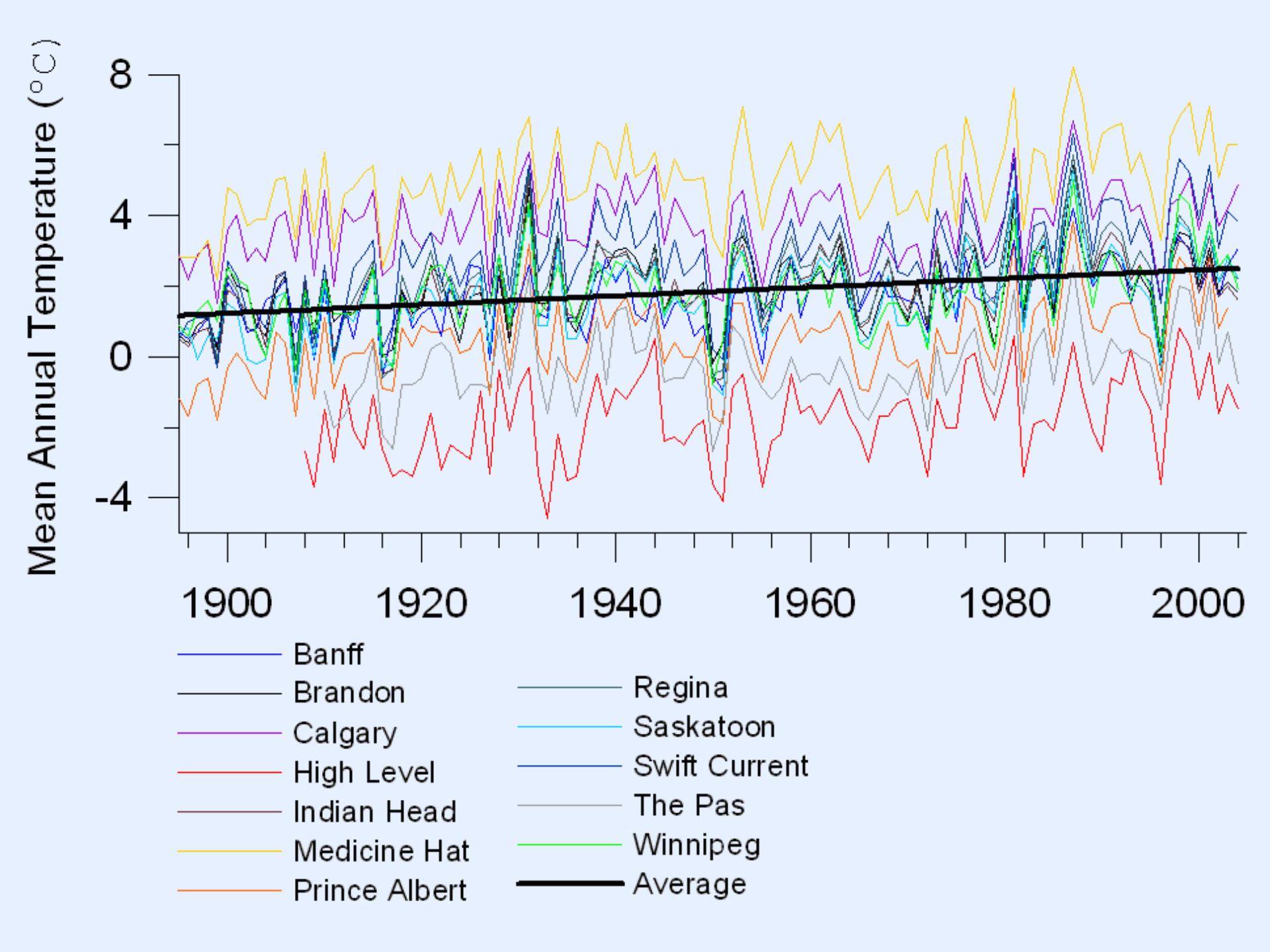
Climate Change & Water Issues for Agriculture Production on the Prairies

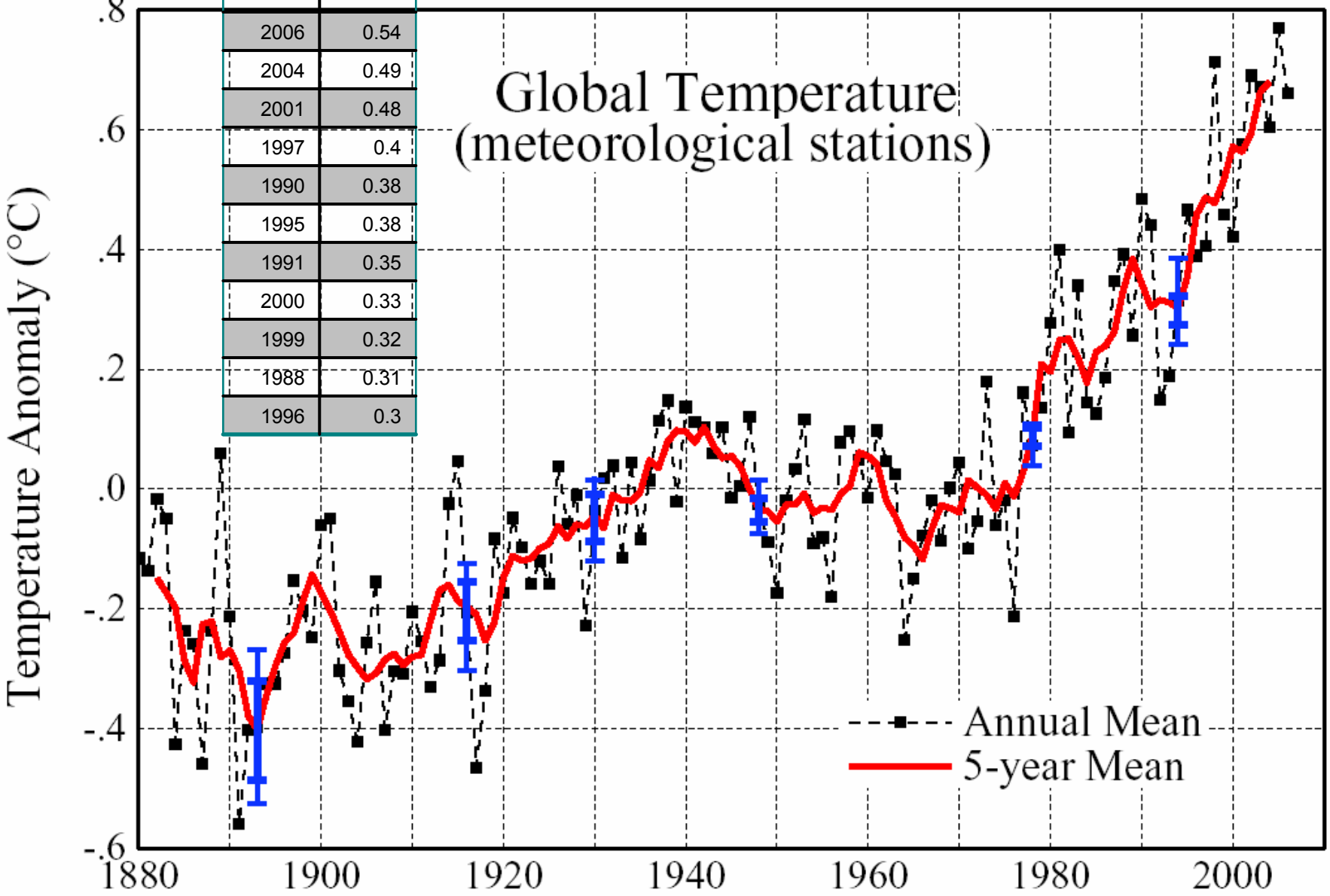
Dave Sauchyn
Prairie Adaptation Research Collaborative
University of Regina

Manitoba Forage Symposium
Winnipeg, 14 March 2007

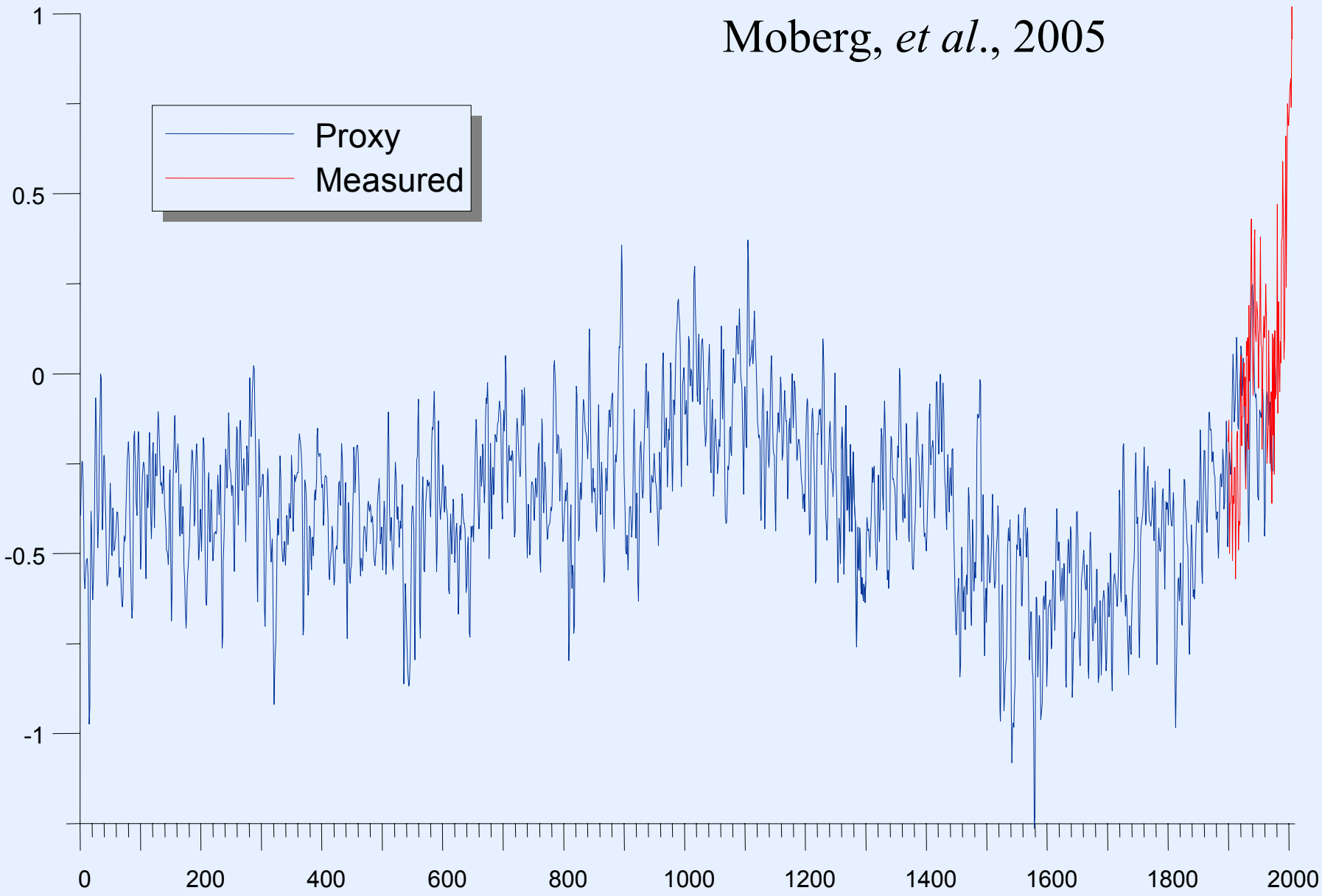

Mean Annual Temperature (°C)
8
4
0
-4
1900
1920
1940
1960
1980
2000
Banff
Brandon
Calgary
High Level
Indian Head
Medicine Hat
Prince Albert
Regina
Saskatoon
Swift Current
The Pas
Winnipeg
Average

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

2005	0.63
1998	0.57
2002	0.56
2003	0.55
2006	0.54
2004	0.49
2001	0.48
1997	0.4
1990	0.38
1995	0.38
1991	0.35
2000	0.33
1999	0.32
1988	0.31
1996	0.3



Northern Hemisphere temperature, past 2000 years



WMO INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE UNEP

4th Assessment Report

800+ contributing authors
450+ lead authors from 130+ countries
2500+ scientitic expert reviewers
6 years of work
4 volumes

Climate Change 2007: The Physical Science Basis - Summary for Policymakers, February 2, 2007

IPCC 4th Assessment Report

- Warming of the climate system is unequivocal
- The warmth of the last half century is unusual in at least the previous 1300 years
- Most of the observed increase in globally averaged temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations
- Anthropogenic warming would continue for centuries, even if greenhouse gas concentrations were to be stabilized

Canadian National Assessment – early fall, 2007

Canadian Climate Change Impacts and Adaptation Assessment
The Assessment Outline

The key sections of the Assessment are described below:

Synthesis Report

A concise overview of what climate change means for Canada. The report will highlight key findings, and discuss commonalities and differences among the regions. It will serve as both an executive summary and a value-added synthesis of the entire Assessment.

Section 1: Introduction/Overview

An introduction to the Assessment, emphasizing its goals and purposes, as well as the importance of understanding vulnerability.

Section 2: Climate and Climate Change in Canada

An overview of the importance of climate and climate change to Canada, with discussion of climatic, social and economic trends that affect exposure to climate. Will also outline future projections for Canada.

Section 3: Regional Chapters

The main content of the Assessment, these chapters will focus on current regional sensitivities and future vulnerabilities to climate and climate change. Case studies will be an important component of these chapters.

The regional chapters are:

- Atlantic Canada
- Quebec
- Ontario
- Prairies
- British Columbia
- The North

Section 4: Canada in an International Context

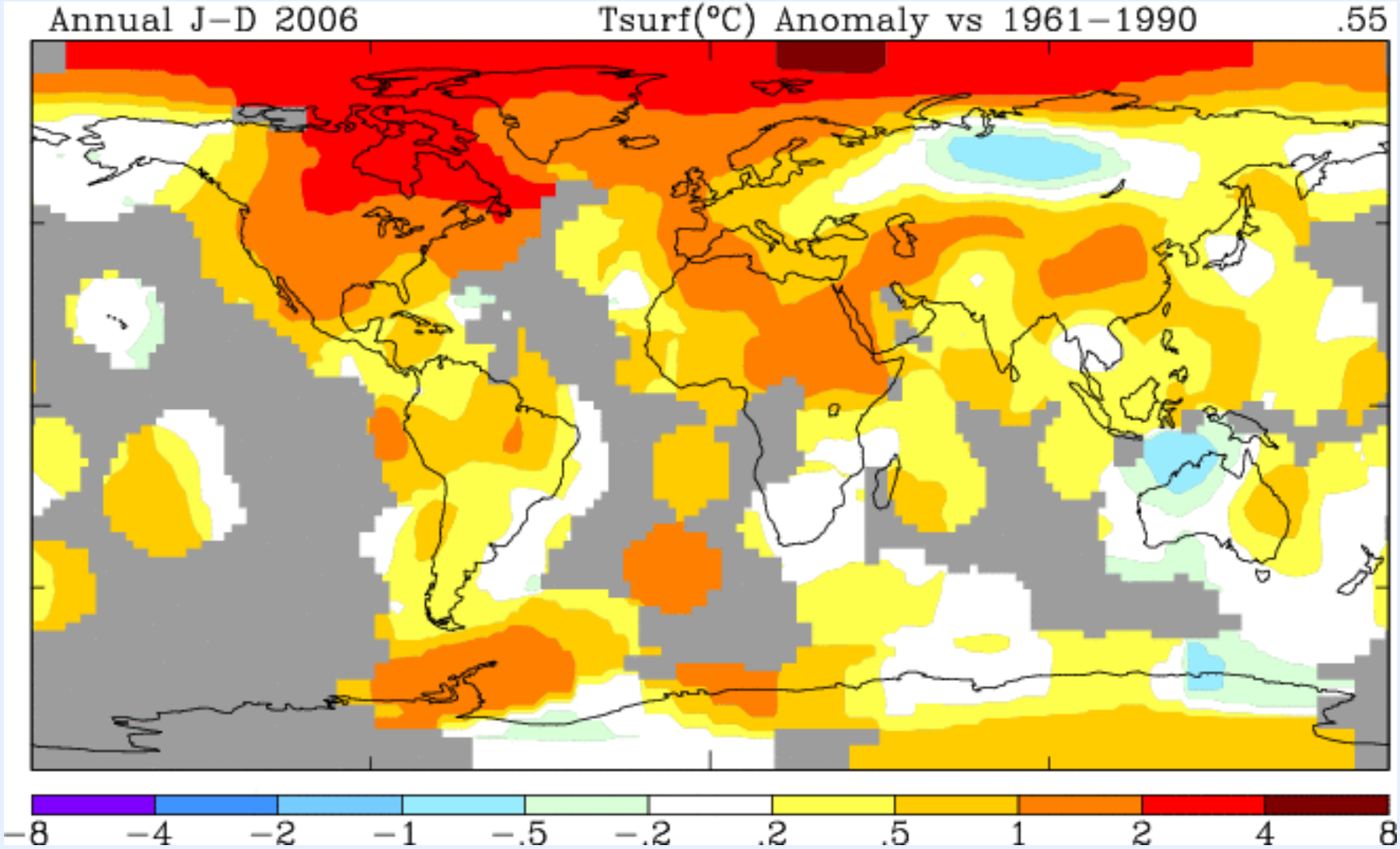
A broader perspective on climate change impacts and adaptation, which discusses climate change impacts and adaptation with respect to continental effects, oceans, global issues, and Canada's international obligations.

