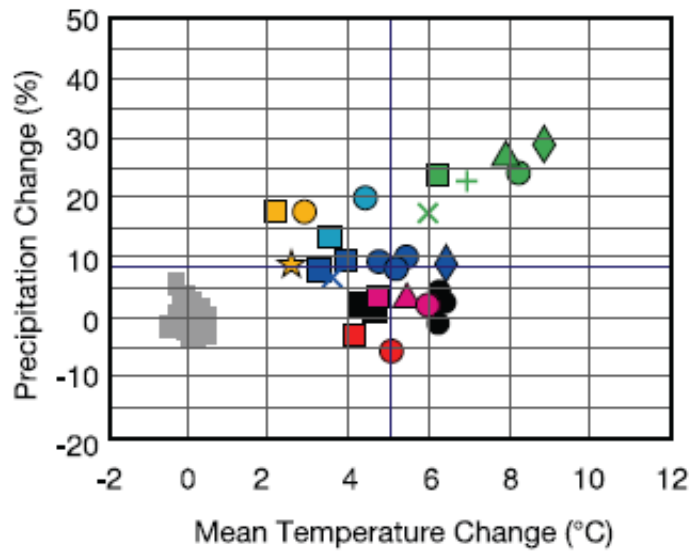
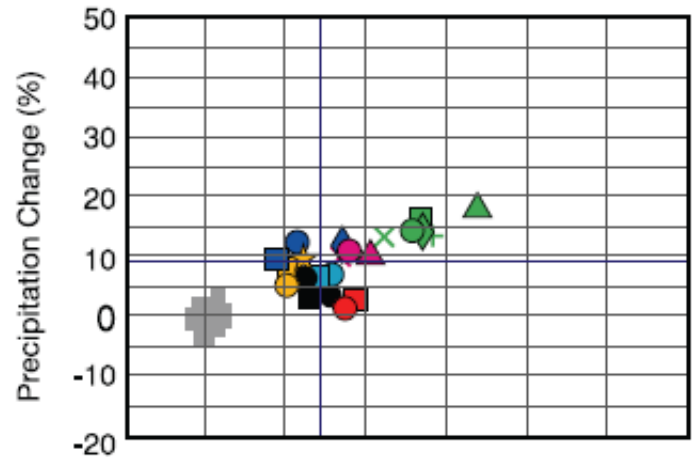
Projected changes in mean seasonal temperature and precipitation for the grassland forest regions. The grey squares indicate the 'natural' climate variability simulated by a long control run of the CGCM2.



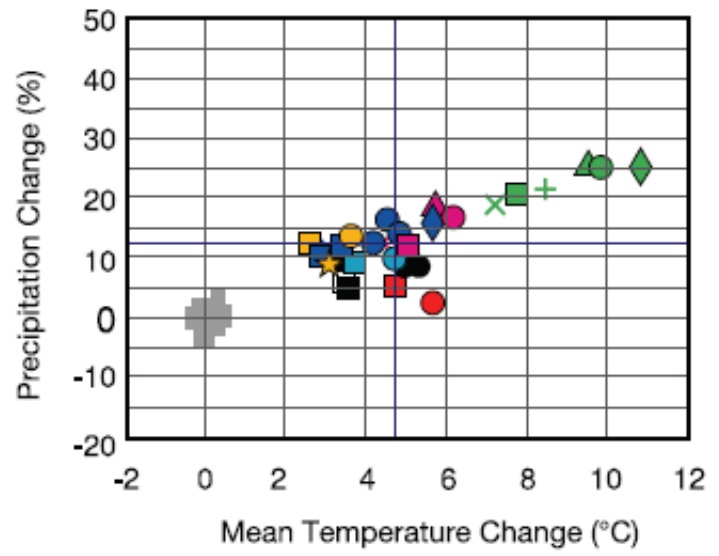




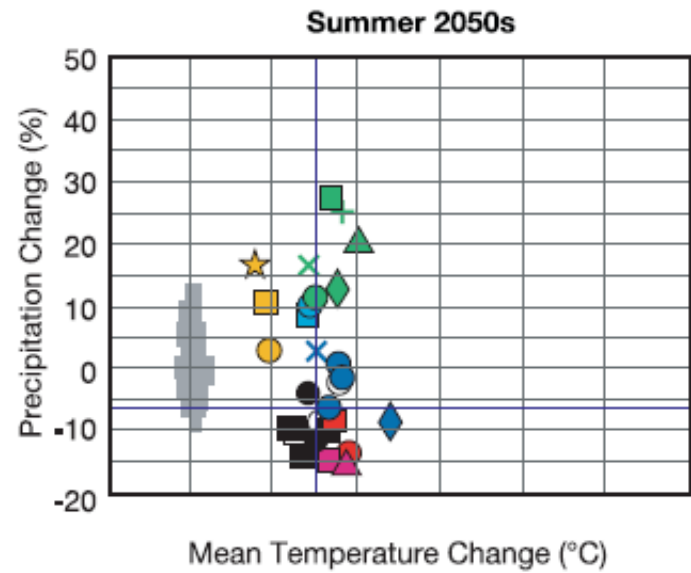
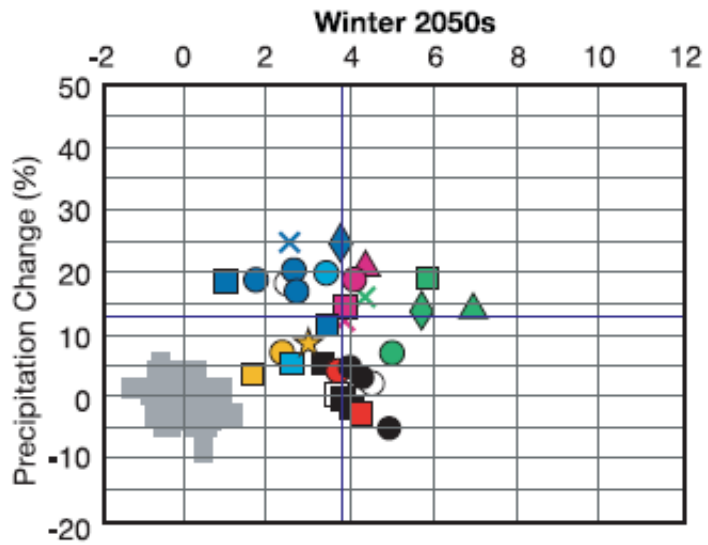
2050s



