Managing the Message in a Variable Climate: Communicating Climate Science in Canada's Western Interior

Dave Sauchyn, Prairie Adaptation Research Collaborative, University of Regina

Exploring Regional Climate Services: Meeting Stakeholder Needs for Practical Climate Information, Victoria 21-23 November 2011

The **Prairie Adaptation Research Collaborative** (PARC) 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.

UNIVERSITY OF REGINA

PARC

- Alberta Vulnerability Assessment Project
  - Climate Change Scenarios
  - Biophysical Impact Assessment
  - Integrated Vulnerability Assessment
- Saskatchewan's Natural Capital In A Changing Climate
  - Climate Change Scenarios
  - Assessment of Biophysical Impacts and Adaptation
- Prairies Chapter, National Assessment of Climate Change Impacts and Adaptation

- Prairies Regional Adaptation Collaborative (**Prairies RAC**)

PRAIRIES REGIONAL ADAPTATION COLLABORATIVE


Water


Drought & Excessive Moisture


Ecosystems


Forums

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PRAC >>

The Prairies Regional Adaptation collaborative (PRAC) is built on shared themes and a similarity of expected climate change impacts and vulnerabilities related to a changing moisture balance across the three Prairie Provinces.

The objective of the PRAC is to advance climate change adaptation decision-making in relevant policy areas and lead to the development of targeted policies and other instruments that encourage appropriate adaptation responses to current and foreseen climate change.

Specific activities of the PRAC include refining policy questions, building the knowledge base through use of appropriate modelling tools at appropriate scales, economic analysis, developing policy options, and engaging decision makers and stakeholders through discussions and forums.

The PRAC has three areas of climate change focus: water resource management, drought and excess moisture management, and terrestrial ecosystems adaptation. Please visit the three specific themes for detail on workplans and objectives. Common to all three themes will be forum activities designed to encourage knowledge transfer as well as develop adaptation options for dealing with climate change risks and opportunities.PRAC participants include Provincial Governments, Crown Corporations, industry, universities and climate research institutions.