Section 5: Impacts and Adaptation Research- Capacity, Tools and Moving Forward

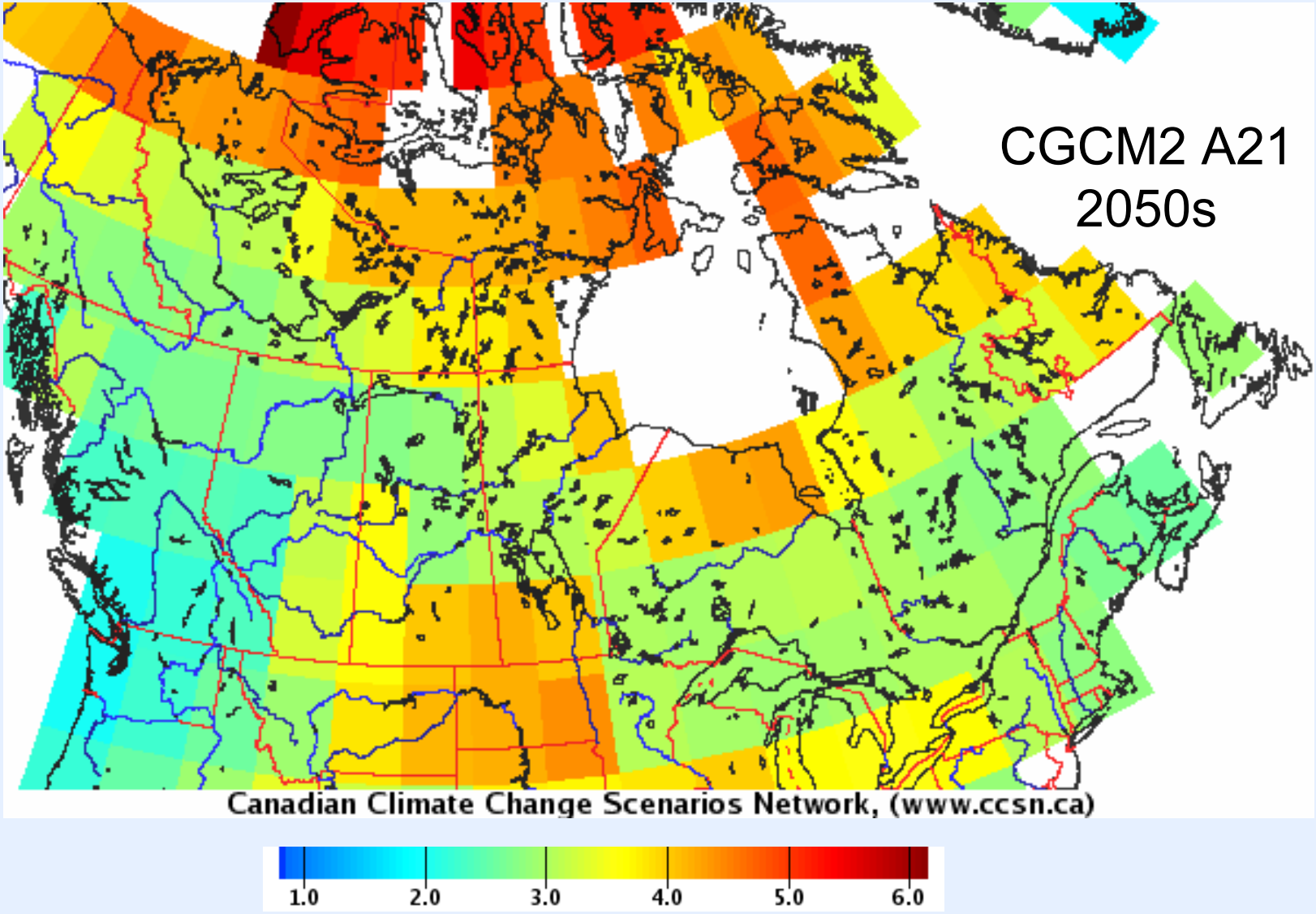
An examination of the present state of impacts and adaptation research in Canada, future directions and needs, and moving research to action.

http://www.adaptation.nrcan.gc.ca/assess_e.php

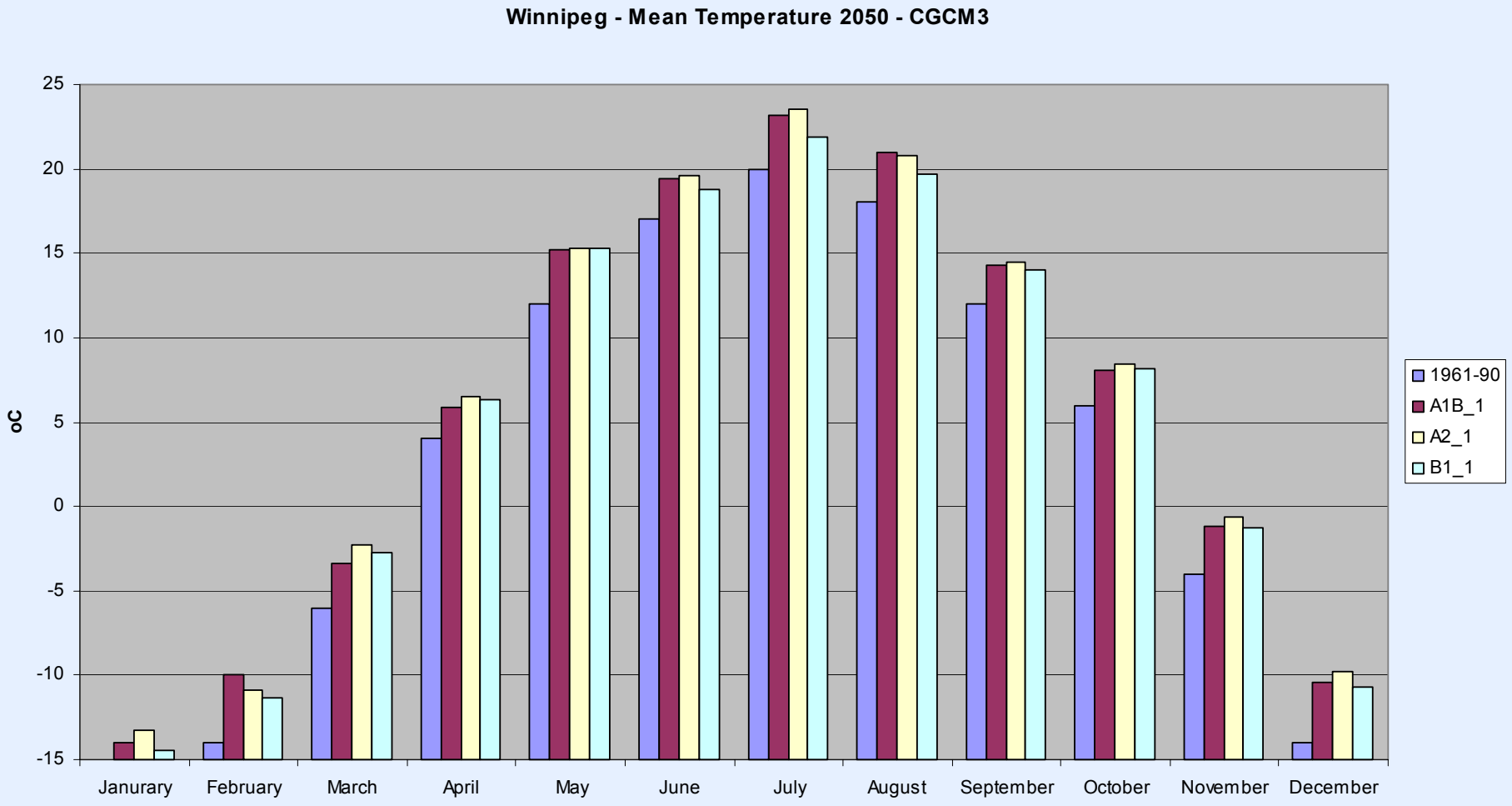
2006 Temperatures: Departures from Normal (1961-90)

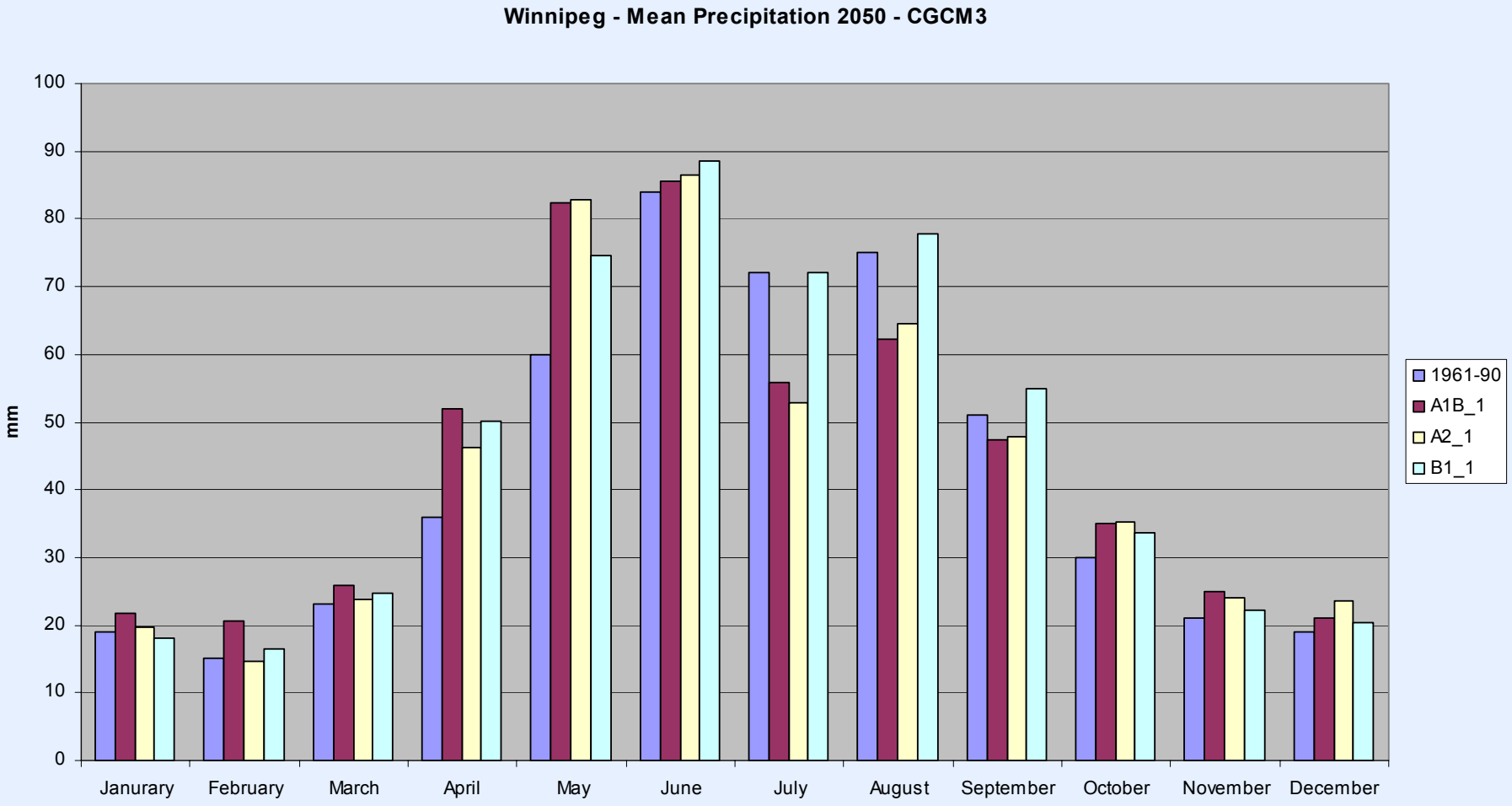


http://data.giss.nasa.gov/gistemp/

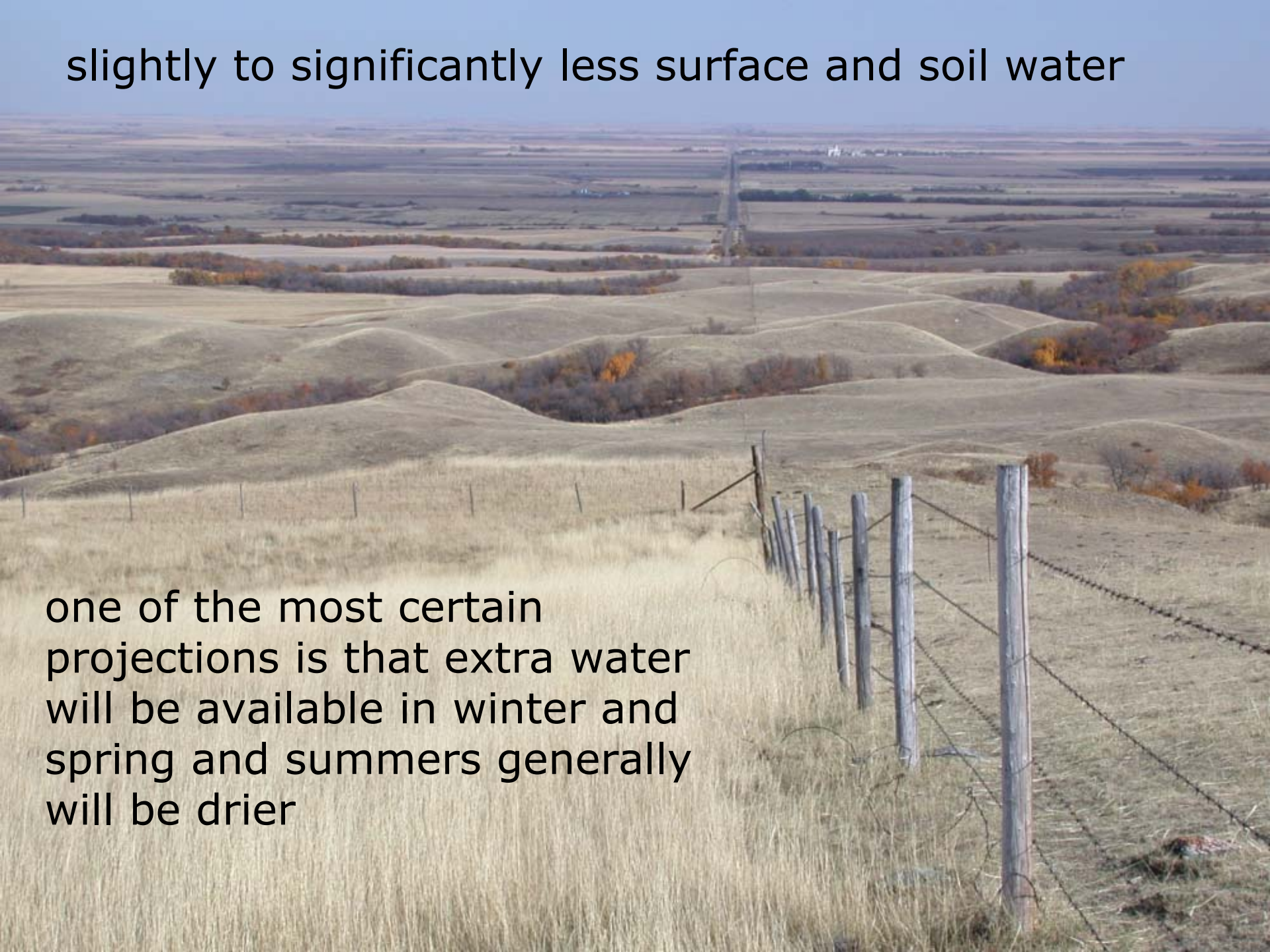


Change in temperature (C) from baseline (1961-90)