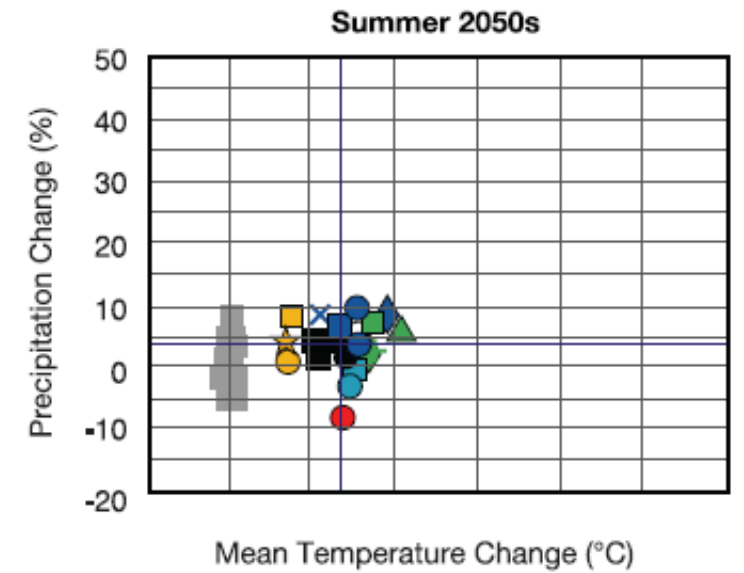
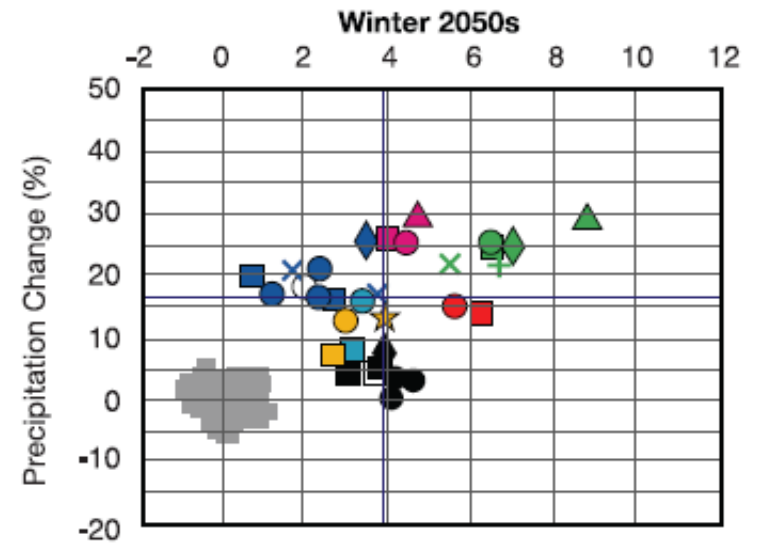
2080s



## Grassland



## Forest



We are losing the advantage of a cold winter

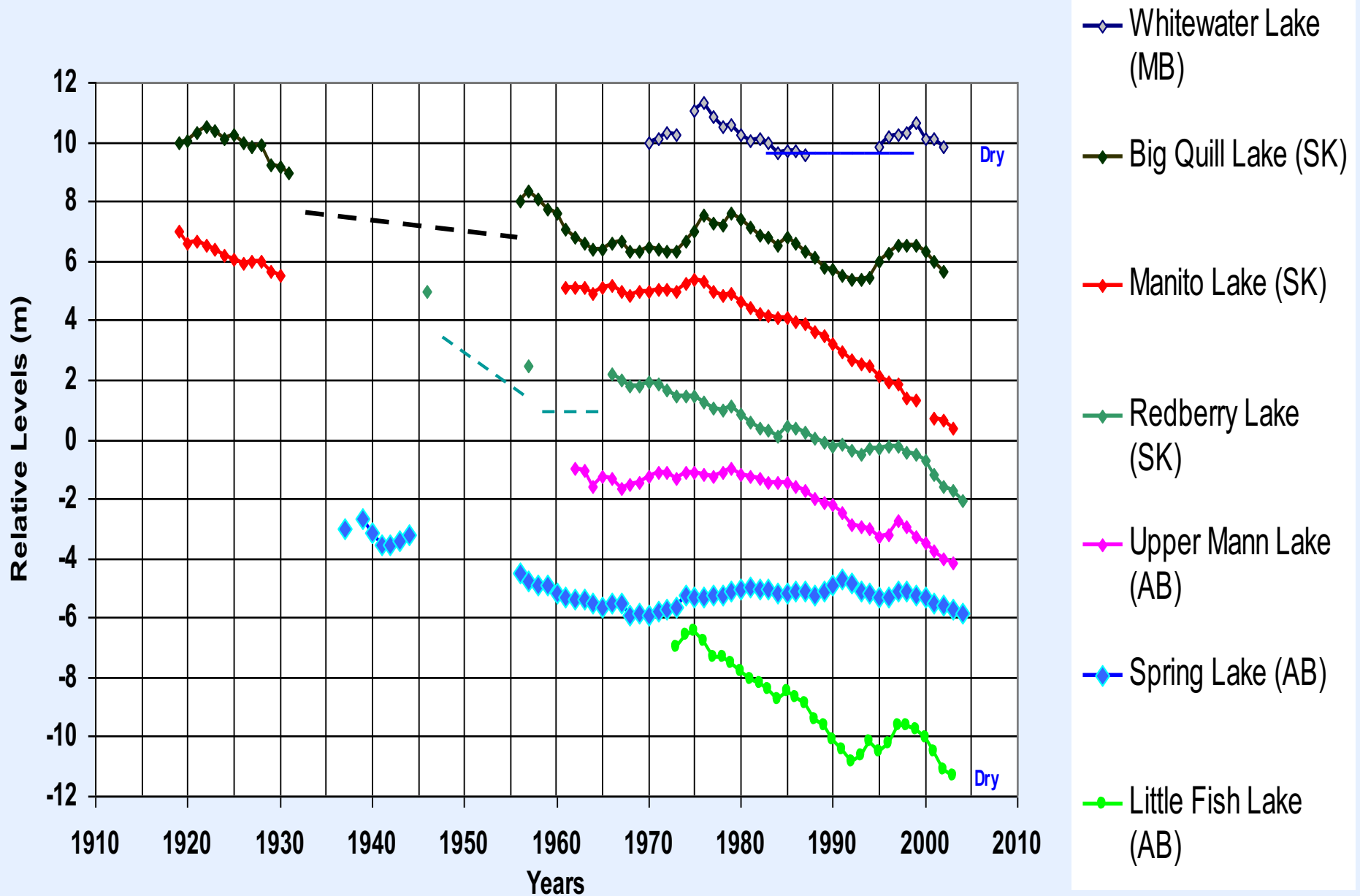


One of the most certain projections is that extra water will be available in winter and spring, while summers generally will be drier