University of Regina

PARC

CGCM

SRC smart science solutions

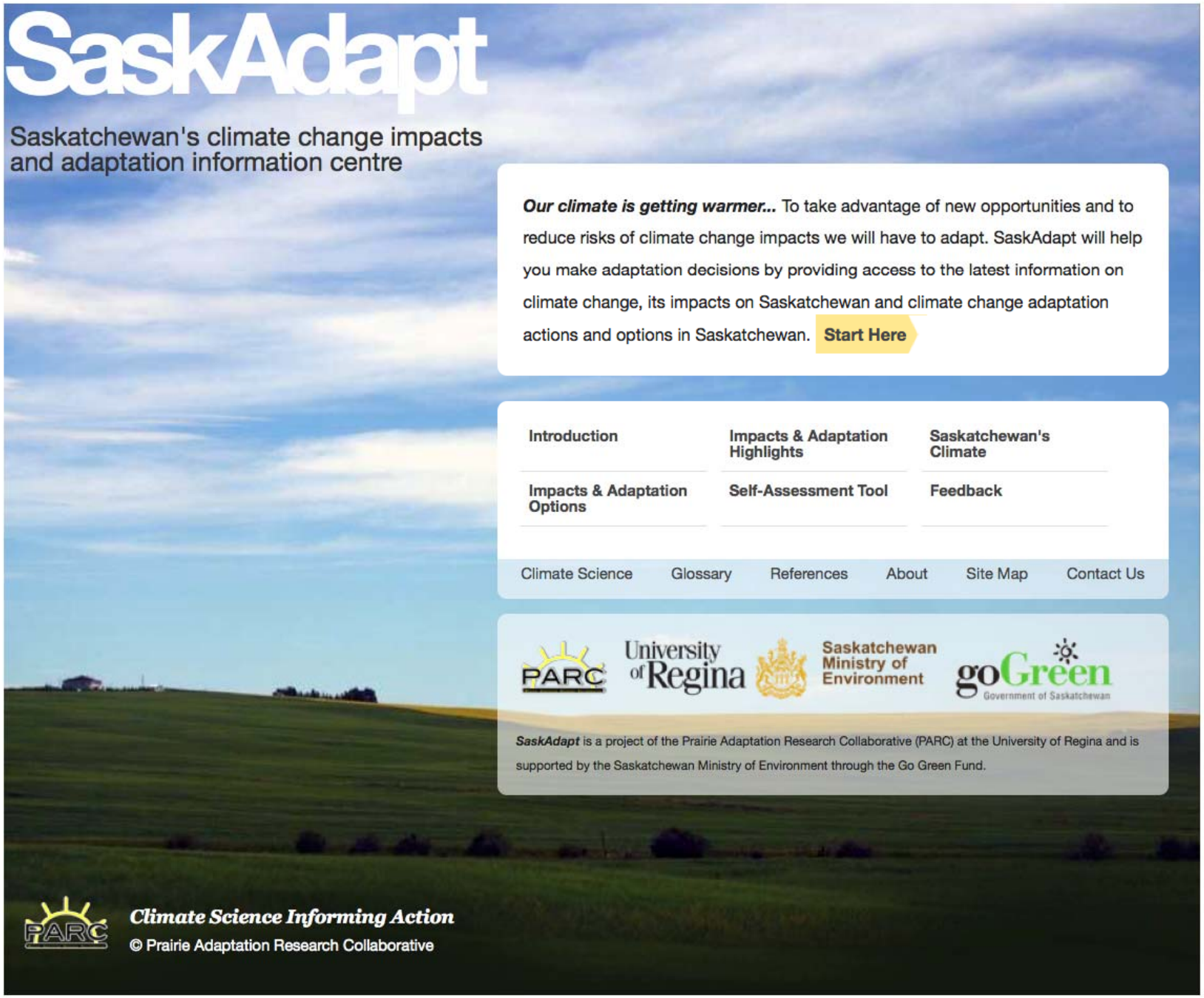
Saskatchewan Watershed Authority

Manitoba

Alberta
Freedom To Create. Spirit To Achieve.

With Funding Support From

Natural Resources Canada / Ressources naturelles Canada
Canada


SaskAdapt
Saskatchewan's climate change impacts and adaptation information centre
Our climate is getting warmer... To take advantage of new opportunities and to reduce risks of climate change impacts we will have to adapt. SaskAdapt will help you make adaptation decisions by providing access to the latest information on climate change, its impacts on Saskatchewan and climate change adaptation actions and options in Saskatchewan.
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Impacts & Adaptation Highlights
Saskatchewan's Climate
Impacts & Adaptation Options
Self-Assessment Tool
Feedback
Climate Science
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Vulnerability and Adaptation to Climate Extremes in the Americas (VACEA)

Vulnerabilidad y Adaptación a los Extremos Climáticos en las Américas

Principal Investigators:

Los investigadores principales

Dr. Dave Sauchyn, University of Regina, Canada
Dr. Fernando Santibañez, Universidad de Chile, Santiago

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www.parc.ca/vacea

Project Overview

VACEA addresses a gap in the current understanding of the consequences of global climate change for regional climate variability and extremes and the resulting vulnerabilities of agricultural and indigenous communities. Our goal is to provide new knowledge to strengthen the capacities of governance institutions and rural populations in Canada, Argentina, Brazil, Chile and Colombia to adapt to shifts in climate variability and the frequency of extreme events. The research framework, based on a vulnerability assessment model, actively engages stakeholders and directs all research activities towards evaluating past, current and future exposure, sensitivity and adaptive capacity, and applying this new knowledge to the design of improved adaptation strategies.

The interdisciplinary research program will have ***three major themes***:

1) Regional Vulnerability Assessment,

2) Climate and Agro-Ecological Variability, and

3) Integrative Risk Analysis.

Theme 1 takes a community-oriented and participatory approach to the study of adaptation policies and practices.

Theme 2 advances scientific understanding of regional climate variability and extreme events and their agro-environmental impacts.