Winnipeg - Mean Temperature 2050 - CGCM3
oC
25
20
15
10
5
0
-5
-10
-15
Janurary
February
March
April
May
June
July
August
September
October
November
December
1961-90
A1B_1
A2_1
B1_1


Winnipeg - Mean Precipitation 2050 - CGCM3
mm
100
90
80
70
60
50
40
30
20
10
0
Janurary
February
March
April
May
June
July
August
September
October
November
December
1961-90
A1B_1
A2_1
B1_1

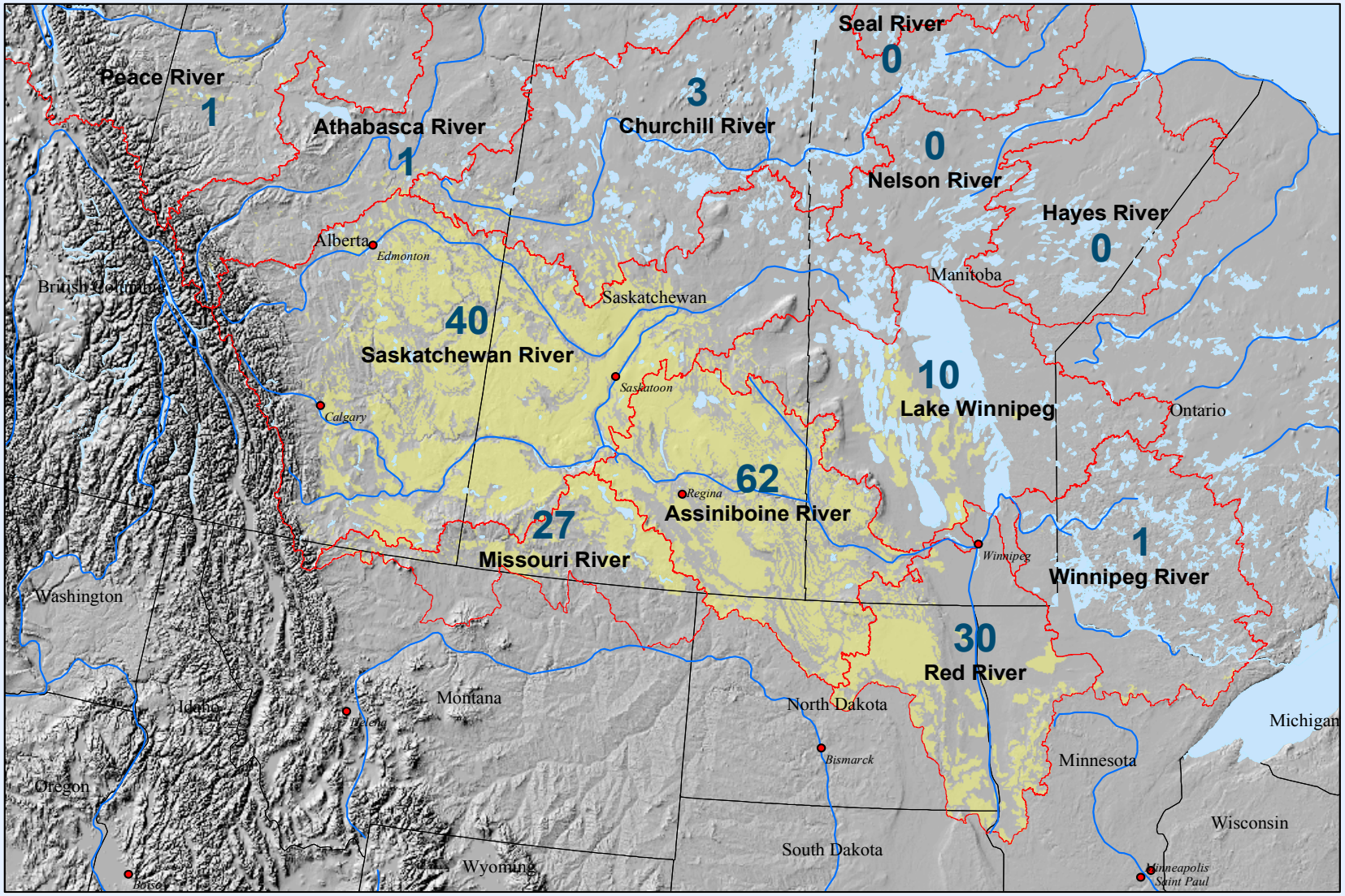
slightly to significantly less surface and soil water



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

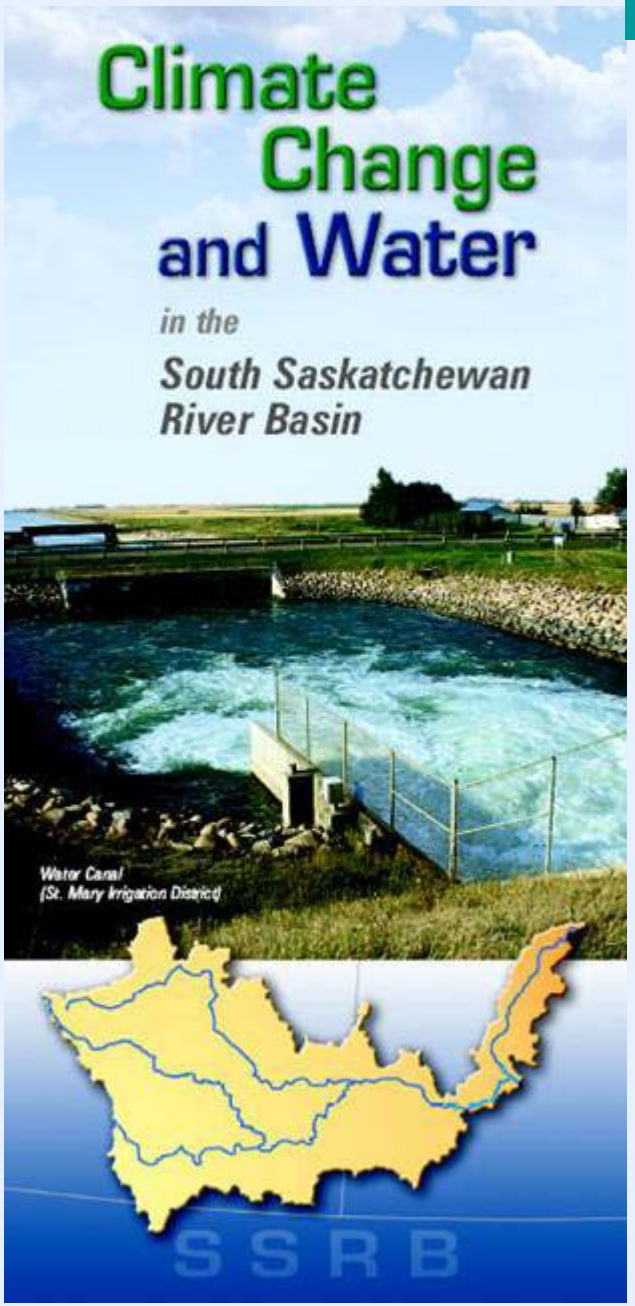
Prairie Drainage Basins

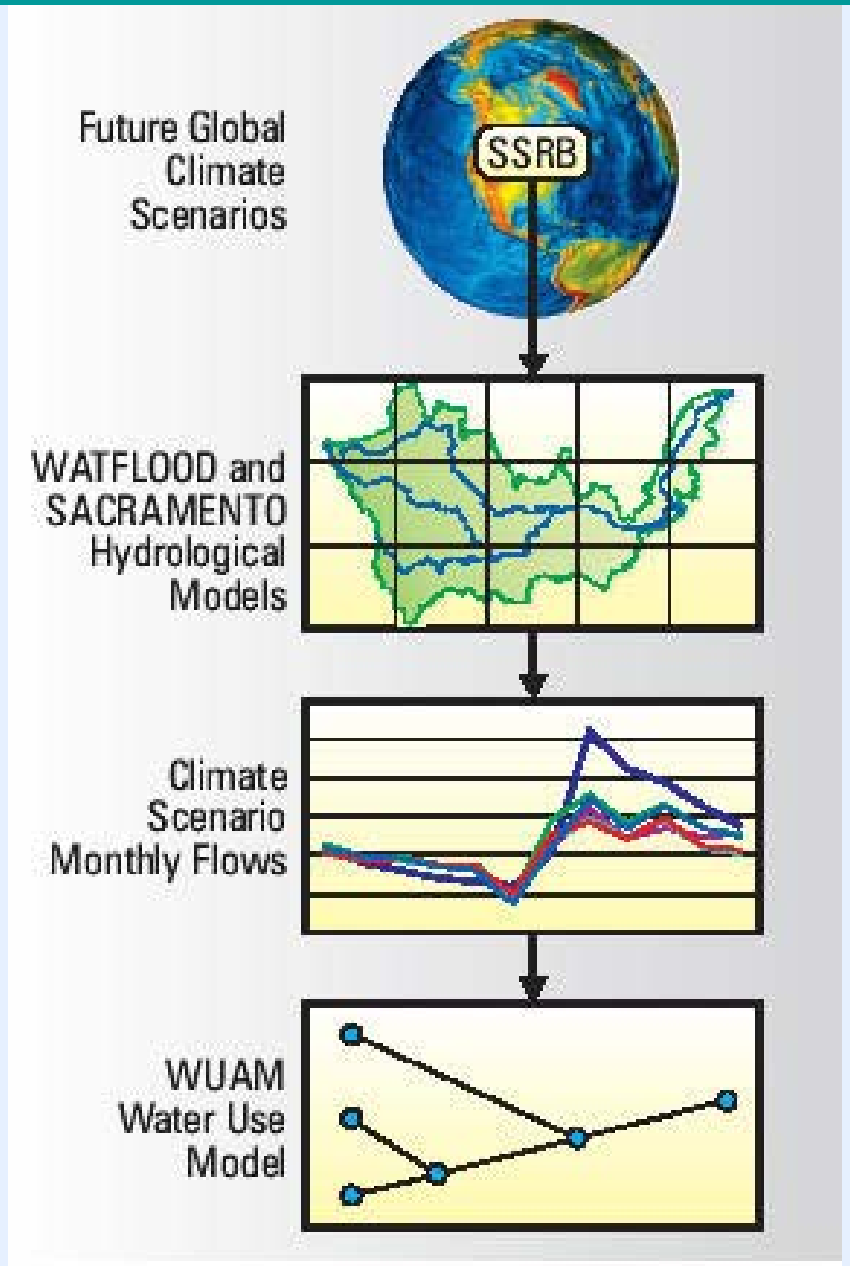
Non-contributing drainage area (percent of total basin area) for prairie drainage basins
-median annual runoff-



Source: Non-contributing area - Agriculture and Agri-Food Canada, P.F.R.A.
Elevation data - Environmental Systems Research Institute

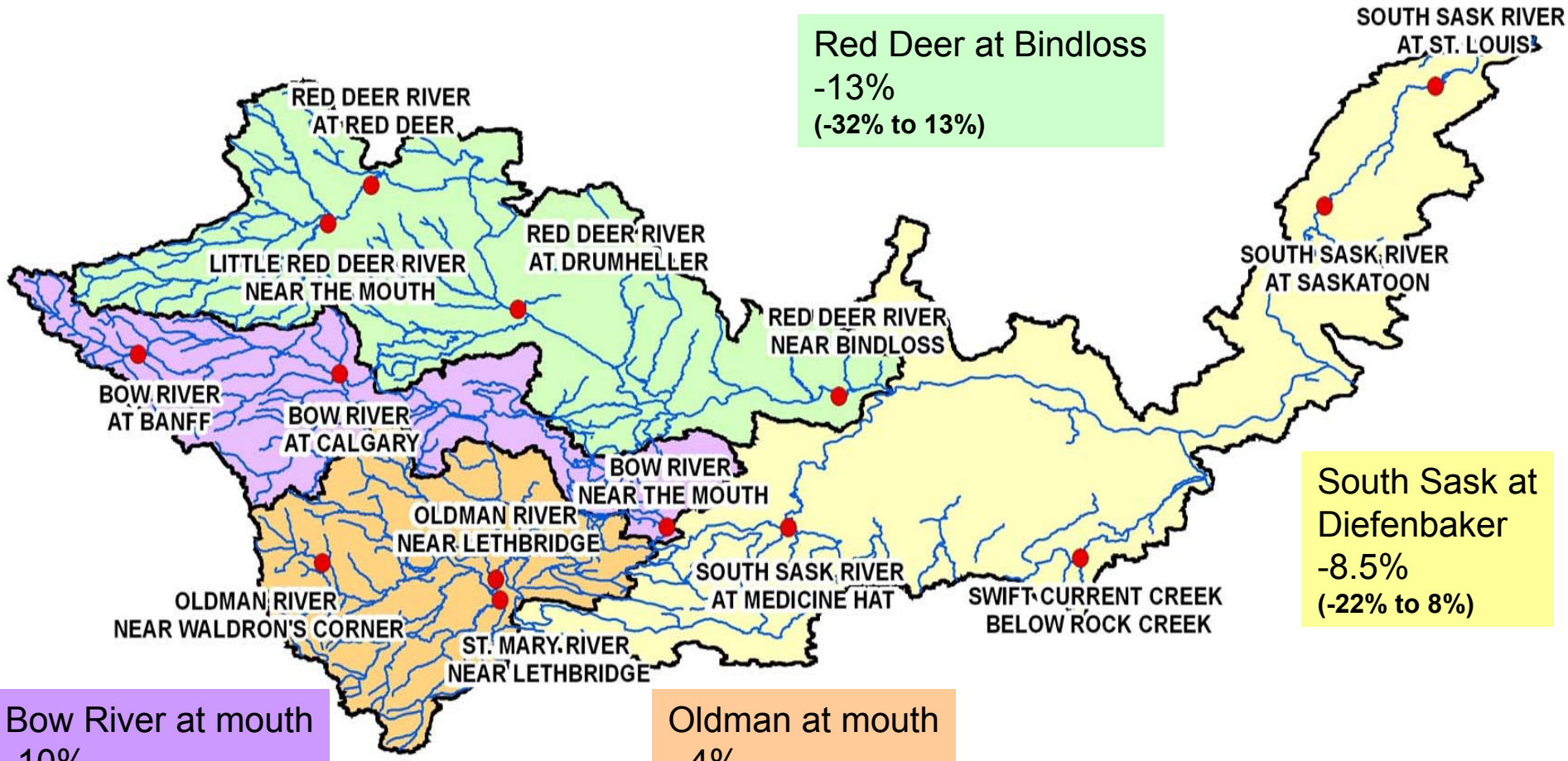
http://www.parc.ca/ssrb/index.html





Projected annual flow, 2039 – 2070

Pietroniro *et al*., 2006



Red Deer at Bindloss
-13%
(-32% to 13%)