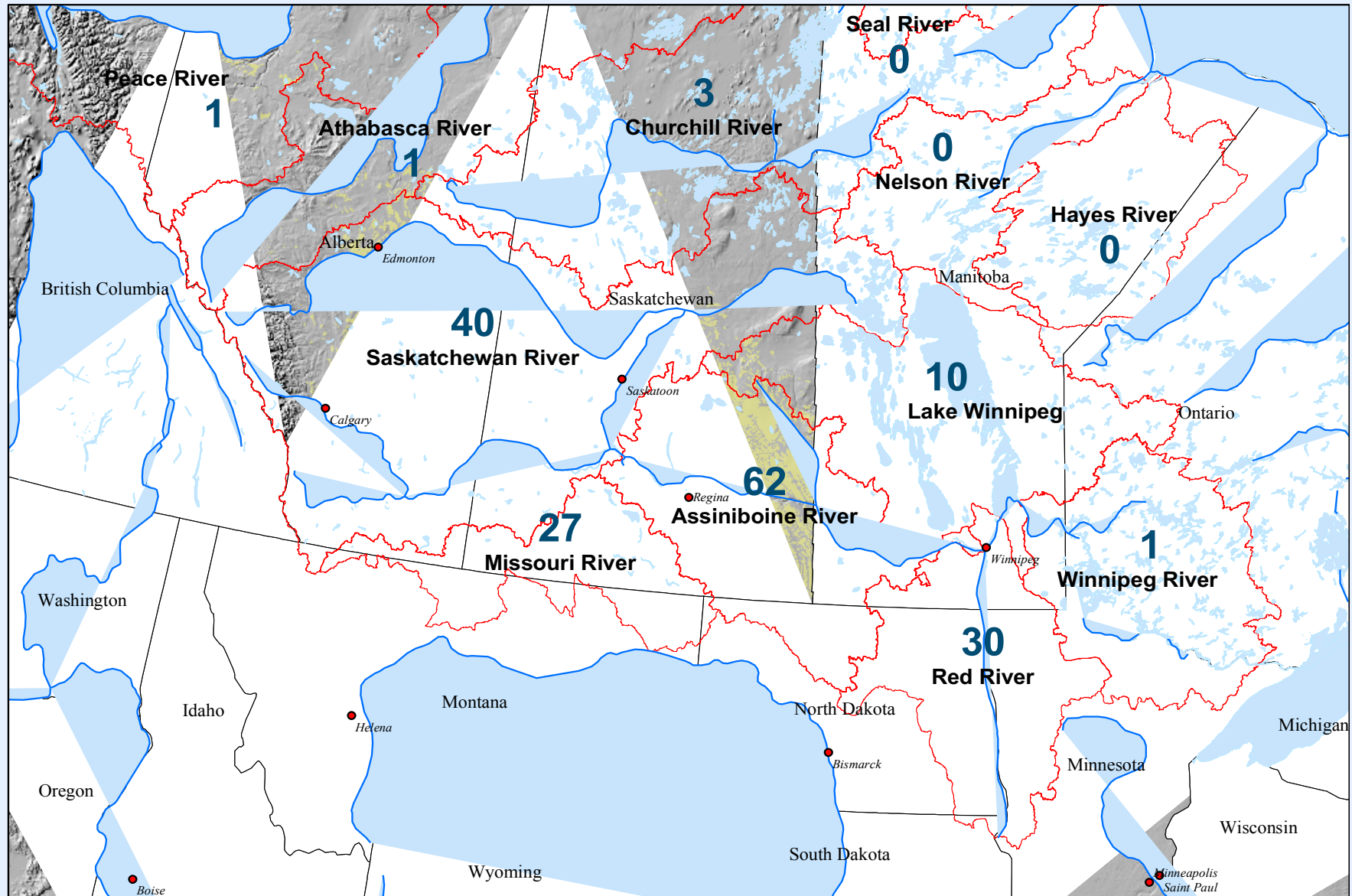


On average, there will be slightly to significantly less surface and soil water

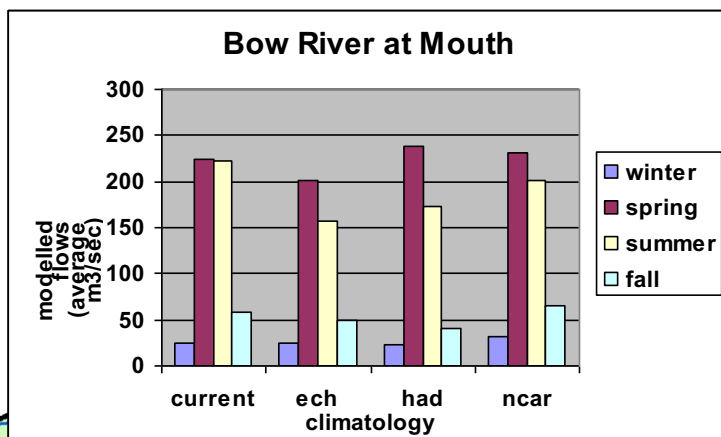
# Closed-basin lake level changes, 1918-2004 (van der Kamp *et al.*)



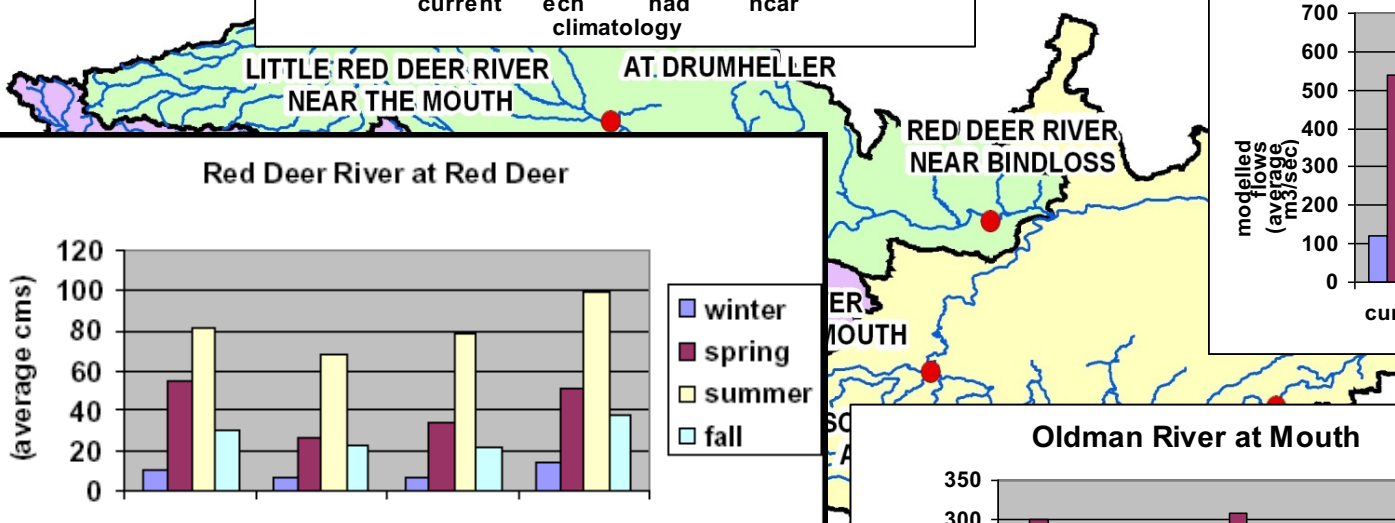
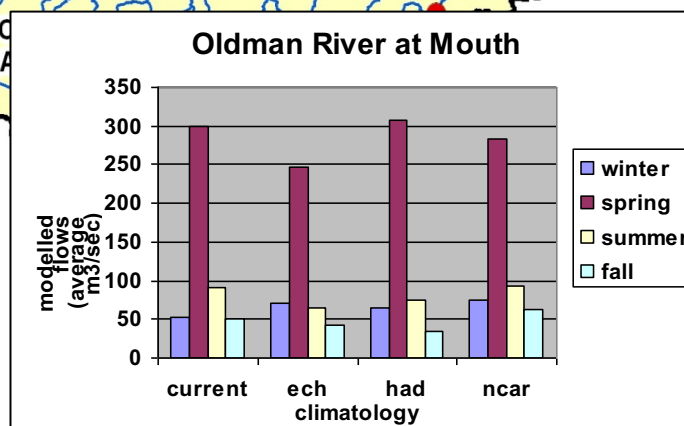
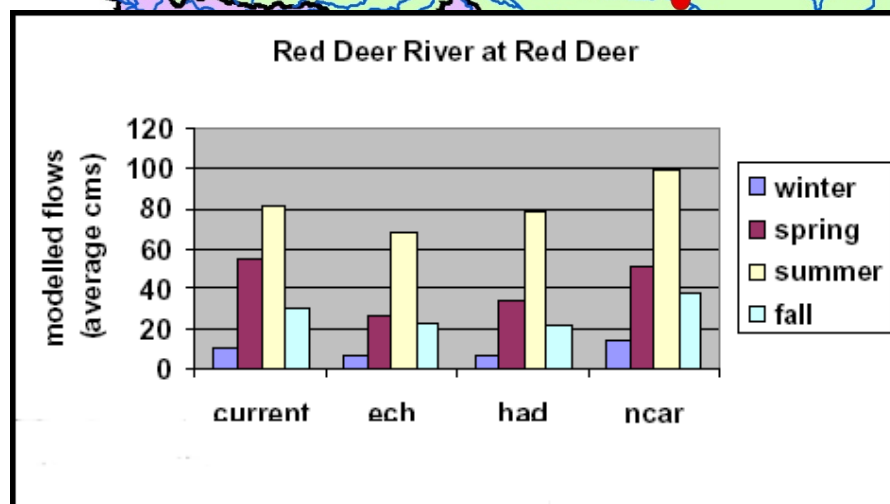
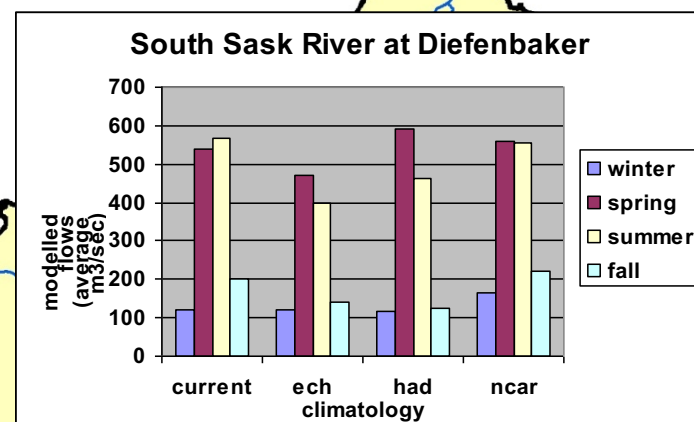
# Prairie Drainage Basins (source: PFRA)