Theme 3 integrates the work of Themes 1 and 2 and applies the research findings to an assessment of the climate risks faced by the rural communities.

With our project partners from the communities and governance institutions we will identify options for managing this risk through adaptive management practices and appropriate governance and policy. We will gather input and advice from the rural communities, agricultural sector, and institutional decision makers to ensure community- and policy-relevant outcomes and deliverables.

Mixed farmer RM #51

I'm **not one of those guys who thinks the climate has gone all to crap** for any particular reason. Down through history the **climate has changed lots of times**. Long before methane gas, long before CFCs coming out of our air conditioner were issues, the climate changed. They never talked about CFCs until farmers got air conditioners in their tractors, and then all of a sudden it becomes a mortal sin. And it's the same now because **having different weather is normal for us**. It's the normal progression of things. It's just that **we live *this* long and we're trying to calculate an average over a span *this* long**. …

The “non-experts”

- Saskatchewan **Epidemiology** Association, Regina
- **Strategic Policy Committee** of Saskatchewan Federal Council, 19 October 2011
- Alberta **Agriculture** and Rural Development, Edmonton, 30 May 2011
- **Solid Waste** Association of NA May 30-June 1, 2011, Saskatoon
- **Consulting Engineers** of Saskatchewan – Regina, 18 January 2011
- Western Canadian **Grazing Conference**, Vermillion, AB, December 2010
- **Engineers Canada**, Regina and Saskatoon, November 2010
- Canadian Institute of **Public Health Inspectors**, Alberta Branch, Edmonton, October 2010
- **Prairie Provinces Water Board**, Regina, September 2010
- Assoc Professional **Engineers, Geologists, and Geophysicists** of Alberta, April 2010, Edmonton
- Saskatchewan **Association of Watersheds**, April 2010, Swift Current
- Saskatchewan Institute of **Agrology**, March 2010
- Southeast Alberta **Watershed Association**, March 2010, Medicine Hat

The “non-experts”

- North Saskatchewan **River Basin Council**, Maidstone / Hafford, SK, February 2010
- **MD of Bighorn**, Cochrane, AB, February 2010
- Saskatchewan **Watershed Authority**, Moose Jaw, December 2009
- International Council of **Academies of Engineering** and Technological Sciences, July 2009, Calgary, Alberta
- 7th Annual **Grazing**

- Alberta Chapter, **Wildlife Society**, March 2009, Edmonton.
- **Alberta Environment**, Water Operations, January 2009, Red Deer
- **Agricultural Service Boards** of Alberta, Medicine Hat, January 2009
- **Red River Basin Commission**, January 2009,Winnipeg
- **EPCOR** Lunch Talks Series, December 2008, Edmonton.
- **Irrigation Development Branch**, December 2008, Regina
- **SaskPower**, October 2008, Regina
- **Kanai Blood Indian Reserve**, Alberta, Grade School, October 2008 and Middle School, November 2008

WARMING TO GLOBAL WARMING

It’s not all bad - a warmer climate has benefits, especially for certain northerly regions, such as Canada, Russia and Scandinavia, **a group of university economists and anthropologists** is predicting.

EDMONTON JOURNAL, November 24, 2008

EDMONTON - **A group of global-warming experts**, made up mainly of university economists and anthropologists, is pushing the notion that global warming might not be an unmitigated disaster, especially for certain northerly regions, such as Canada, Russia and Scandinavia.

Leading the charge is Robert Mendelsohn, an economics professor at Yale University, who says the benefits of global warming for Canada - from a longer growing season to the opening up of shipping through the Northwest Passage - 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.”**