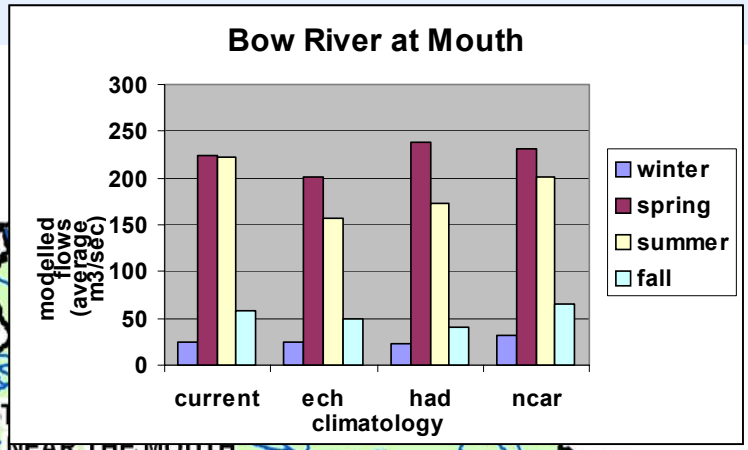
South Sask at Diefenbaker
-8.5%
(-22% to 8%)

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

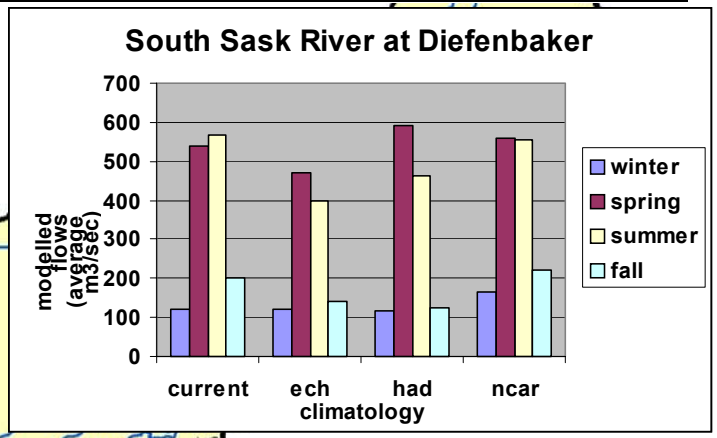
Oldman at mouth
- 4%
(-13% to 8%)

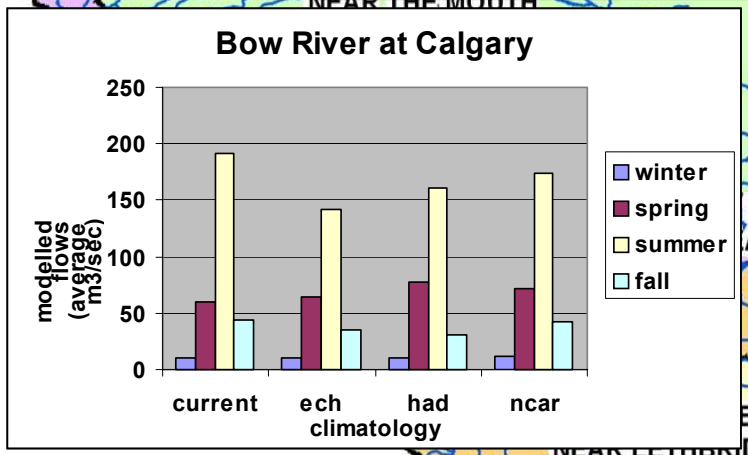
Seasonal flows, SSRB, 2039-2070

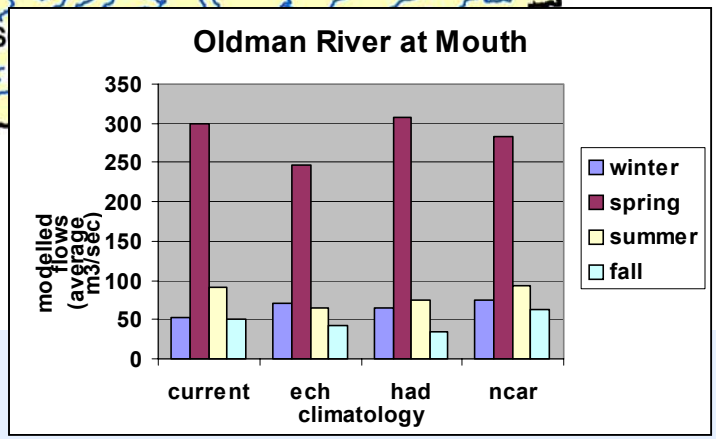
Pietroniro *et al*., 2006



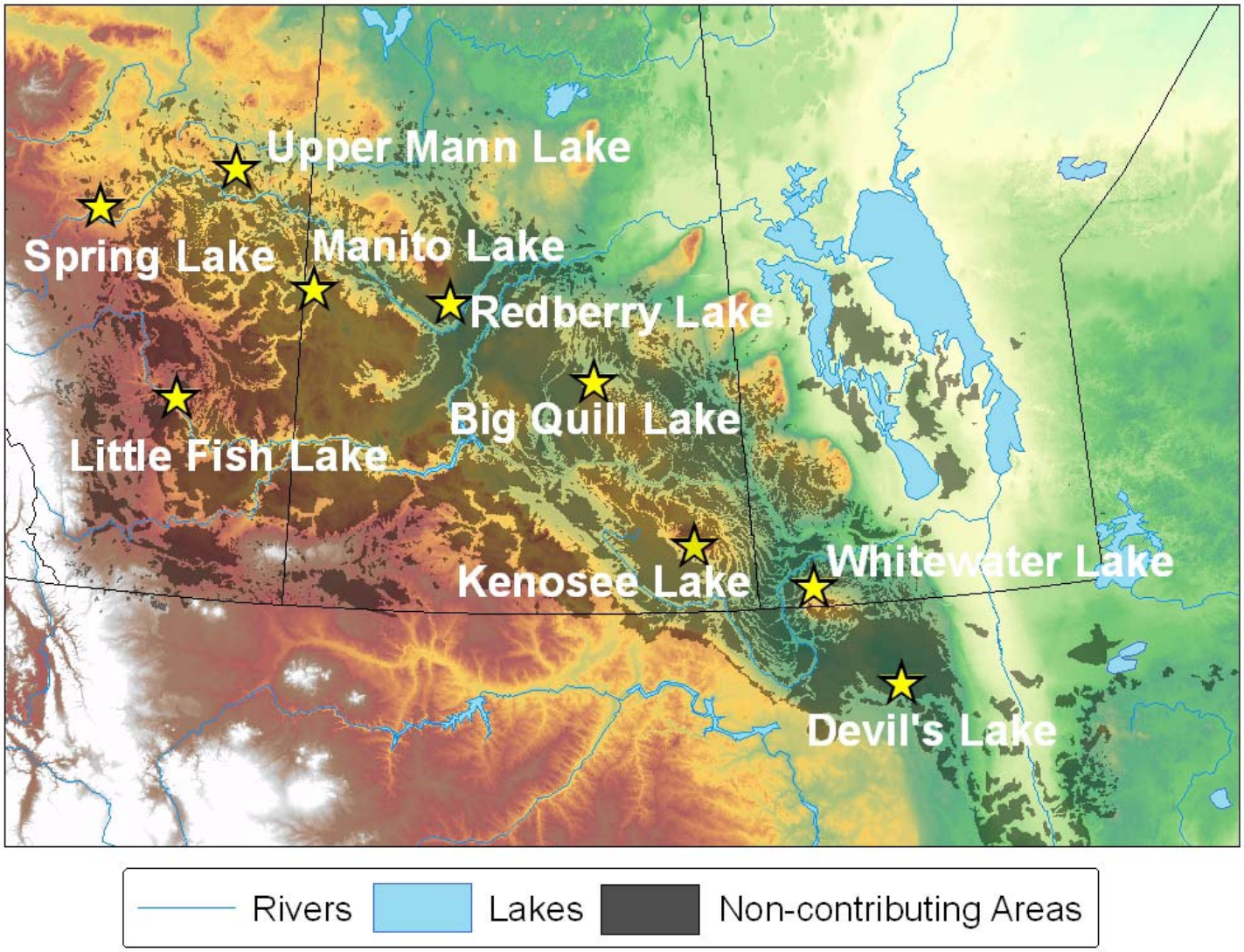
GCM	%Precip	+Temp	Description
echa21	-3.8	2.8	driest, warmest
echb21	-2.0	2.8	
hada21	6.4	2.3	moderately wet and warm
hadb21	0.2	2.1	
ncara21	11.5	1.7	wettest and least warm
ncarb21	9.1	1.5	







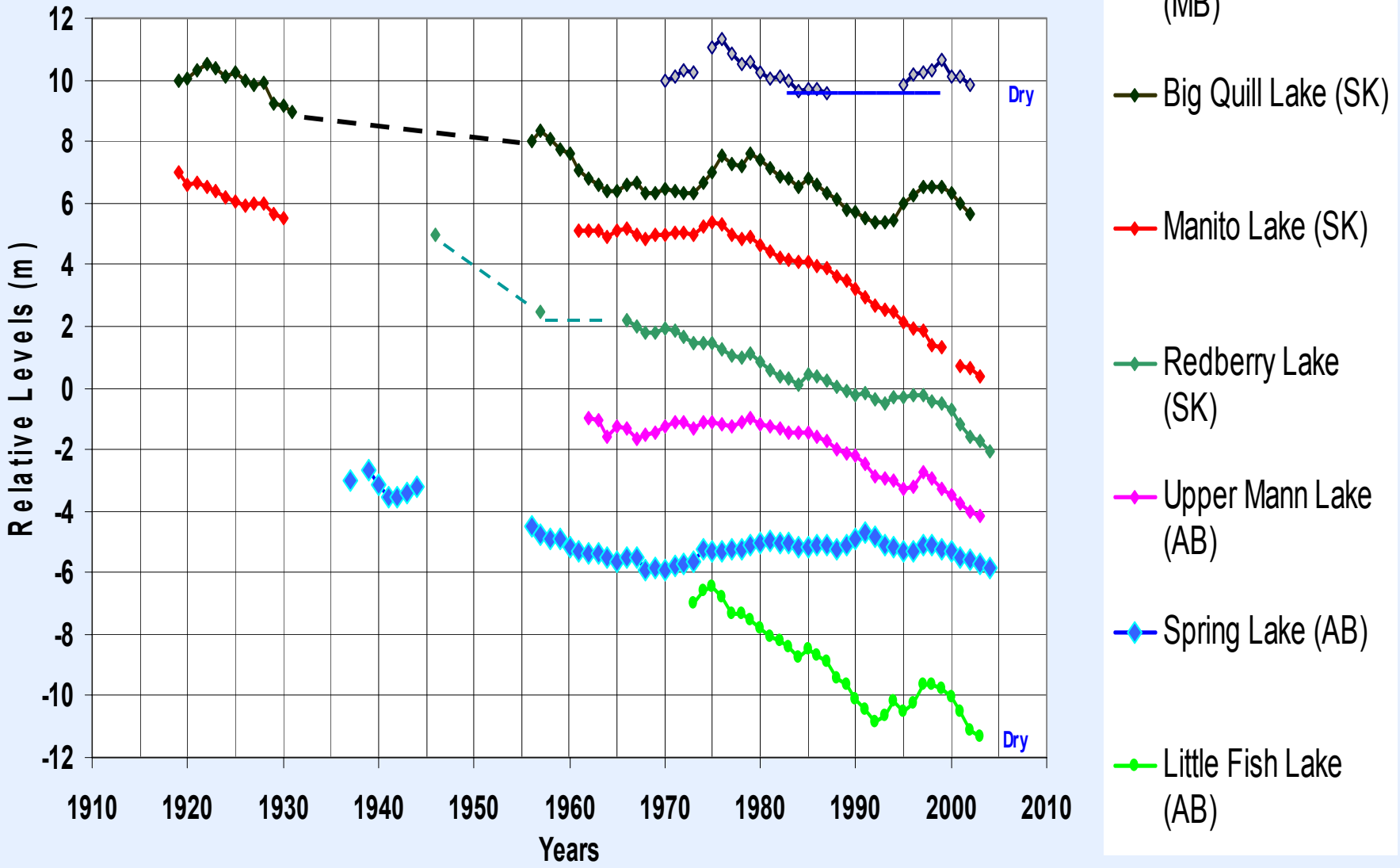
Closed-basin Prairie Lakes

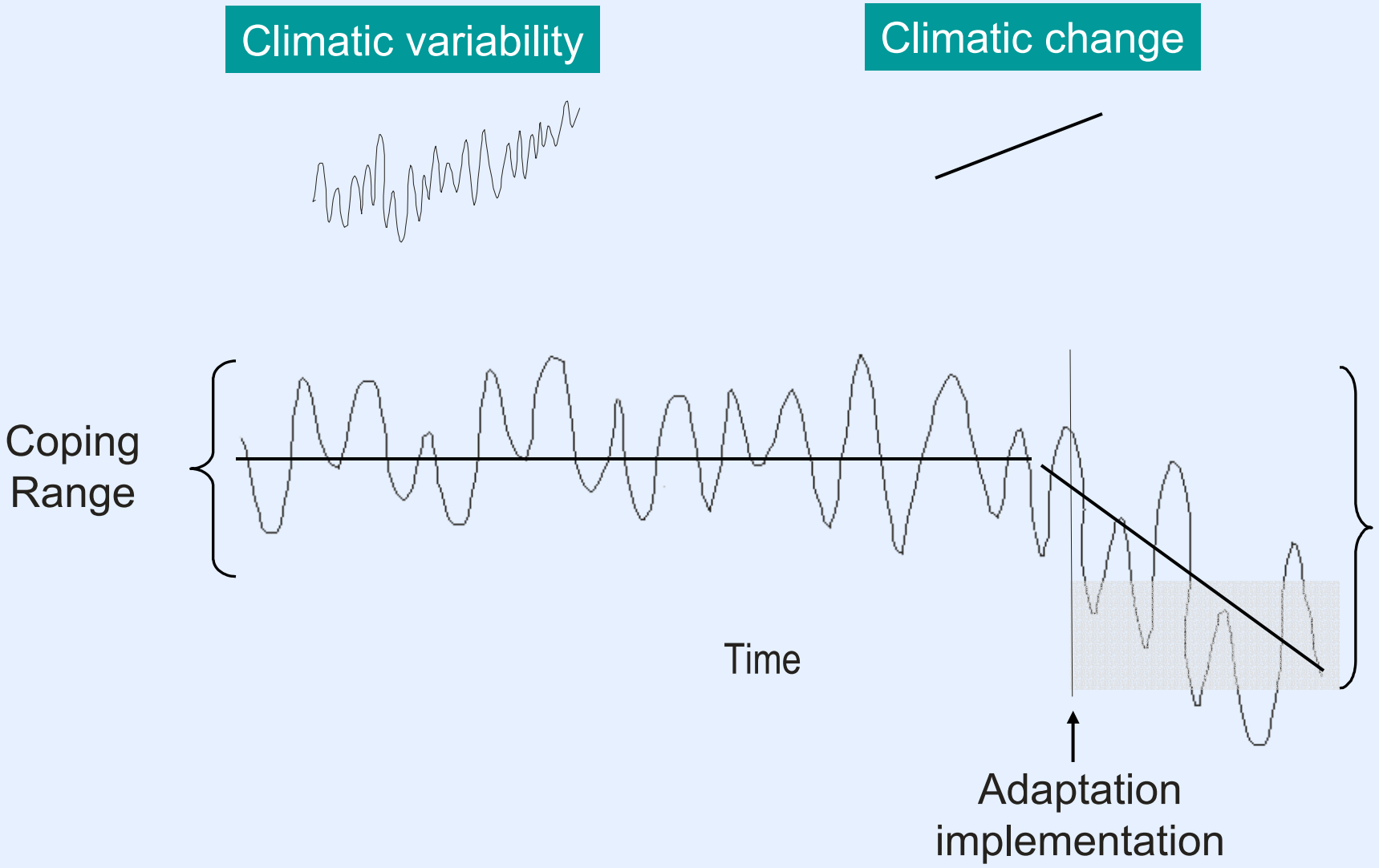


van der Kamp *et al.*)