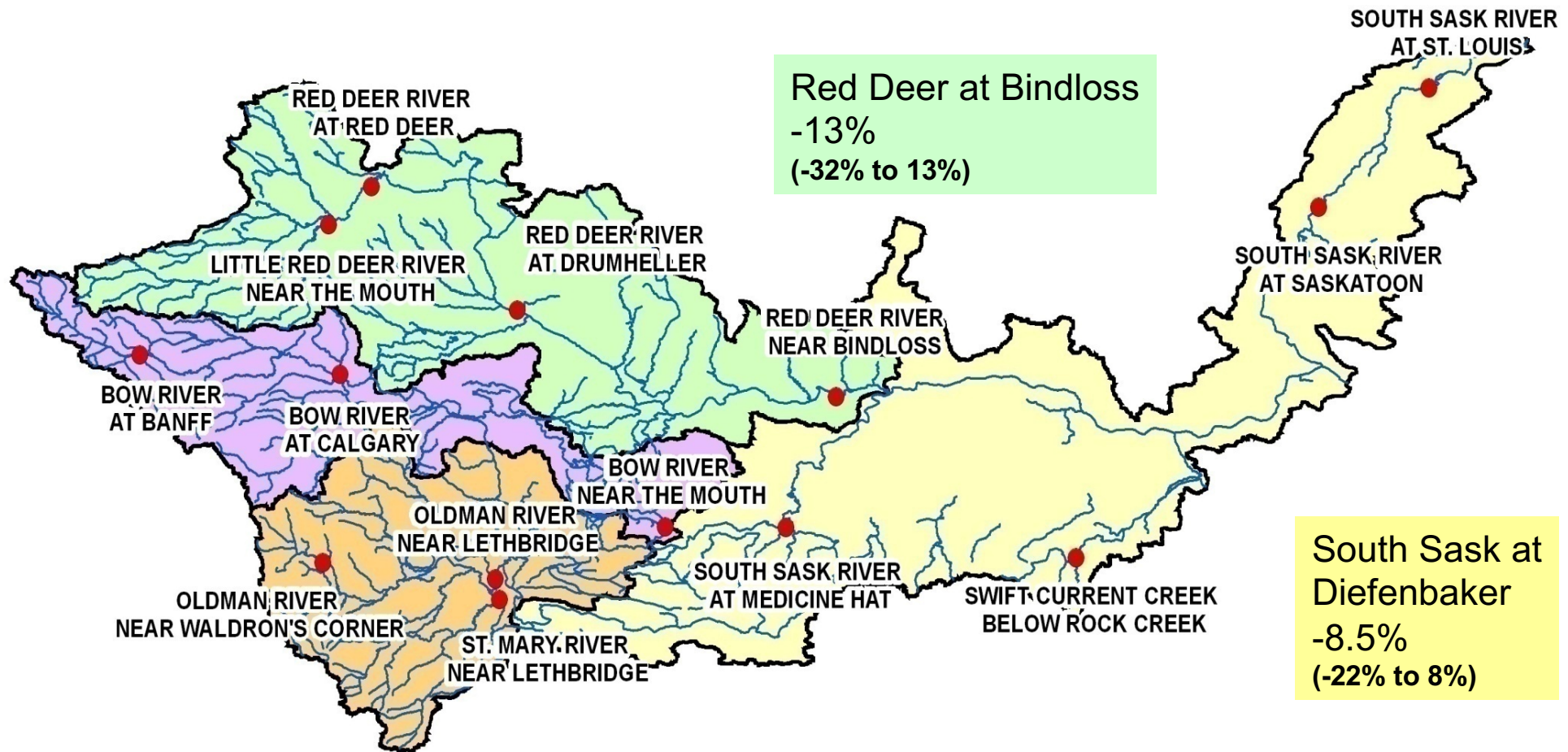
# Seasonal flows, SSRB, 2039-2070 (Pietroniro *et al.*, 2006)



GCM	%Precip	+Temp	Description
echa21	-3.8	2.8	driest, warmest
echb21	-2.0	2.8	
hada21	6.4	2.3	moderately wet and warm
hadb21	0.2	2.1	
ncara21	11.5	1.7	wettest and least warm
ncarb21	9.1	1.5	



# Annual flows, SSRB, 2039 – 2070 (Pietroniro *et al.*, 2006)



Bow River at mouth  
-10%  
(-19% to 1%)

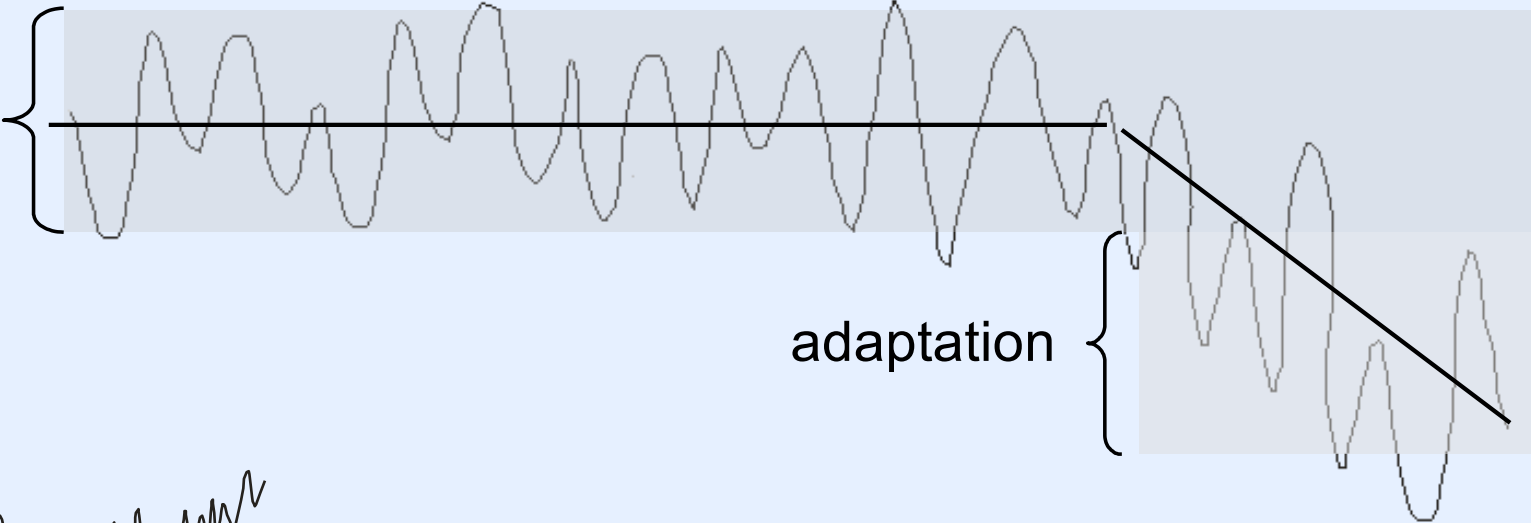
Oldman at mouth  
-4%  
(-13% to 8%)