… WARMING TO GLOBAL WARMING

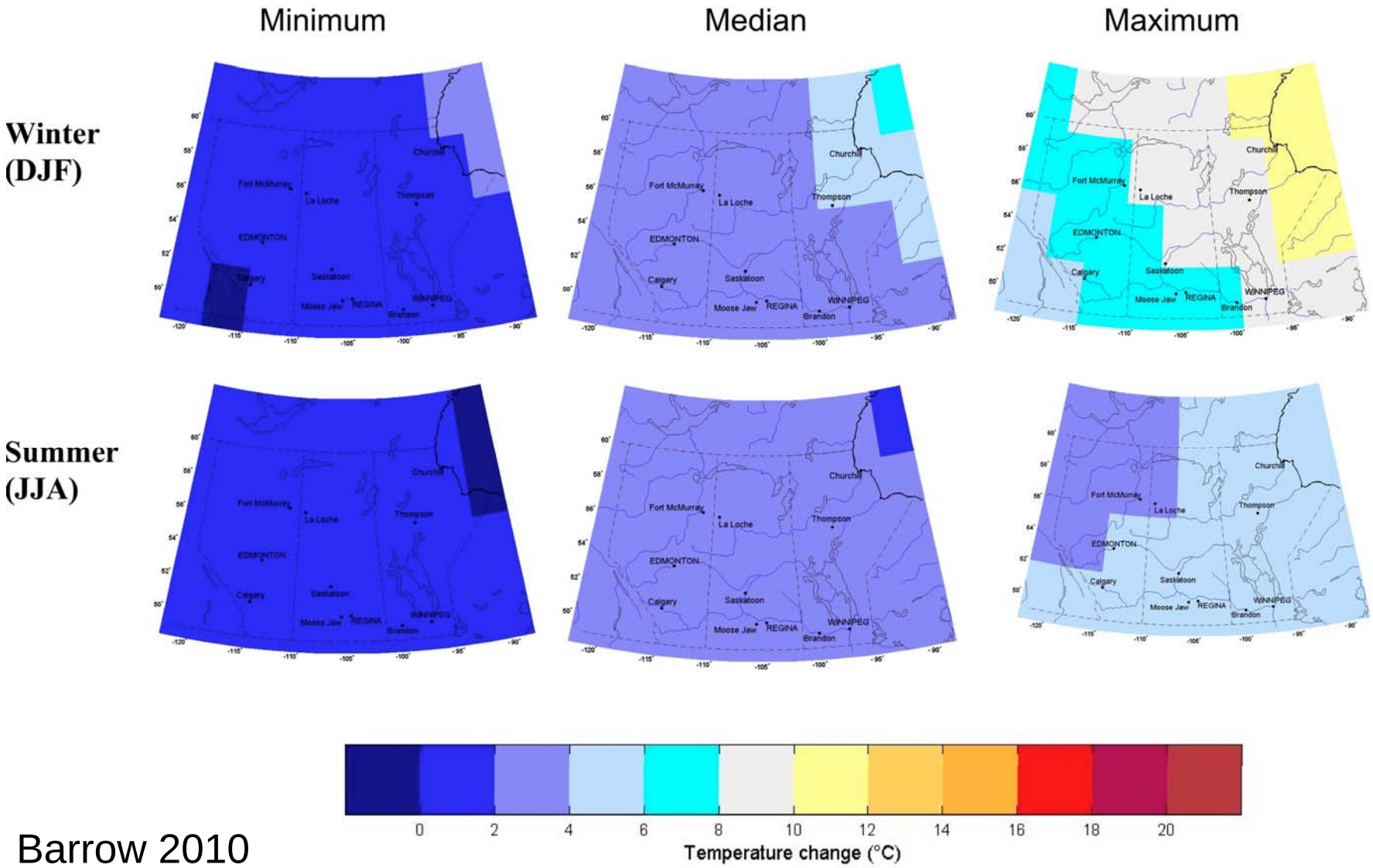
Gale Moore, a senior fellow at the Hoover Institute in California. "When it comes down to doing something about global warming, it quickly turns out to be kind of expensive and certain people . . . would look out and say, **'Wow, global warming, that's going to be nice. I don't want to spend any money stopping that.**' "

But, on the whole, moderate climate change of **an additional two degrees will likely be beneficial for the world**, says **Benny Peiser, an anthropologist at John Moores University in Liverpool, England**. For countries like Canada and Russia, though, **even more dramatic warming wouldn't be a problem**, Peiser says.