Closed-basin prairie lakes

Water level changes, 1918-2004 (van der Kamp *et al.*)

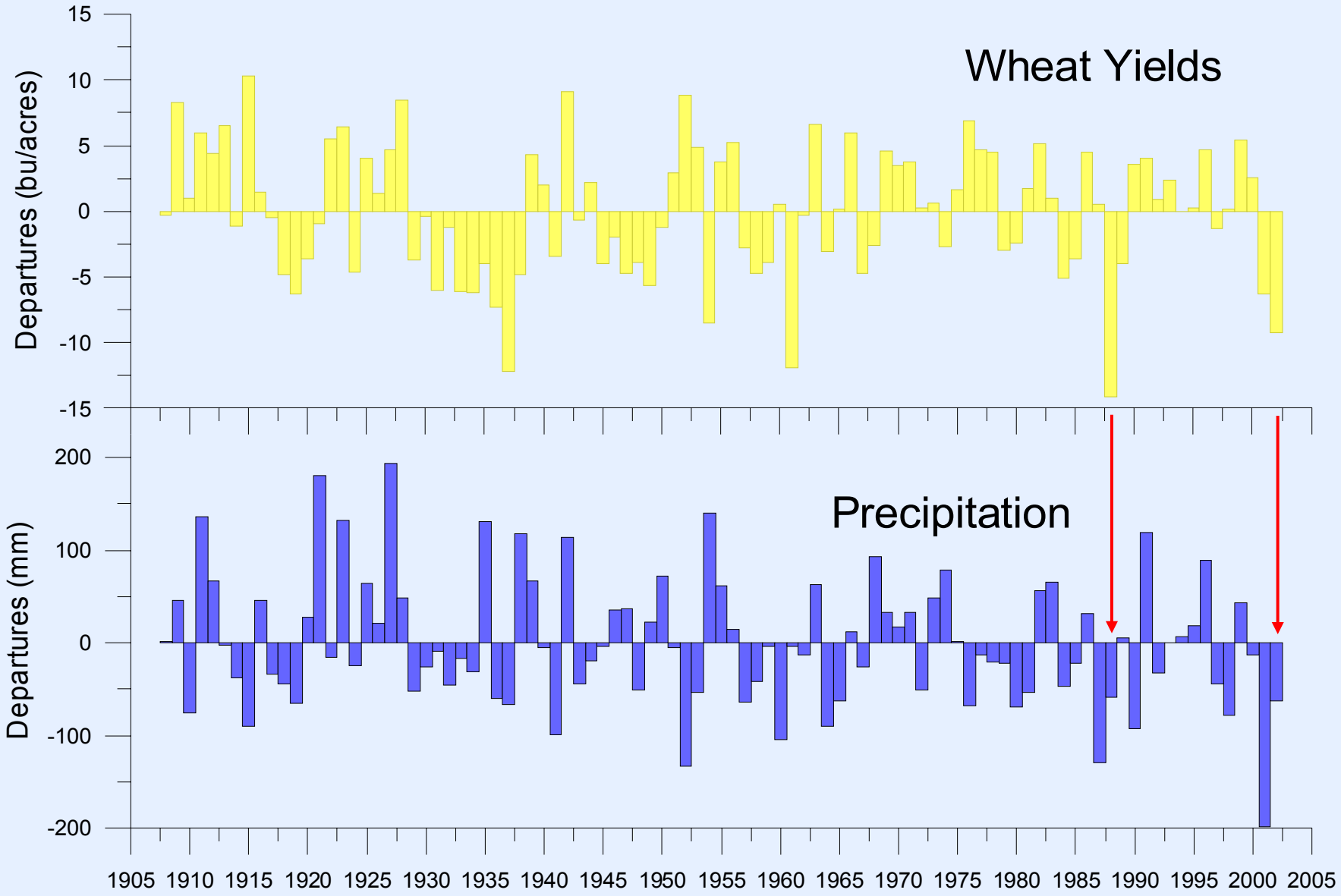



Climatic variability
Climatic change
Coping Range
Time
Adaptation implementation

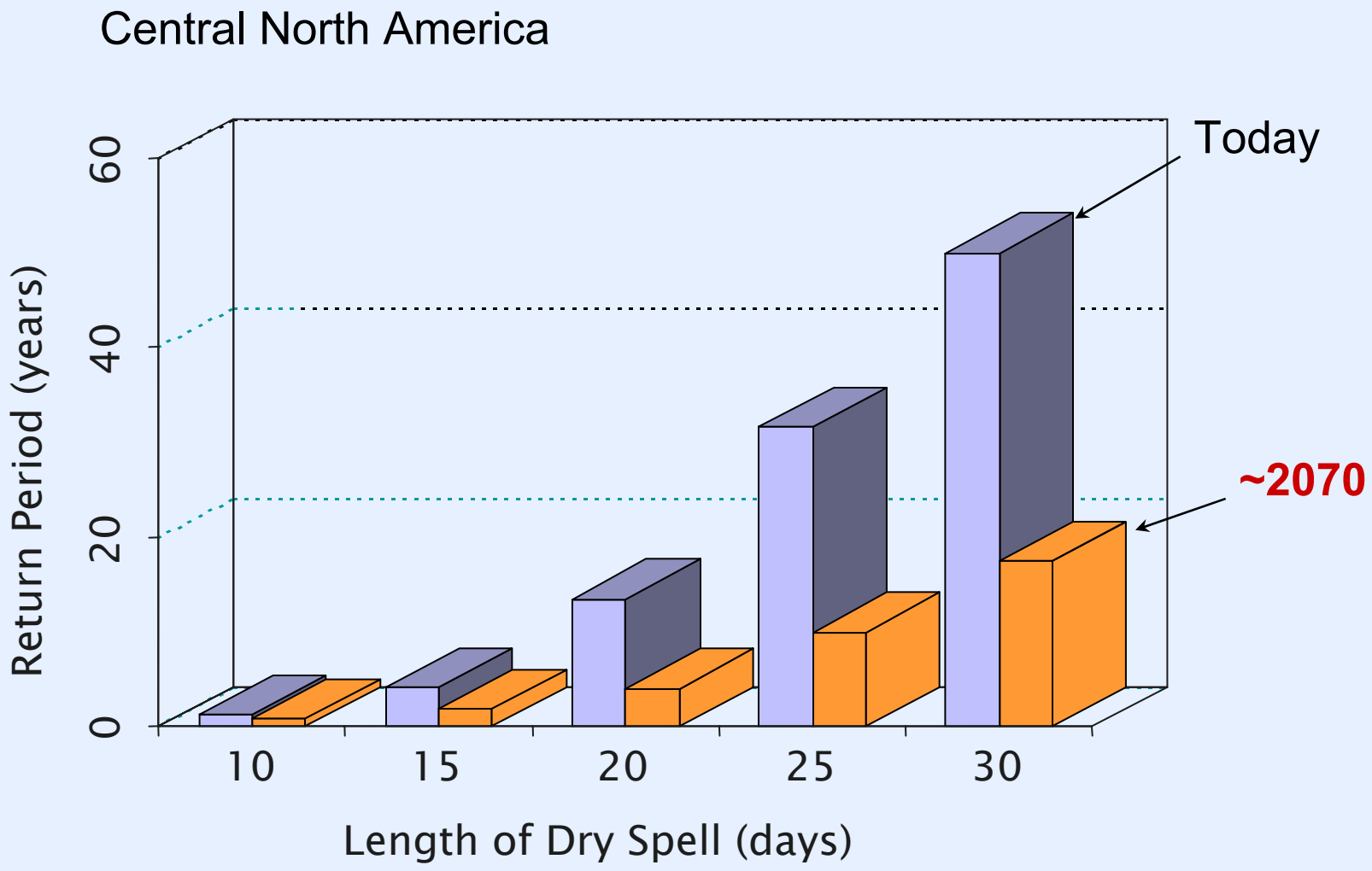
There will be greater variation from season to season and year to year

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

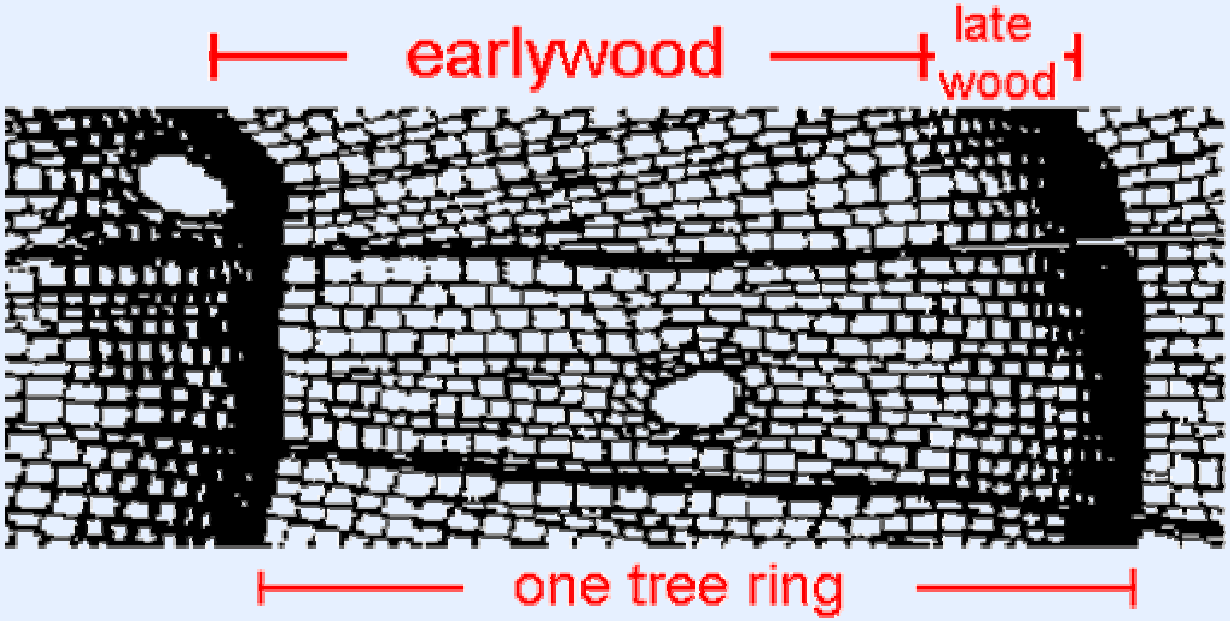
Wheat Yields, Saskatchewan / Precipitation, Saskatoon, 1906-2002