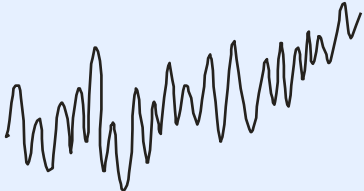
# Climate Trends and Variability

———— mean conditions

Coping  
Range

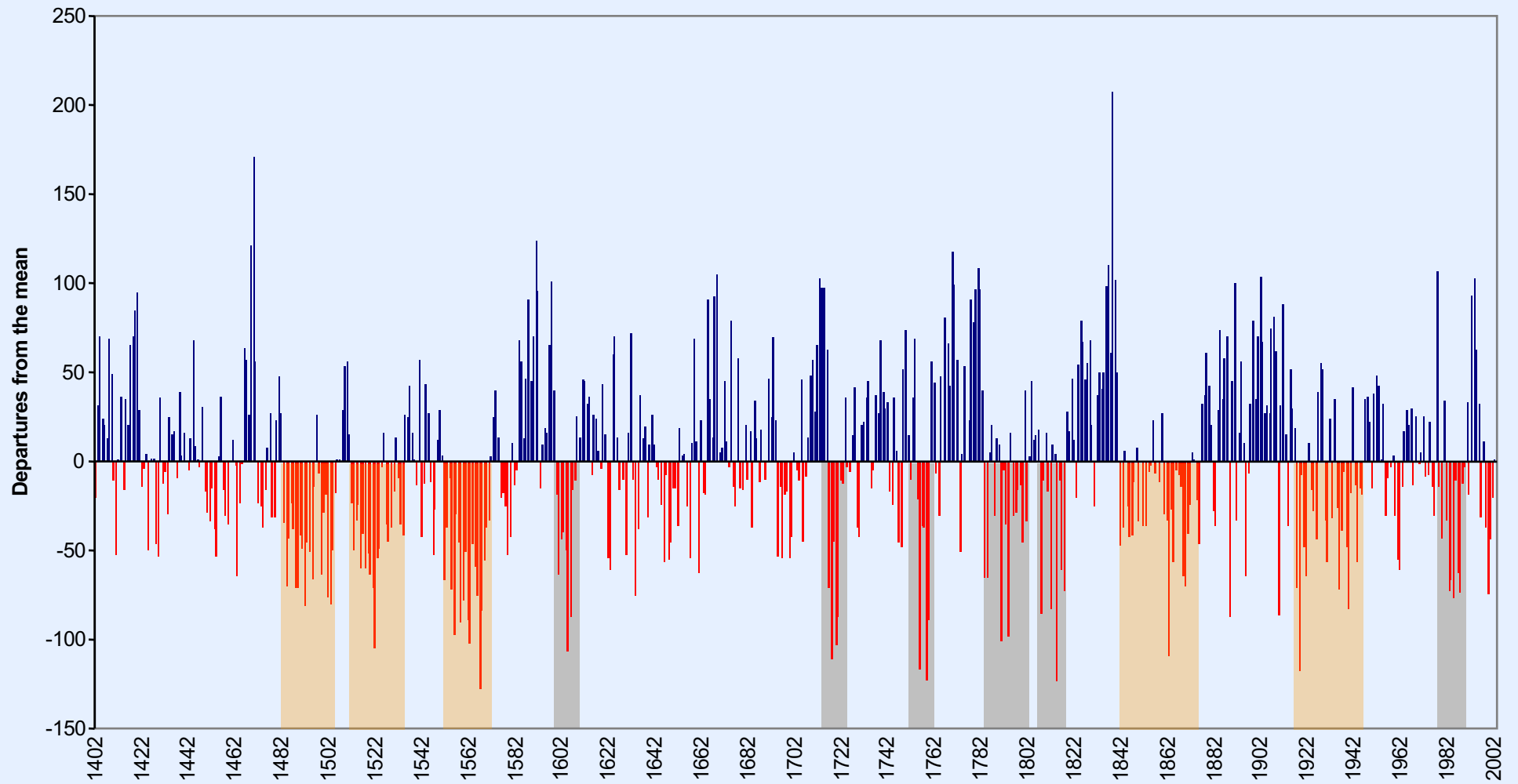


adaptation

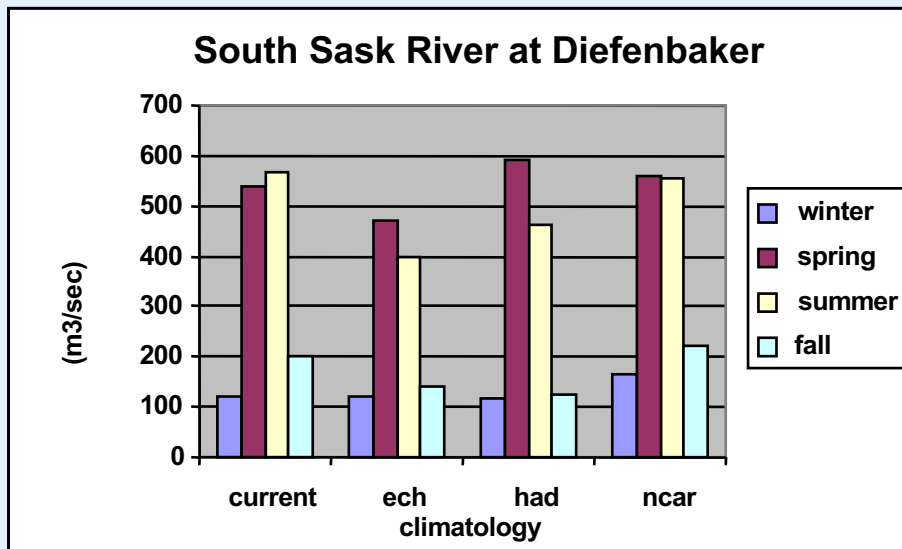
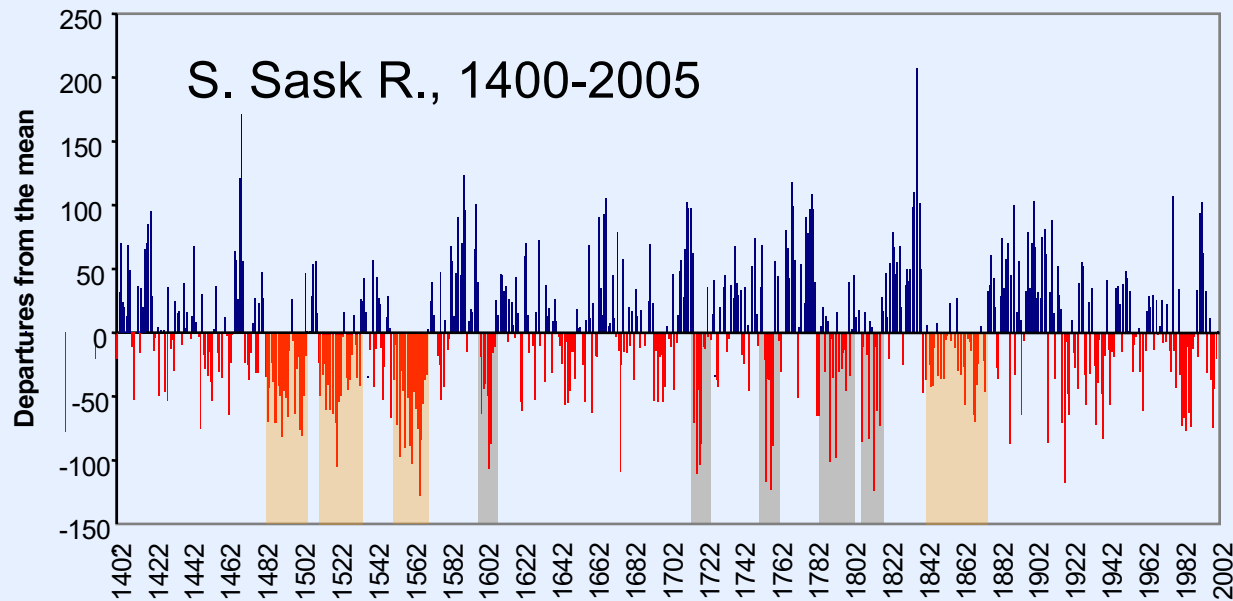


departures from mean conditions

# South Saskatchewan River at Medicine Hat, 1402-2004



# A drier past ... and a drier future?



A “myth of abundance” and an assumption that “the hydrological regime is stationary and will continue to be stationary in the future”.

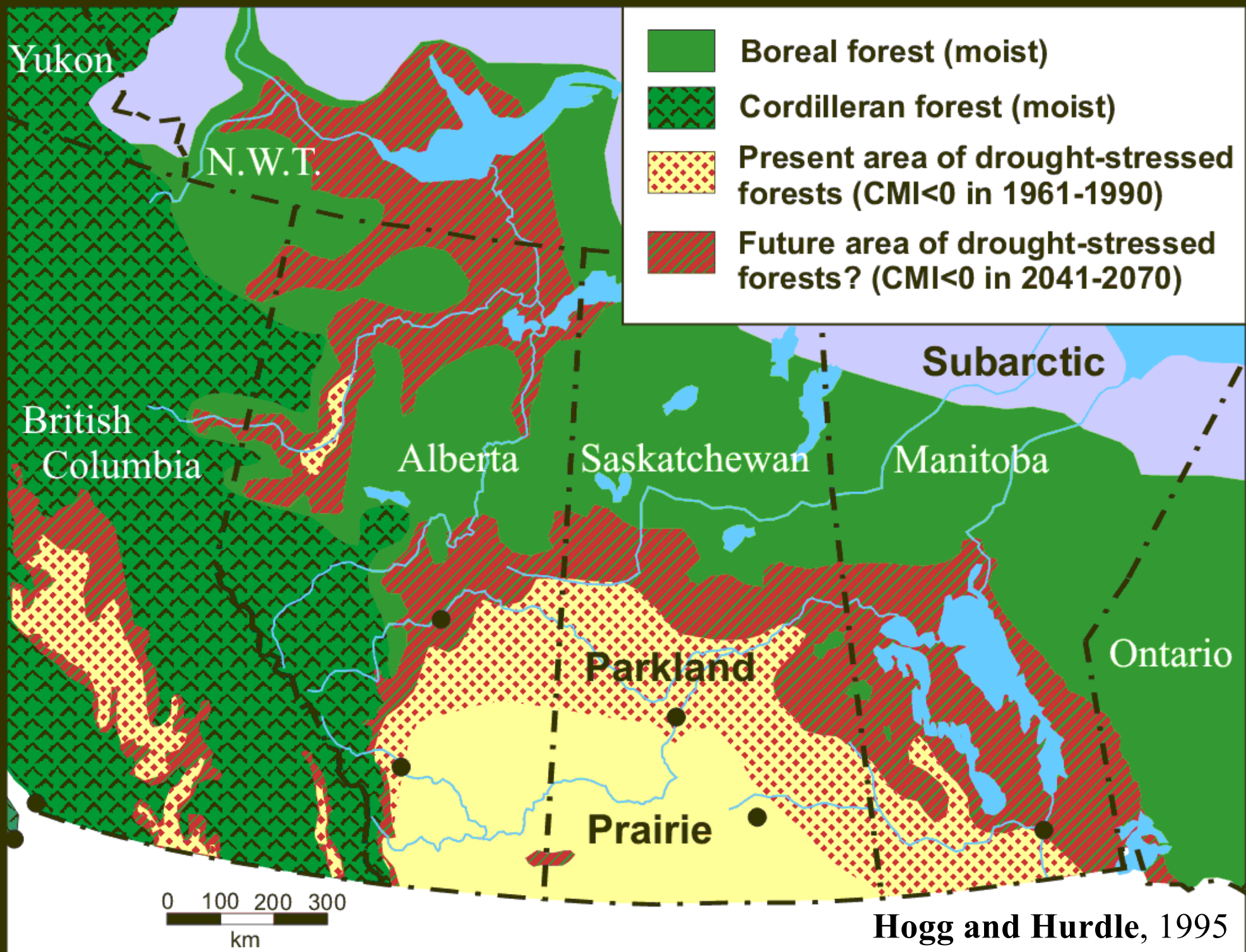
There will be greater variation in hydroclimate