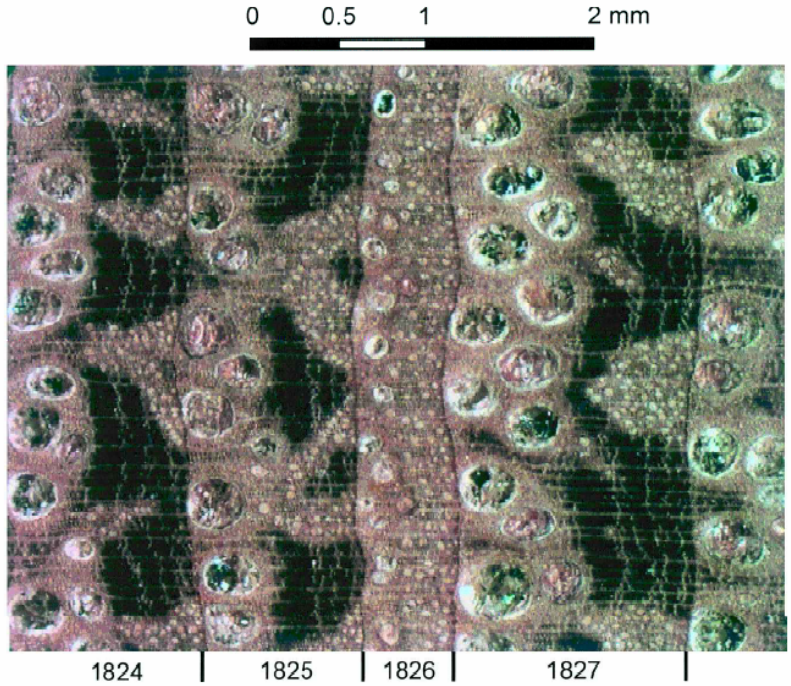


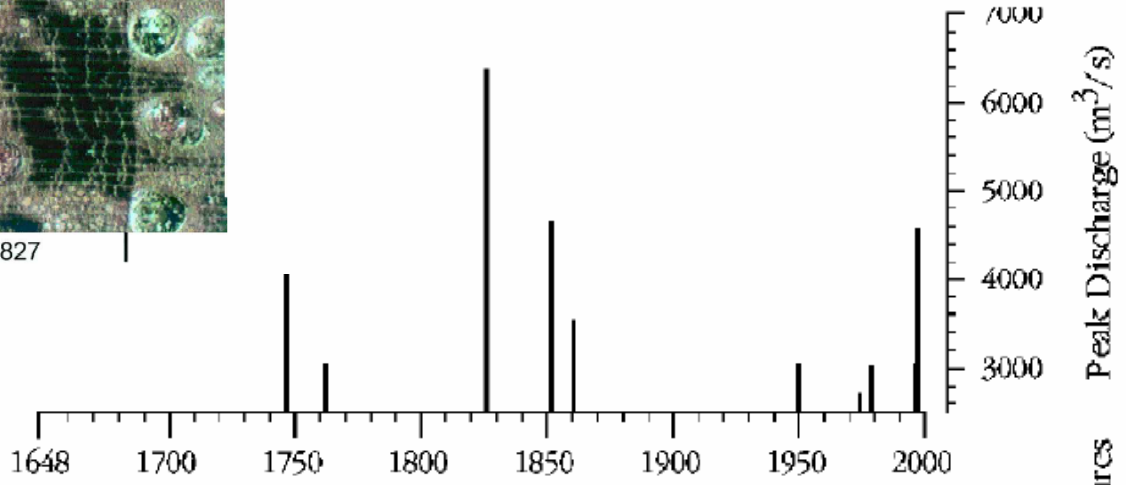
Increasing Drought Frequency

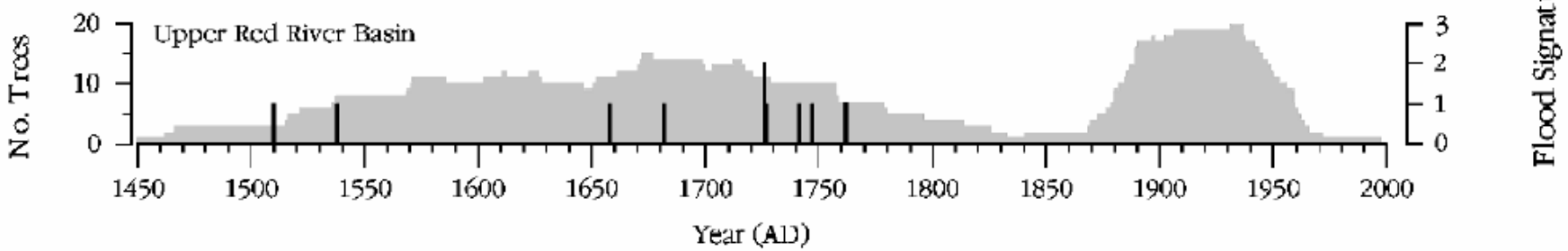


Kharin and Zwiers 2000

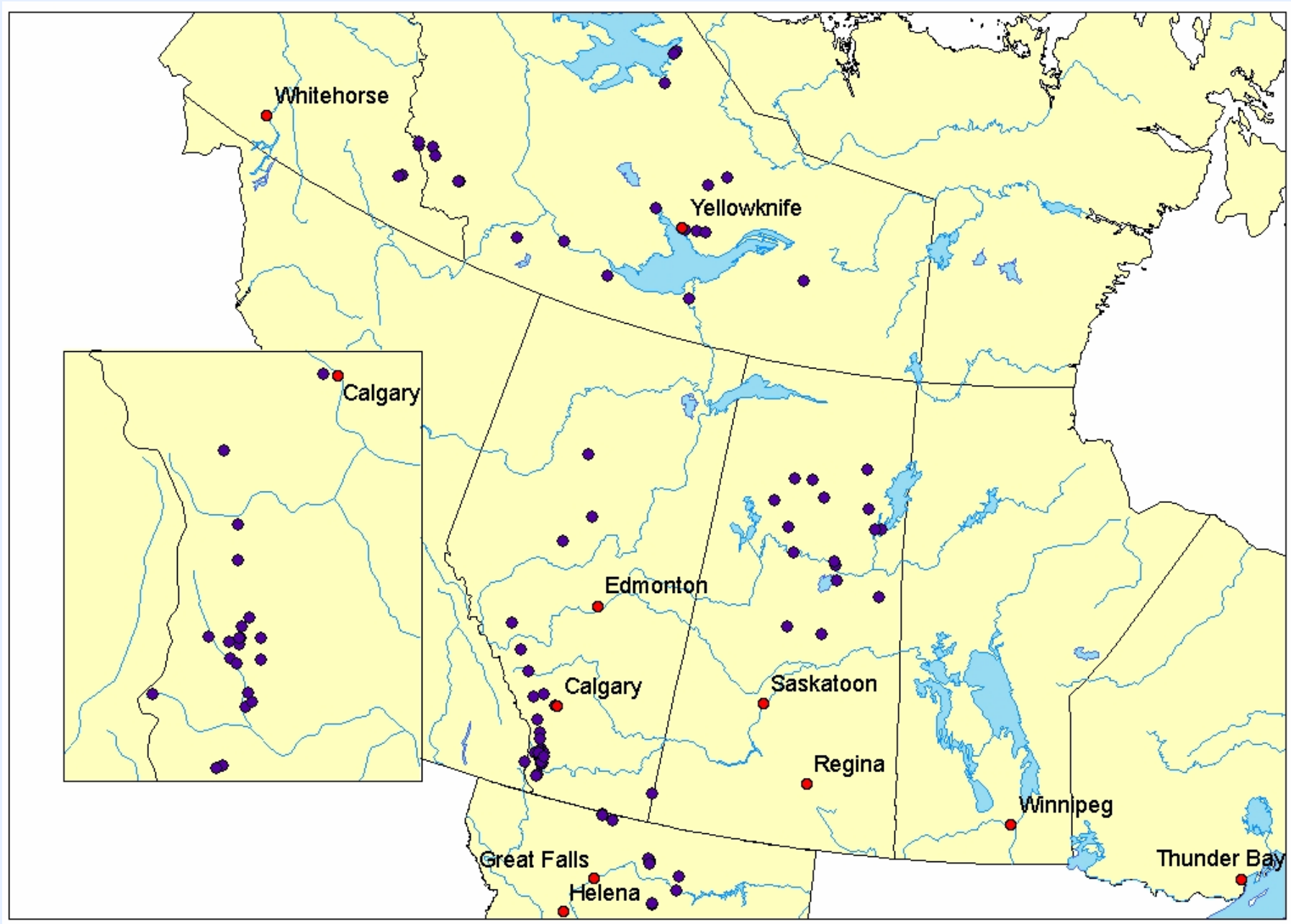

earlywood
late wood
one tree ring

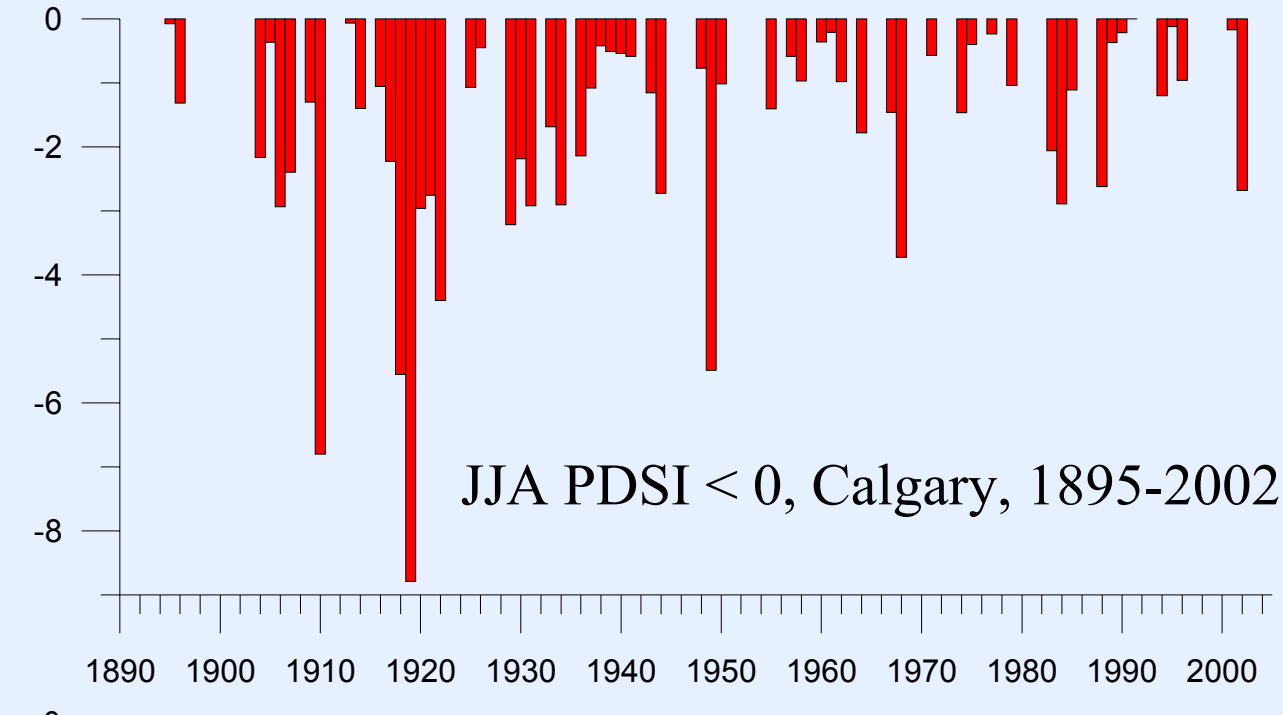

0
0.5
1
2 mm
1824
1825
1826
1827


7000
6000
5000
4000
3000
Peak Discharge (m3/s)
1648
1700
1750
1800
1850
1900
1950
2000

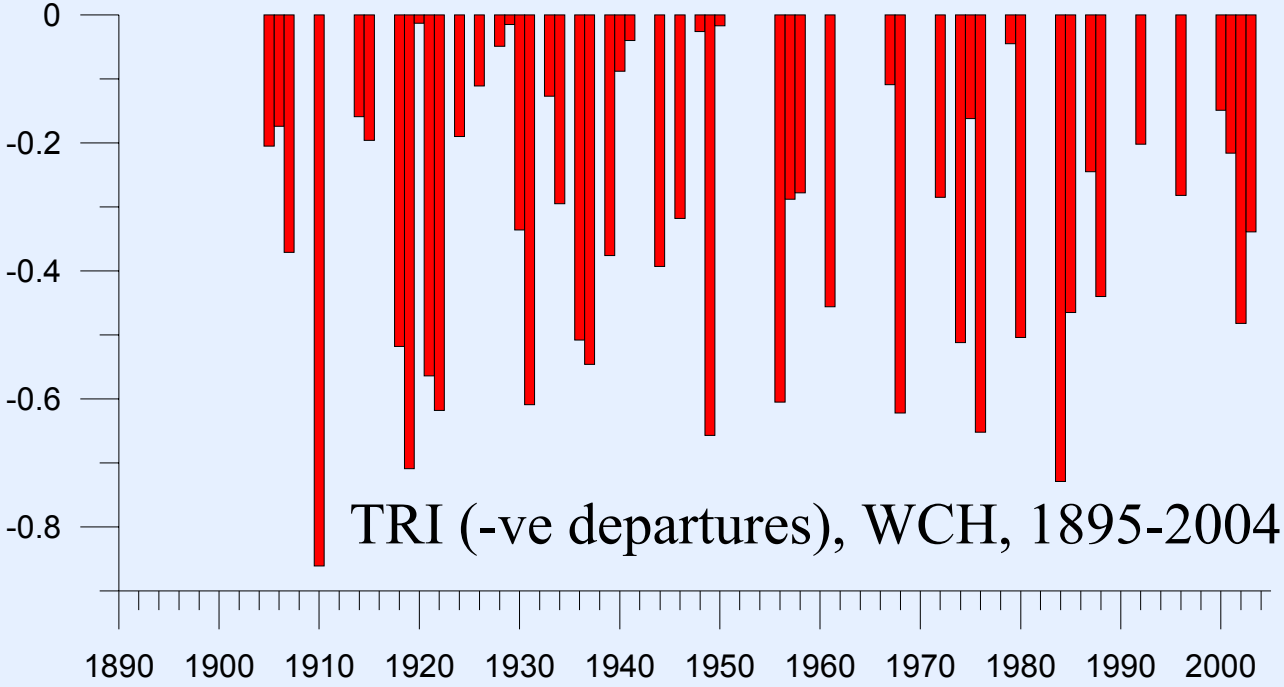

Upper Red River Basin
No. Trees
20
10
0
3
2
1
0
Flood Signatures
1450
1500
1550
1600
1650
1700
1750
1800
1850
1900
1950
2000
Year (AD)

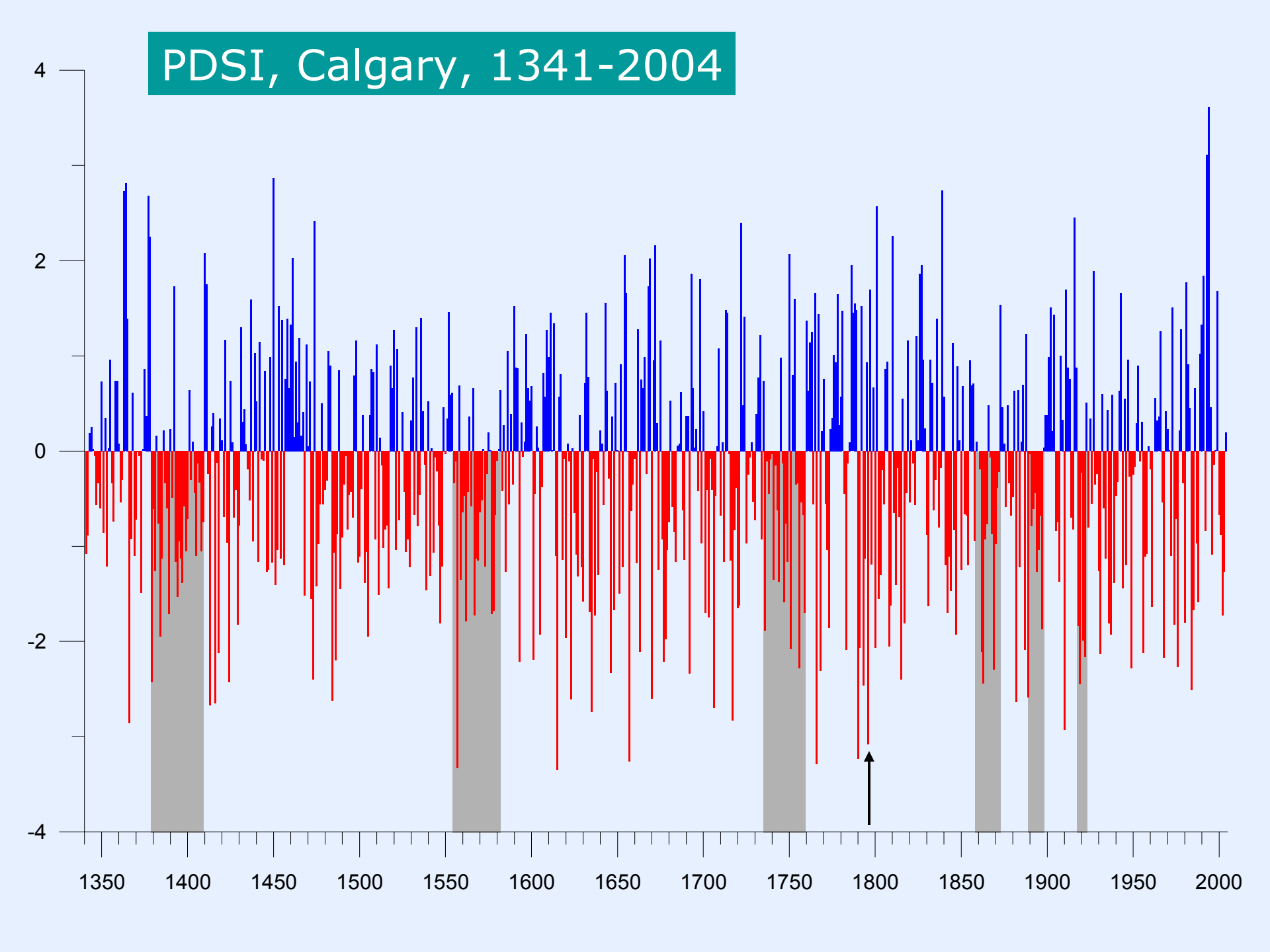
Tree-Ring Sampling Sites




0
-2
-4
-6
-8
JJA PDSI < 0, Calgary, 1895-2002
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000