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

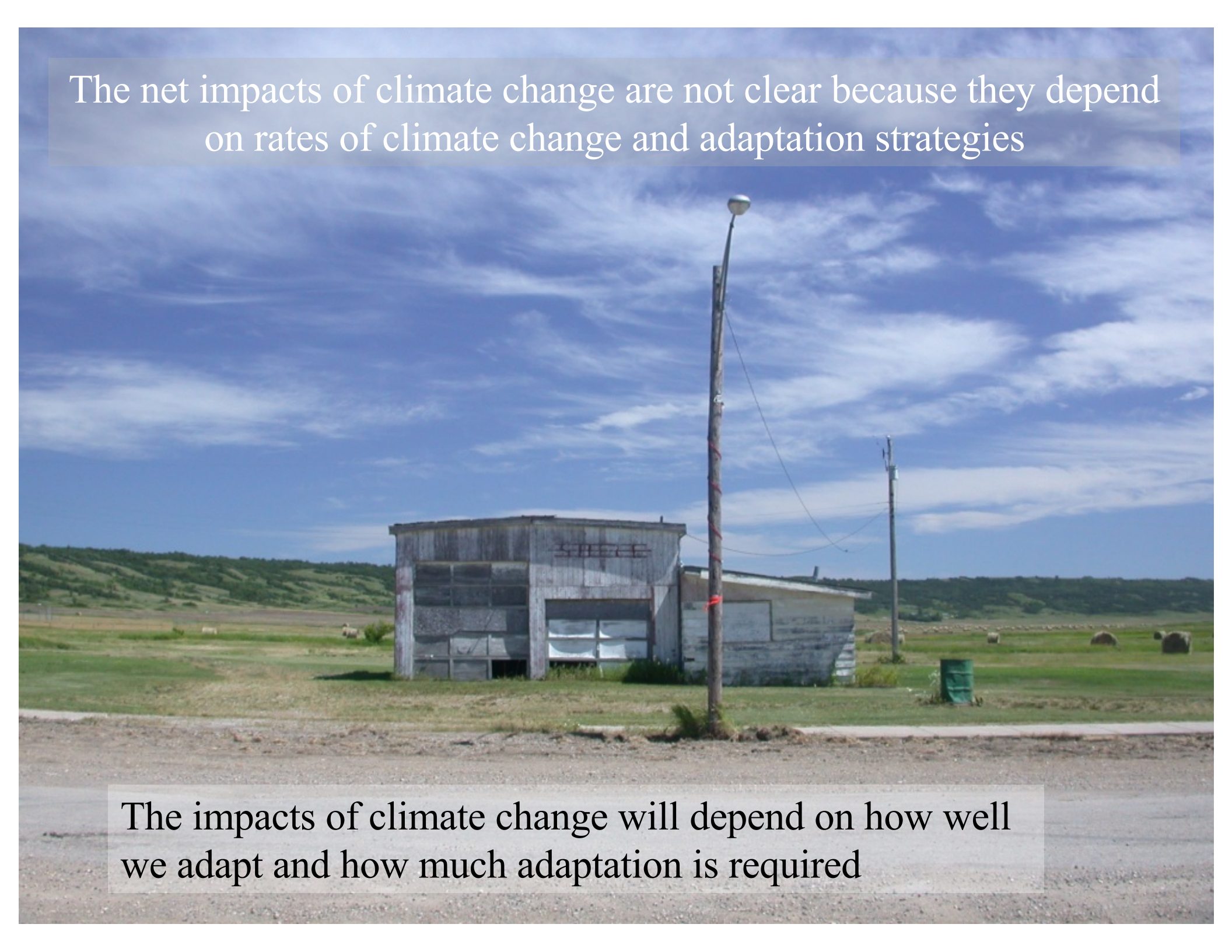


Major ecological changes are expected.





The net impacts of climate change are not clear because 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

# Adaptive Capacity

Determinant	Explanation
Economic resources	Greater economic resources increase adaptive capacity Lack of financial resources limits adaptation options
Technology	Lack of technology limits range of potential adaptation options Less technologically advanced regions are less likely to develop and/or implement technological adaptations
Information and skills	Lack of informed, skilled and trained personnel reduces adaptive capacity Greater access to information increases likelihood of timely and appropriate adaptation
Infrastructure	Greater variety of infrastructure can enhance adaptive capacity, since it provides more options Characteristics and location of infrastructure also affect adaptive capacity
Institutions	Well-developed social institutions help to reduce impacts of climate-related risks, and therefore increase adaptive capacity
Equity	Equitable distribution of resources increases adaptive capacity Both availability of, and access to, resources is important



Adaptive capacity is generally high



But unevenly distributed



Most impacts are adverse because most economies and practices are not sufficiently adaptive



Resources and communities are sensitive to climate variability

# Canadian Disaster Database

- 1. Drought: Prairie provinces, 1980**  
Prairie provinces, 1980. Poor wheat yield due to cereal crop drought that occurred in parts of the Prairies (drought continued from 1979); severe and widespread... [more information.](#)  
Dead: 0 Injured: 0 Evacuated: 0
- 2. Freezing rain: Ontario to New Brunswick, 1998**  
Ontario to New Brunswick, Jan 6-10 1998. Freezing rain (50 to >100mm) fell in a corridor extending from Kingston-to Ottawa-to Montréal to the Monteregie area south... [more information.](#)  
Dead: 28 Injured: 945 Evacuated: 800000
- 3. Drought: Prairie Provinces to ON, 1988**  
Prairie provinces and Central and Southern ON, Jul 5-11 1988. . Drought caused damage to Ontario corn. Drought caused dust storm frequency to increase; duck... [more information.](#)  
Dead: 0 Injured: 0 Evacuated: 0
- 4. Drought: Prairie provinces, 1979**  
Prairie provinces, 1979. Poor wheat yield due to cereal crop drought that occurred in parts of the Prairies (drought continued into 1980)... [more information.](#)  
Dead: 0 Injured: 0 Evacuated: 0
- 5. Drought: Prairie provinces, 1984**  
Prairie provinces, 1984. The worst agricultural drought since the 1930s to occur in the Prairies; severe and widespread surface water droughts reported on the Prairies... [more information.](#)  
Dead: 0 Injured: 0 Evacuated: 0
- 12. Drought: Prairie provinces, 1961**  
Prairie provinces, 1961. One of the worst agricultural droughts to occur in the Prairies; among the most severe and widespread surface water droughts ever to occur... [more information.](#)  
Dead: 0 Injured: 0 Evacuated: 0
- 13. Flood: Southern MB, 1997**  
Assiniboine, Red and Winnipeg Rivers MB, May 1997. Over 7000 military personnel were employed for 36 days to assist in preventing flood damage and in relocating... [more information.](#)  
Dead: 0 Injured: 0 Evacuated: 25447
- 14. Drought: Western Canada, 1985**  
Western Canada, 1985. Second drought year in a row; one of the worst agricultural droughts to occur in the Prairies; insect infestations. On June 8, there was... [more information.](#)  
Dead: 0 Injured: 0 Evacuated: 0
- 15. Tornado: Edmonton AB, 1987**  
Edmonton AB, Jul 31 1987. 27 dead, 600 injured, 1700 homeless; widespread heavy rainfall from a powerful tornado hit Edmonton on July 31, 1987; 300 mm of rain fell... [more information.](#)  
Dead: 27 Injured: 600 Evacuated: 1700
- 16. Drought: Prairie provinces, 1977**  
Prairie provinces, 1977. Cereal crop drought occurred in parts of the Prairies; among the most severe and widespread surface water droughts ever to occur on the... [more information.](#)  
Dead: 0 Injured: 0 Evacuated: 0
- 17. Drought: Prairie provinces, 1990**  
Prairie provinces, 1990. Cereal crop drought occurred in parts of the Prairies... [more information.](#)  
Dead: 0 Injured: 0 Evacuated: 0
- 18. Drought: Prairie provinces, 1992**  
Prairie provinces, 1992. Livestock yields were low in northern Alberta and Saskatchewan due to dry conditions; severe and widespread surface water droughts reported... [more information.](#)  
Dead: 0 Injured: 0 Evacuated: 0

SE  
Alberta

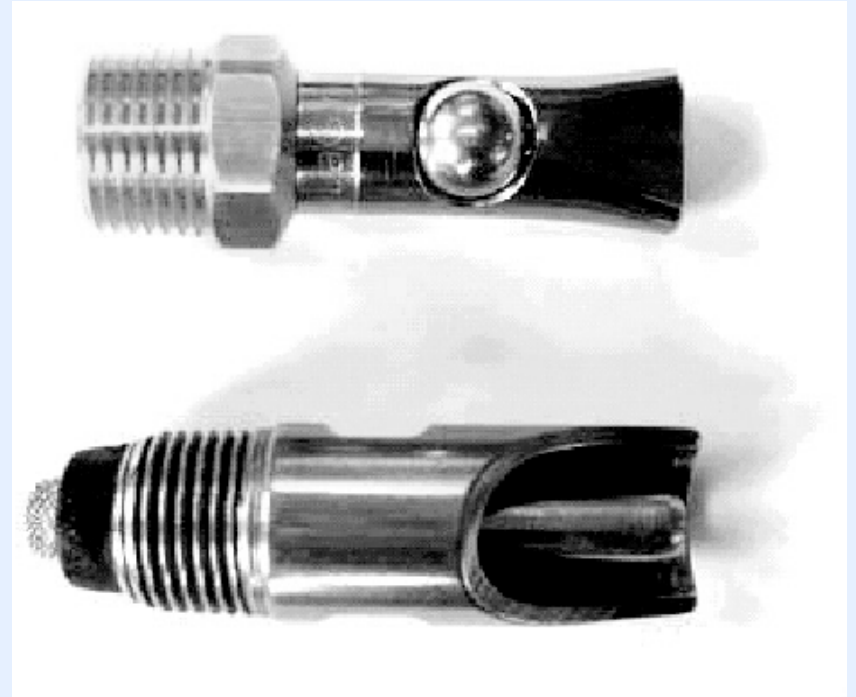


CCRS / CCT 1998

## JV Farms, High River, Alberta

ball-bite drinker

standard drinker



- one-year trial, from August 2004 to July 2005, the ball-bite drinker sections of the barn used 35 per cent less water than the standard drinker sections
- no detrimental effects on the animals or facility management
- decrease in water usage led to many secondary benefits