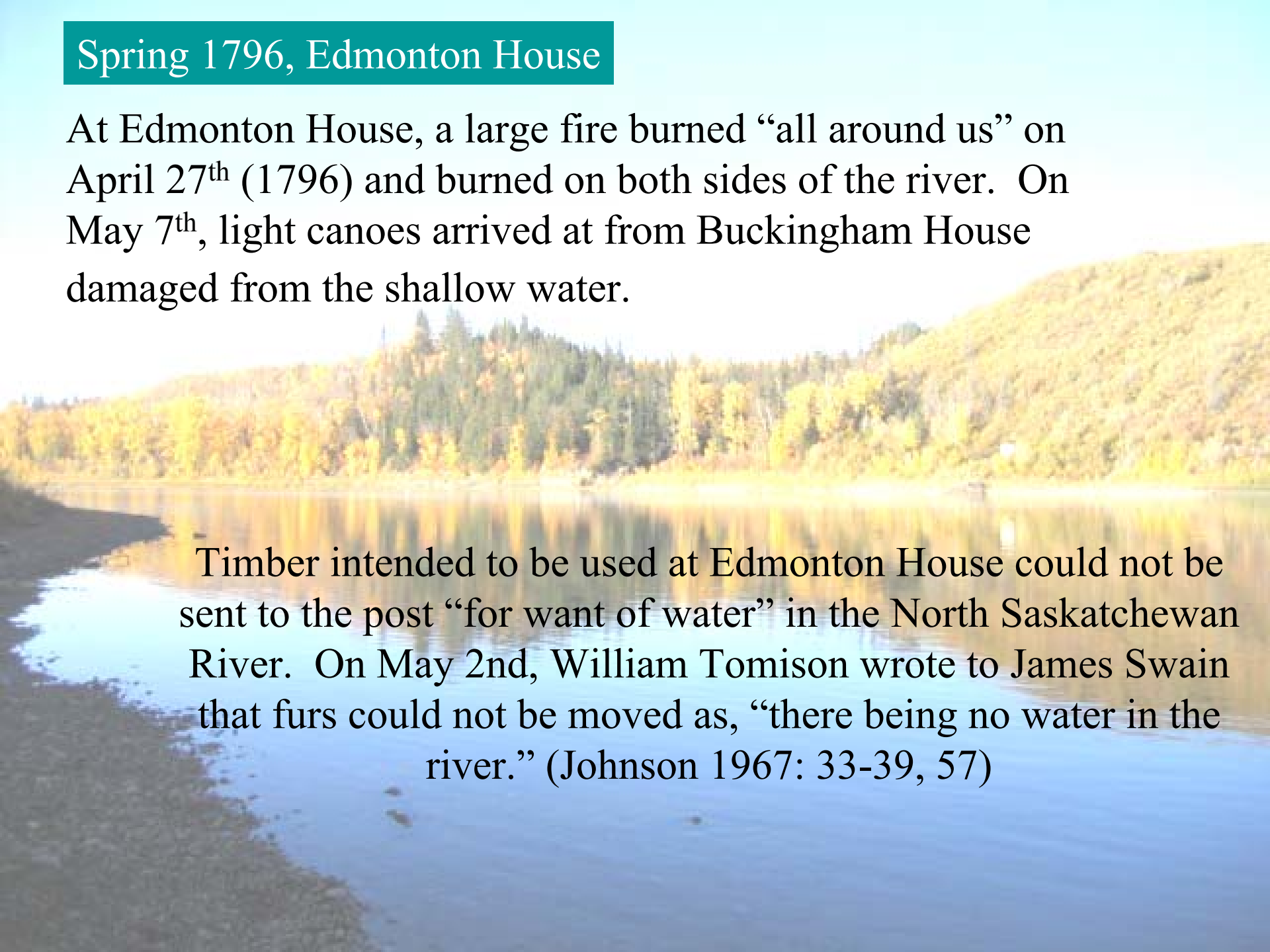
r = 0.628


0
-0.2
-0.4
-0.6
-0.8
TRI (-ve departures), WCH, 1895-2004
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000


PDSI, Calgary, 1341-2004
4
2
0
-2
-4
1350
1400
1450
1500
1550
1600
1650
1700
1750
1800
1850
1900
1950
2000

Spring 1796, Edmonton House

At Edmonton House, a large fire burned "all around us" on April 27th (1796) and burned on both sides of the river. On May 7th, light canoes arrived at from Buckingham House damaged from the shallow water.



Timber intended to be used at Edmonton House could not be sent to the post "for want of water" in the North Saskatchewan River. On May 2nd, William Tomison wrote to James Swain that furs could not be moved as, "there being no water in the river." (Johnson 1967: 33-39, 57)

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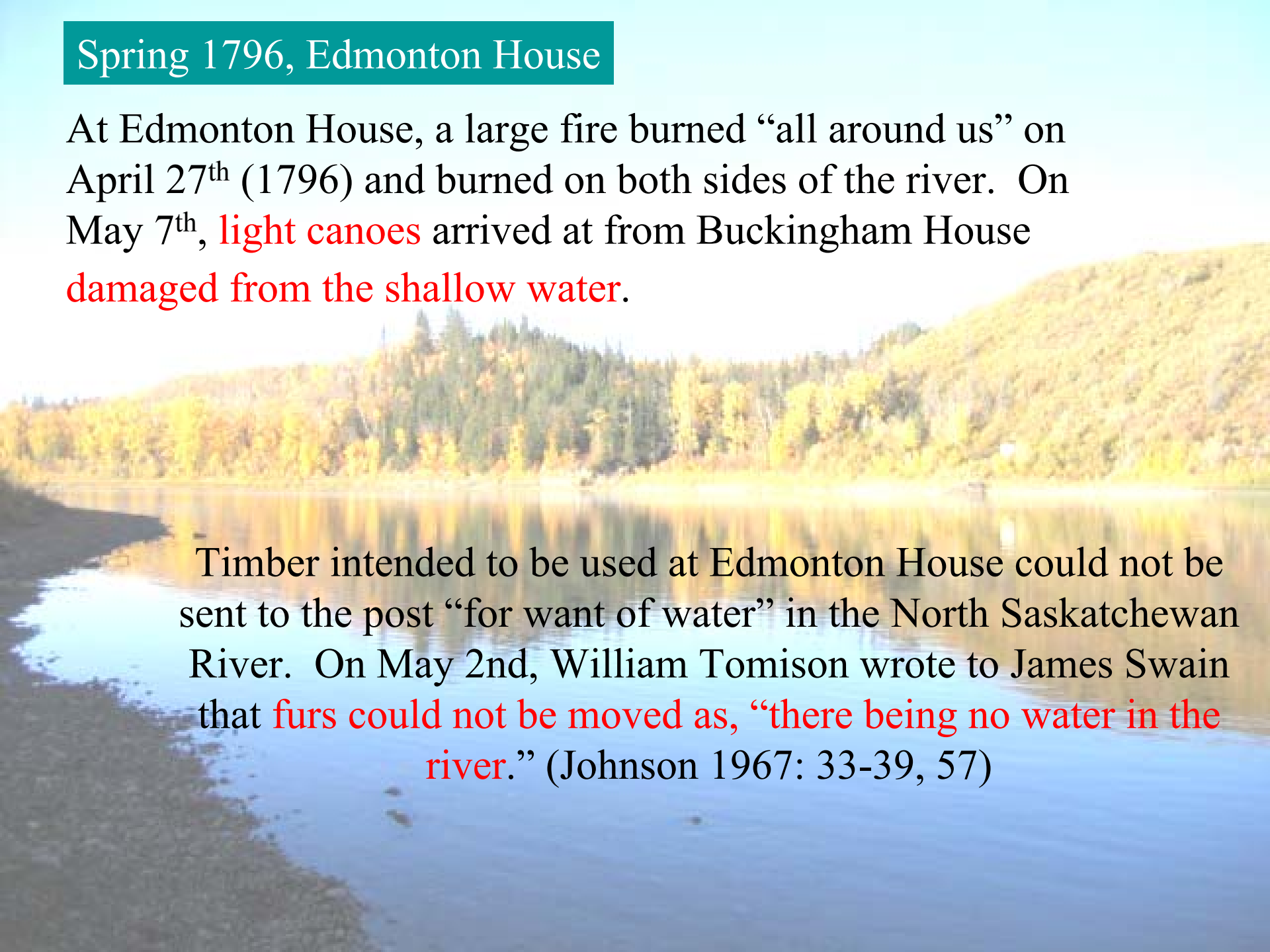

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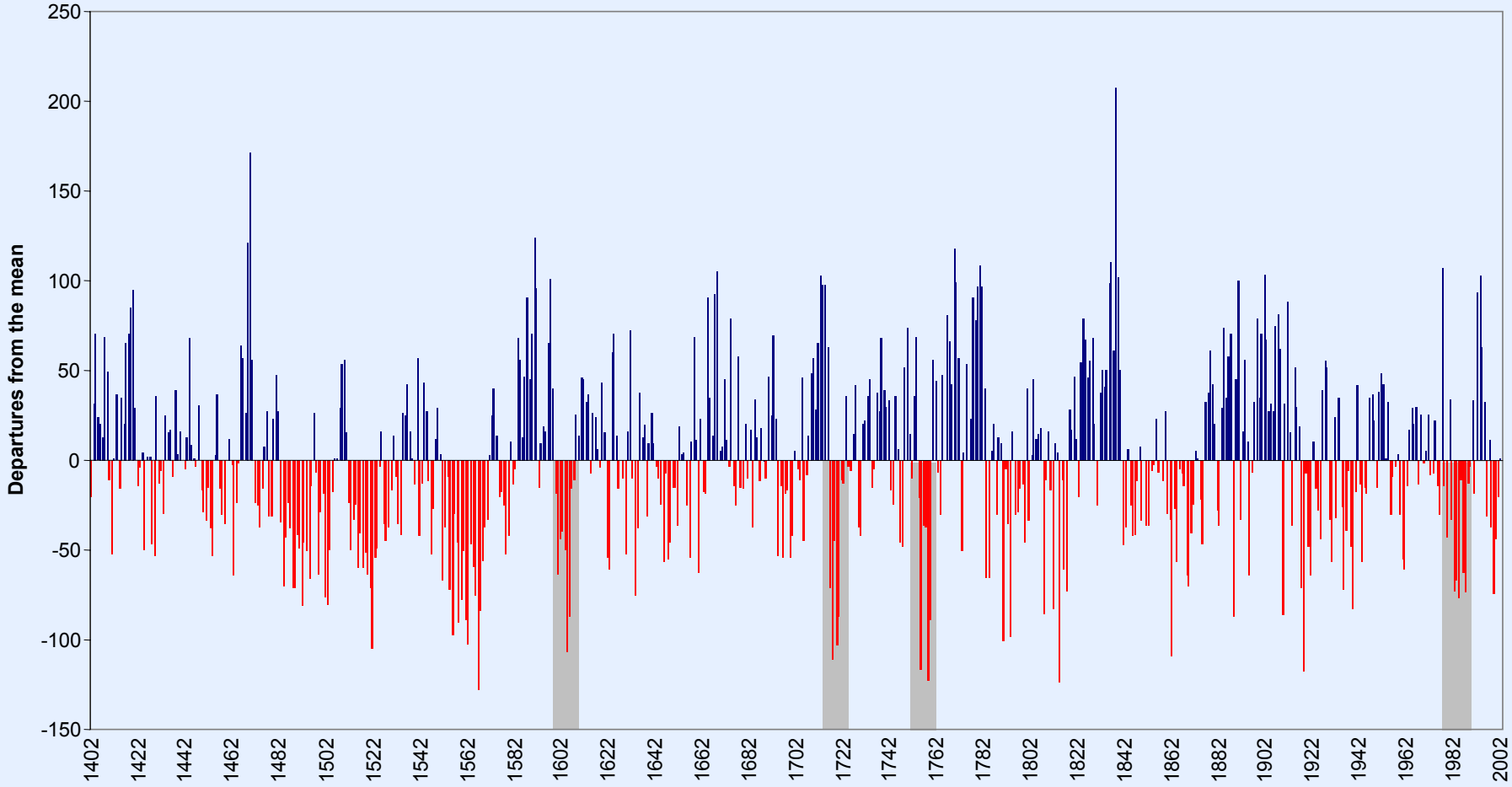
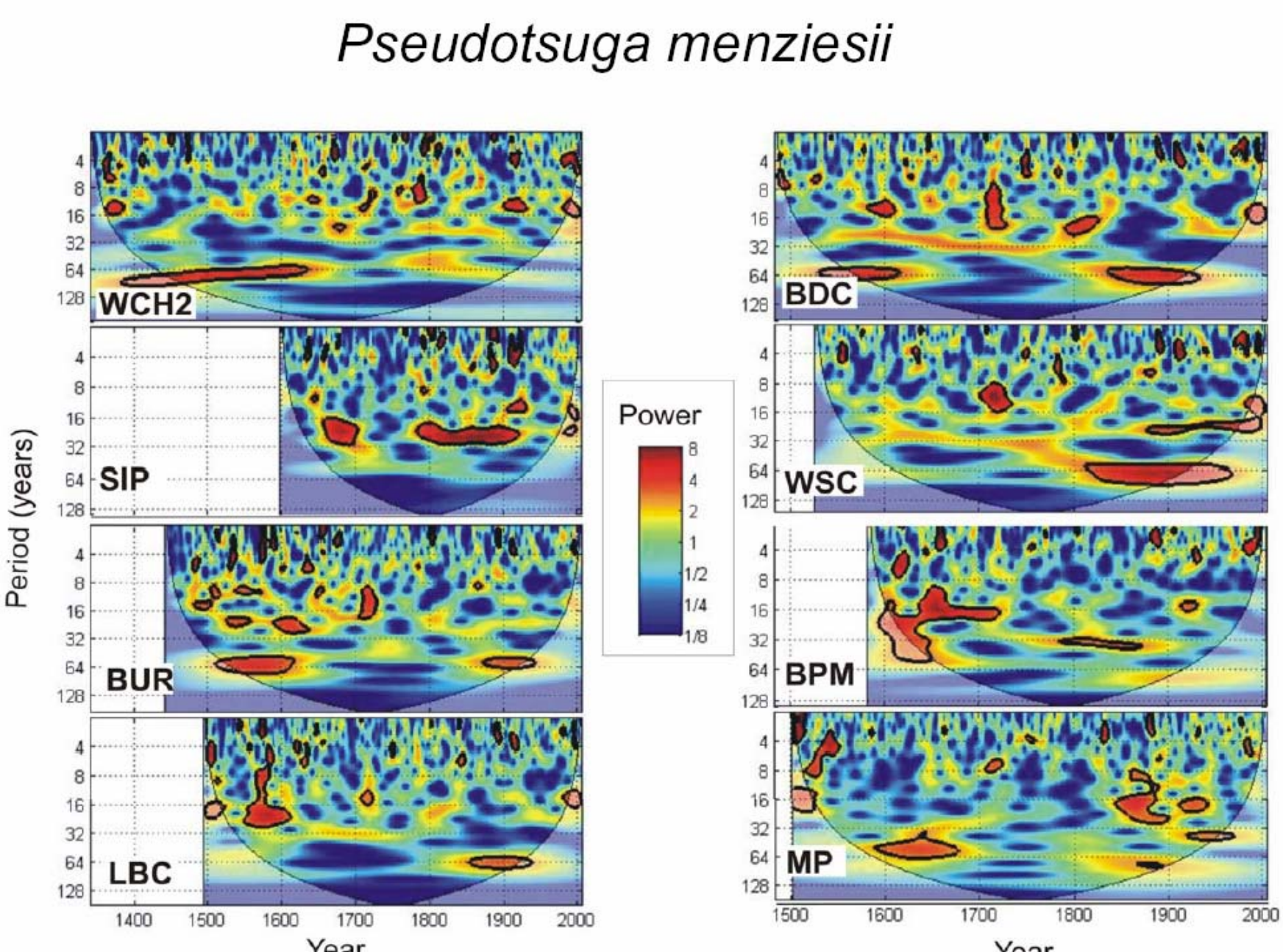
South Saskatchewan River at Medicine Hat, 1402-2004