## Adaptation to water shortages in 2001-02, Hannah, AB

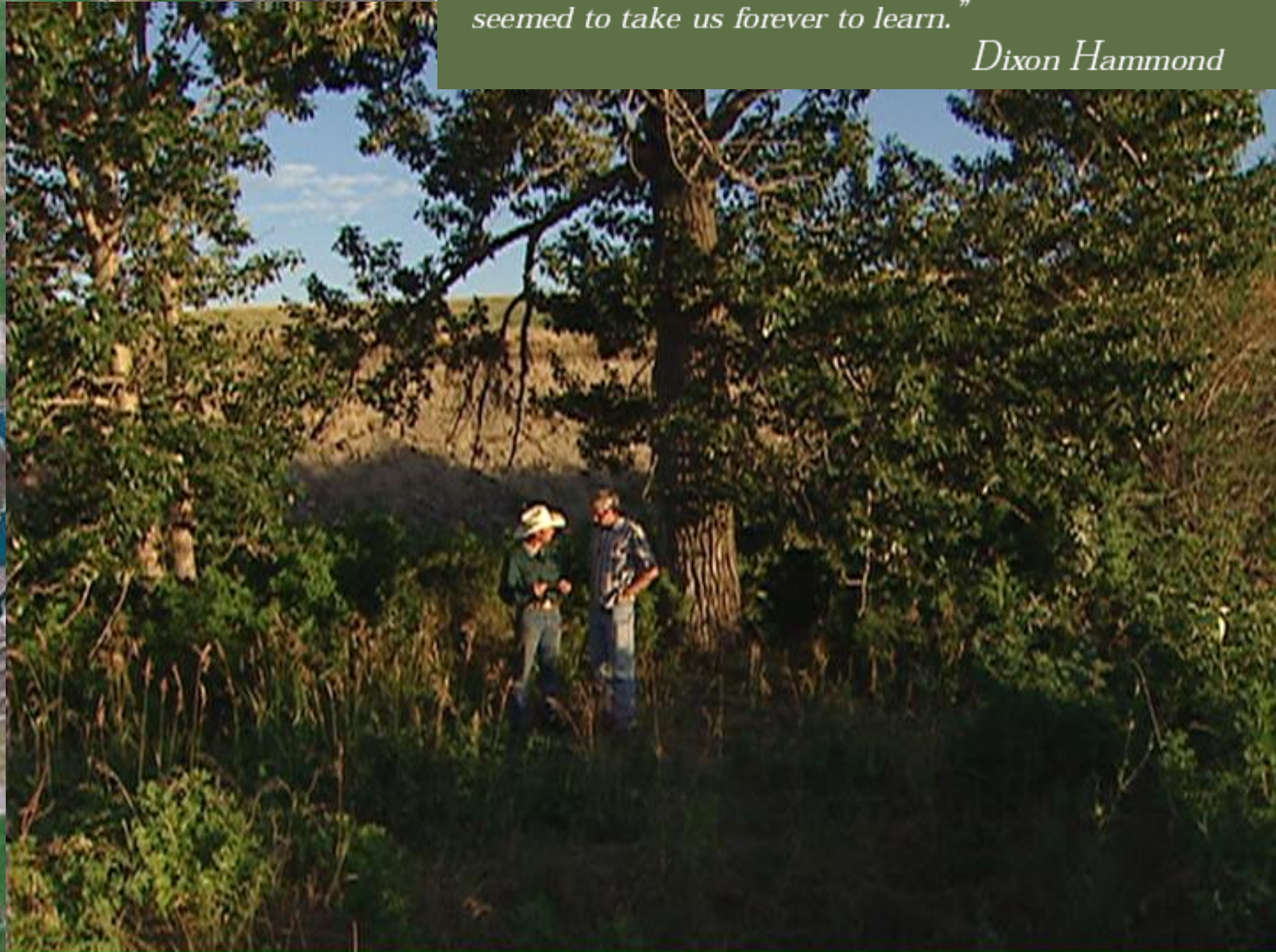
- hauling water
- shallow (seasonal) and deep (permanent) water pipelines
- access to Sheerness Power Generating Station water pipeline
- calls for second pipeline from Red Deer River
- culled and moved livestock
- careful range management
- off-farm income mostly from oil
- historic adaptation measures with establishing the Special Areas (e.g. > 2,000 dugouts)



# *Beaver Creek Watershed Group*

*"We are really the ones who manage the land every day and the positive actions we take today will ensure that our children have healthy riparian areas and clean water. Hopefully they will grow up understanding what it seemed to take us forever to learn."*

*Dixon Hammond*



Planned adaptation is a component of adaptive management and sustainable economic development



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Producers

Agri-  
Industries

## National Environmental Farm Planning Initiative

## Sustainable Agriculture

Sustainable agriculture refers to an agricultural production and distribution system that:

- Achieves the **integration** of natural biological cycles and controls,
- Protects and renews **soil** fertility and the natural resource base,
- Optimizes the management and use of **on-farm** resources,
- **Reduces** the use of nonrenewable resources and purchased production inputs,
- Provides an adequate and dependable farm **income**,
- Promotes **opportunity** in family farming and farm communities, and
- **Minimizes** adverse impacts on health, safety, wildlife, water quality and the environment

Centre for Young Farmers and  
Sustainable Agriculture



The Alberta Vulnerability Assessment Project  
is expected to result in:

*Alberta adapting to a changing climate by managing short and long-term climate risks and opportunities within an integrated sustainable development policy framework.*





water for life



alberta's strategy for sustainability



 **Land-use**  
FRAMEWORK

**Draft Land-use Framework**

# Premier's Forum on Climate Change June 1, 2007, Regina

HOUSE OF COMMONS

39th Parliament 1st Session

Standing Committee on Environment and Sustainable  
Development (ENVI)

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## Witness Information

Alberta Caucus, House of  
Commons, March 28, 2007

Standing Committee on  
Environment and Sustainable  
Development



CANADA

NUMBER 010 | 2nd SESSION | 39th PARLIAMENT

## EVIDENCE

Wednesday, January 30, 2008

Meeting the Challenge  
Alberta's Climate Change Plan  
International Expert Panel  
June 8, 2007  
Kananaskis, Alberta

## CLIMATE CHANGE: WE ARE AT RISK

Standing Senate Committee on Agriculture and Forestry

**Senate of Canada** INTERIM REPORT

### CHAPTER 5:

### EFFECTS OF CLIMATE CHANGE ON WATER

“...the climate anomaly of greatest concern is drought.”

*Dr. Dave Sauchyn, University of Regina*[\[2\]](#)