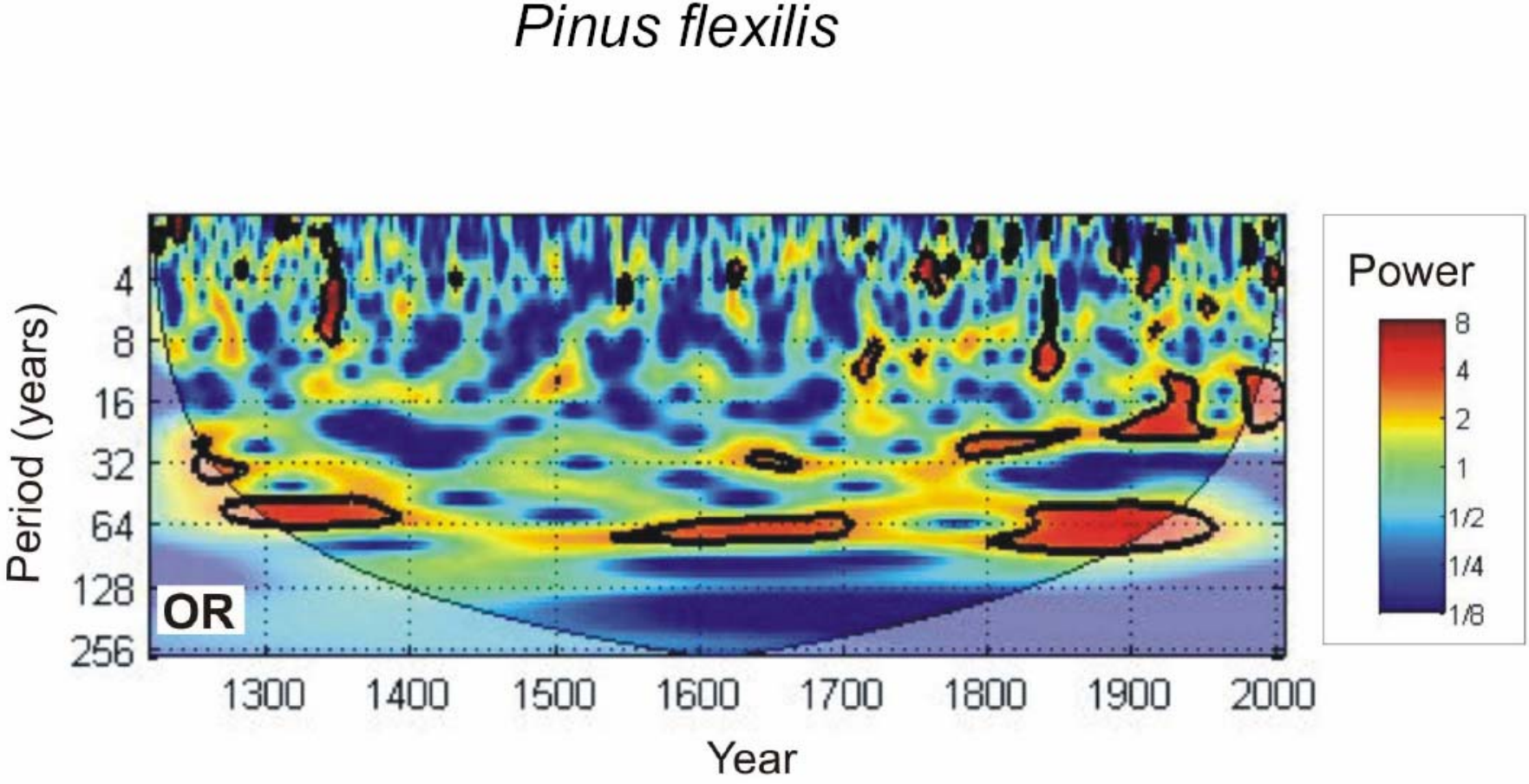
Paleohydroclimate, northern Chile

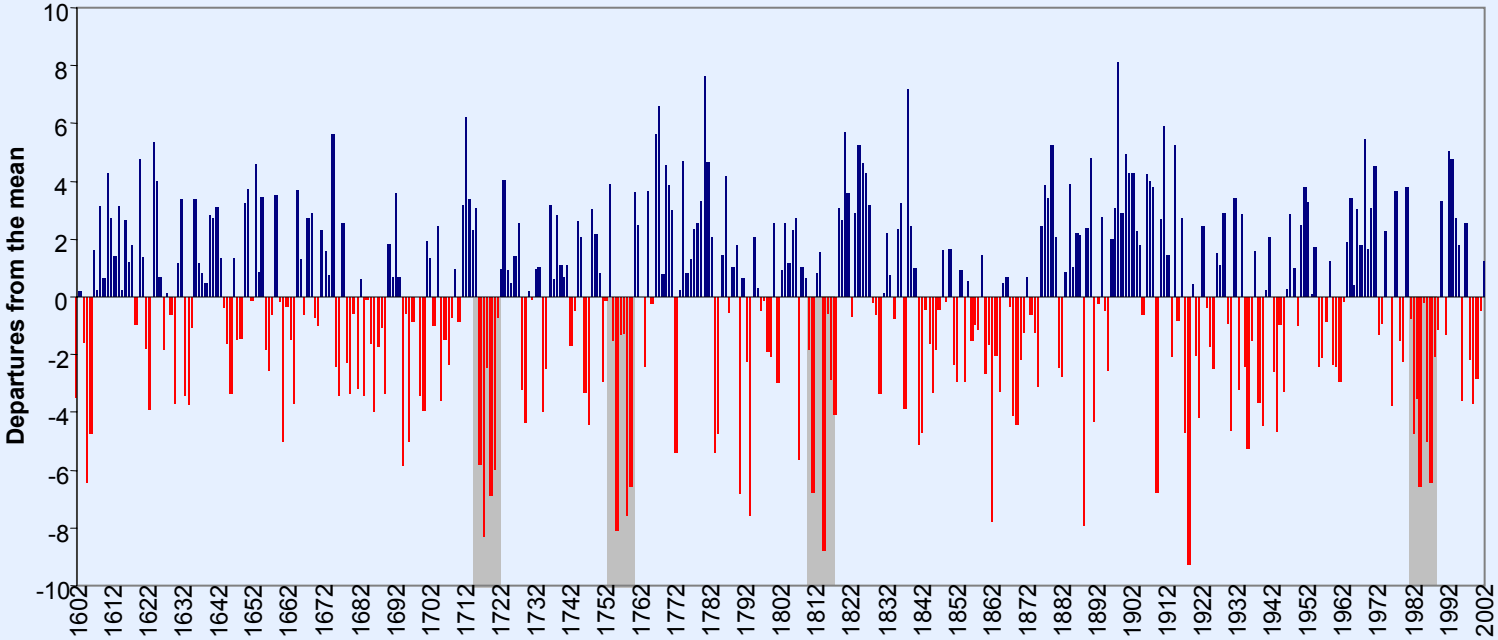
Jonathan Barichivich, Laboratorio de Dendrocronología
Universidad Austral de Chile,Valdivia

Wavelet power spectra

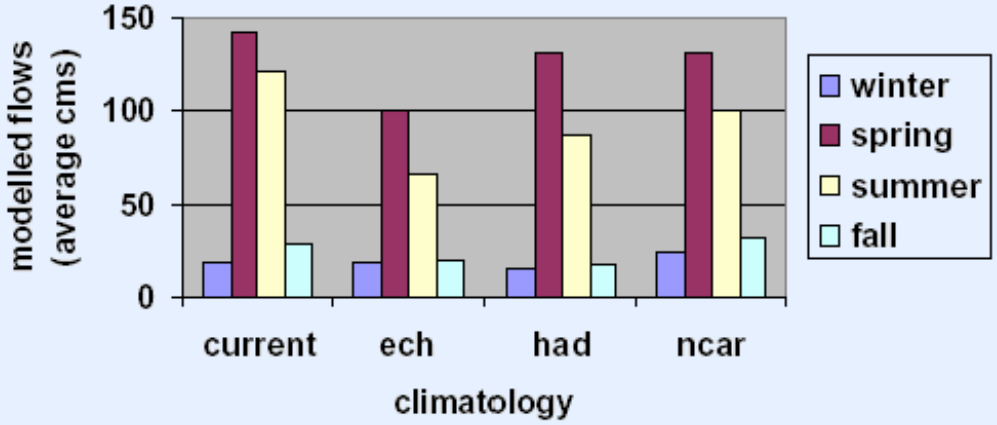


Wavelet power spectrum





Old Man River at Lethbridge



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

Most impacts are adverse because economies and activities are not adapted to change


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

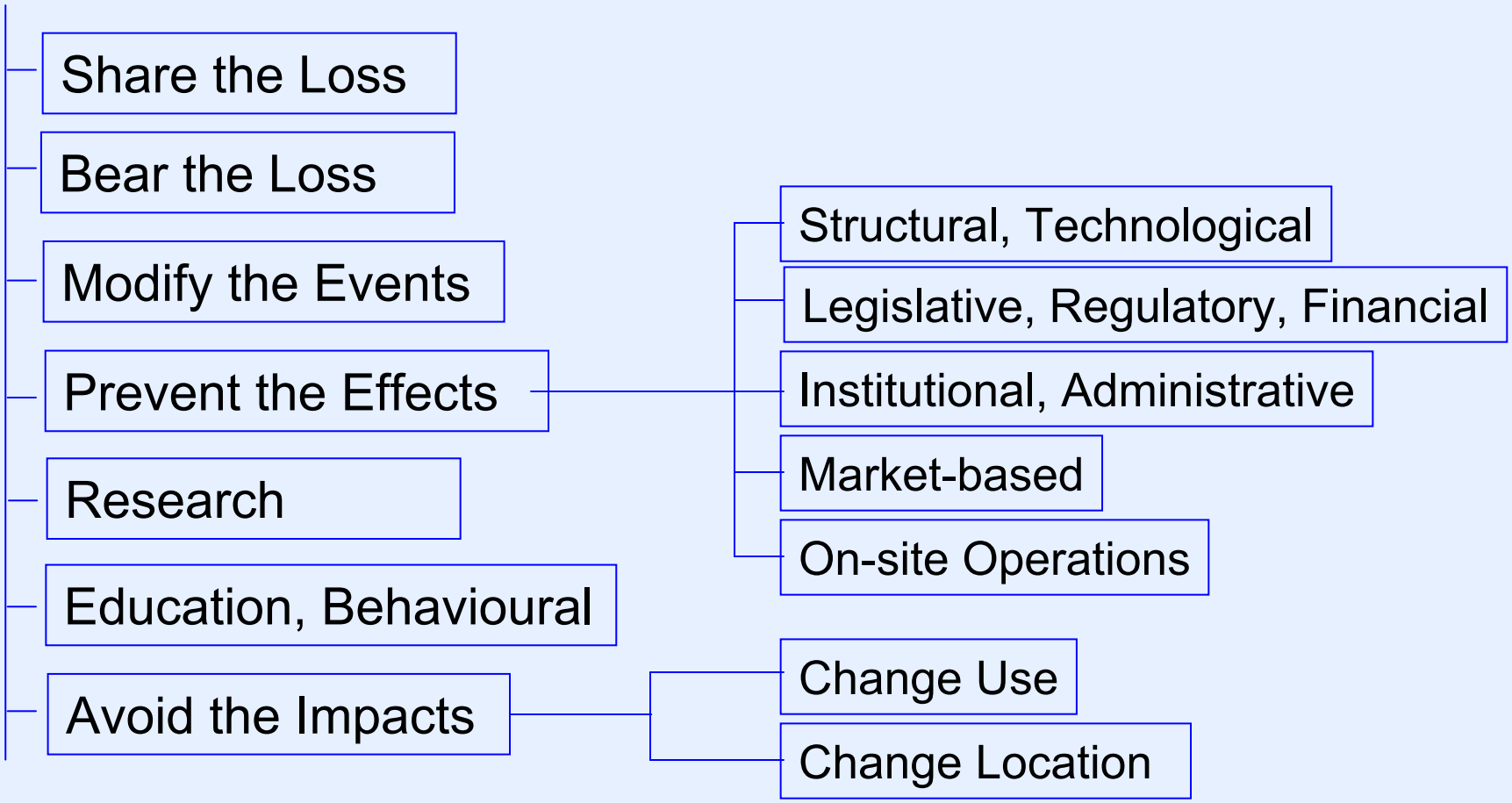
Adaptation

The degree to which adjustments are possible in practices, processes, or structures of systems to projected or actual changes of climate (IPCC, 2001).

Adaptive Capacity

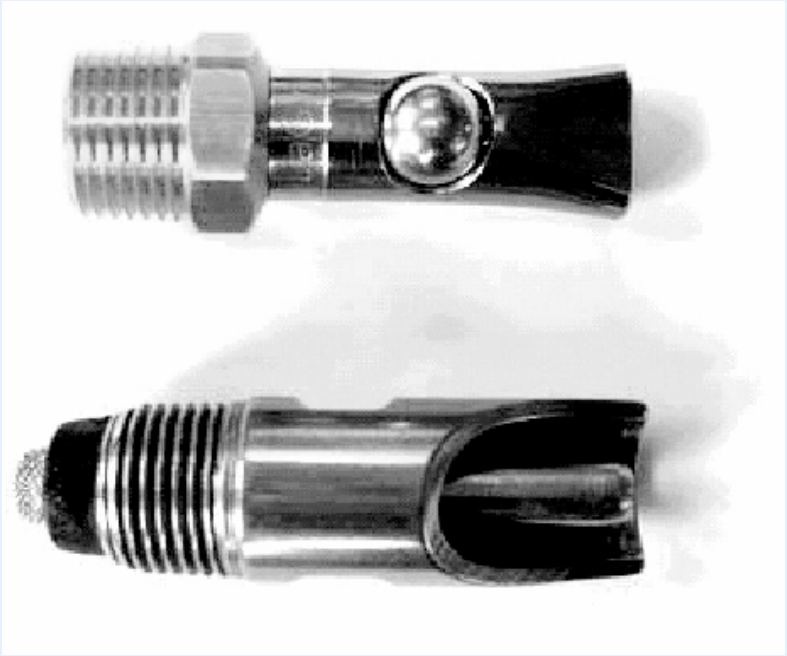
Determinant	Explanation
Economic resources	Greater economic resources increase adaptive capacity Lack of financial resources limits adaptation options
Technology	Lack of technology limits range of potential adaptation options Less technologically advanced regions are less likely to develop and/or implement 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

Adaptation Options



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 that the standard drinker sections
- no detrimental effects on the animals or facility management. the
- significant decrease in water usage led to many secondary benefits

Dennis McKerracher
JV Farms, High River, AB

Does change cost?

- Are we optimal – with everything perfected?
- Nature – conservation of mass and energy, cascades and transforms
- Human systems – 15% used, 85% wasted
- Maybe we are outrageously imperfect?
- Maybe change pays?

C. Kirkland
SaskEnergy Leadership Forum, Oct 21/02


Okanagan River Restoration Initiative
Nemes-Lougheed Re-Meandering Site 2006
Newbury
Hydraulics
Wild Earth Photography 2006

Centre for Young Farmers and 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

To achieve sustainable agriculture we must deal both with issues involving environmental impacts as well as productivity of the land. Any program to successfully develop a system of sustainable agriculture must have farmer involvement at all stages of its development, and must look at a farming system as a whole, not just at individual elements.

COMMITTEES

HOUSE OF COMMONS

39th Parliament 1st Session

Standing Committee on Environment and Sustainable Development (ENVI)

Select a Session:

39th Parliament
1st 03/04/2006
38th Parliament
1st 04/10/2004-29/11/2005
37th Parliament
3rd 02/02/2004-23/05/2004
2nd 30/09/2002-12/11/2003
1st 29/01/2001-16/09/2002
36th Parliament
2nd 12/10/1999-22/10/2000
1st 22/09/1997-18/09/1999
35th Parliament
2nd 27/02/1996-27/04/1997
1st 17/01/1994-02/02/1996

Witness Information

Documents:

- Guide for Witnesses Appearing Before Committees of the House of Commons
- Preparing a Submission to a House of Commons Committee

Search Tool:

When a "committee" or "study" option is selected, the witness search tool will re
results for the current session only.

Committee Environment and Sustainable Development (ENVI)

Study ALL

Or

Contains Starts with

Name Sauchyn

Contains Starts with

Example: John Smith

Organization

Contains Starts with

Search

1020

Mr. Nathan Cullen
Dr. David Sauchyn
Mr. Nathan Cullen
Dr. David Sauchyn
Mr. Nathan Cullen
Dr. David Sauchyn
Mr. Nathan Cullen
The Chair
Dr. David Sauchyn
The Chair
Mr. Mark Warawa
Mr. Michael Cleland

1025

Mr. Mark Warawa
Mr. Kory Teneycke
Dr. David Sauchyn

Thanks