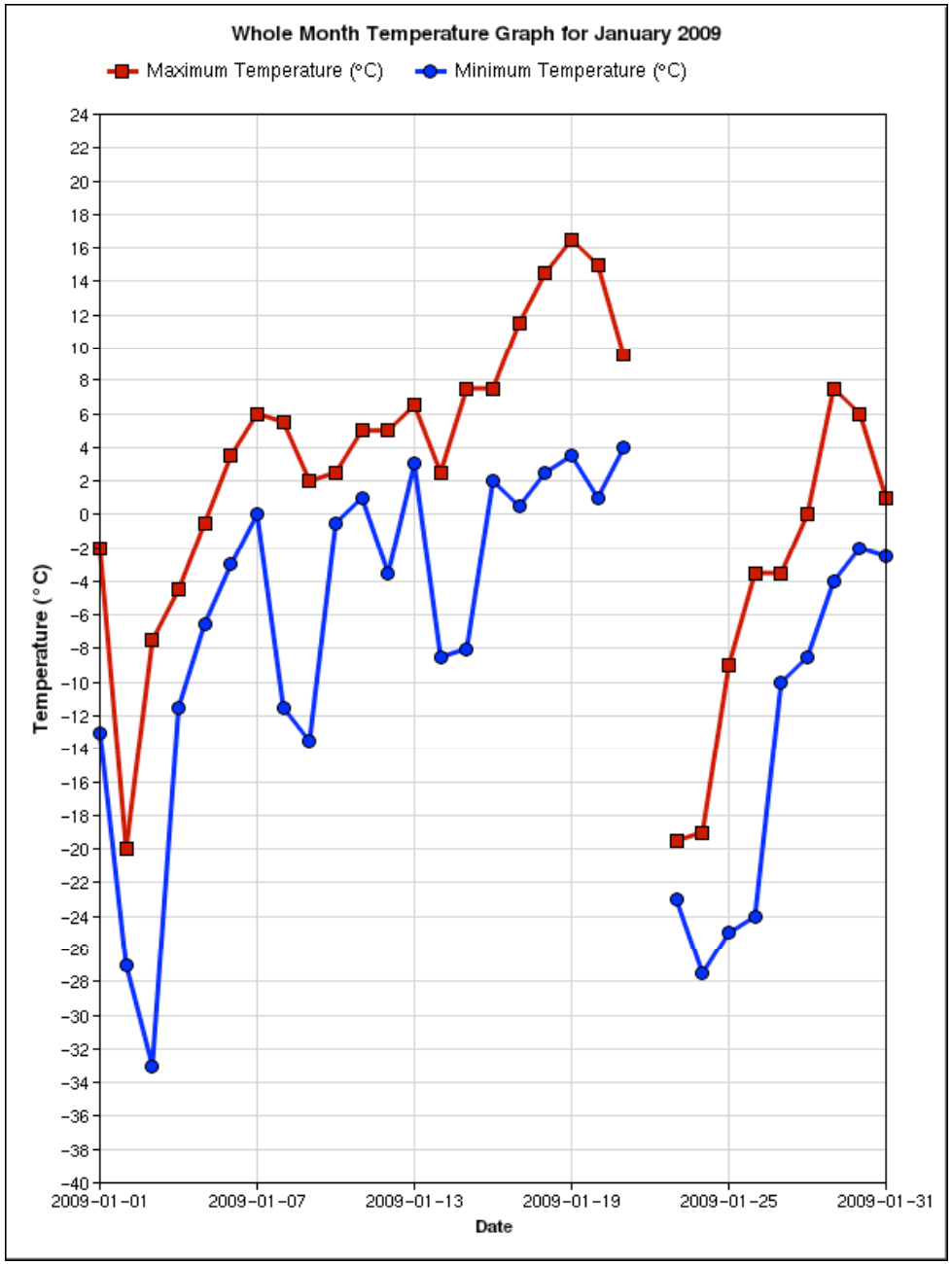
…

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

Seasonal Temperature Scenarios, 2050s



Barrow 2010

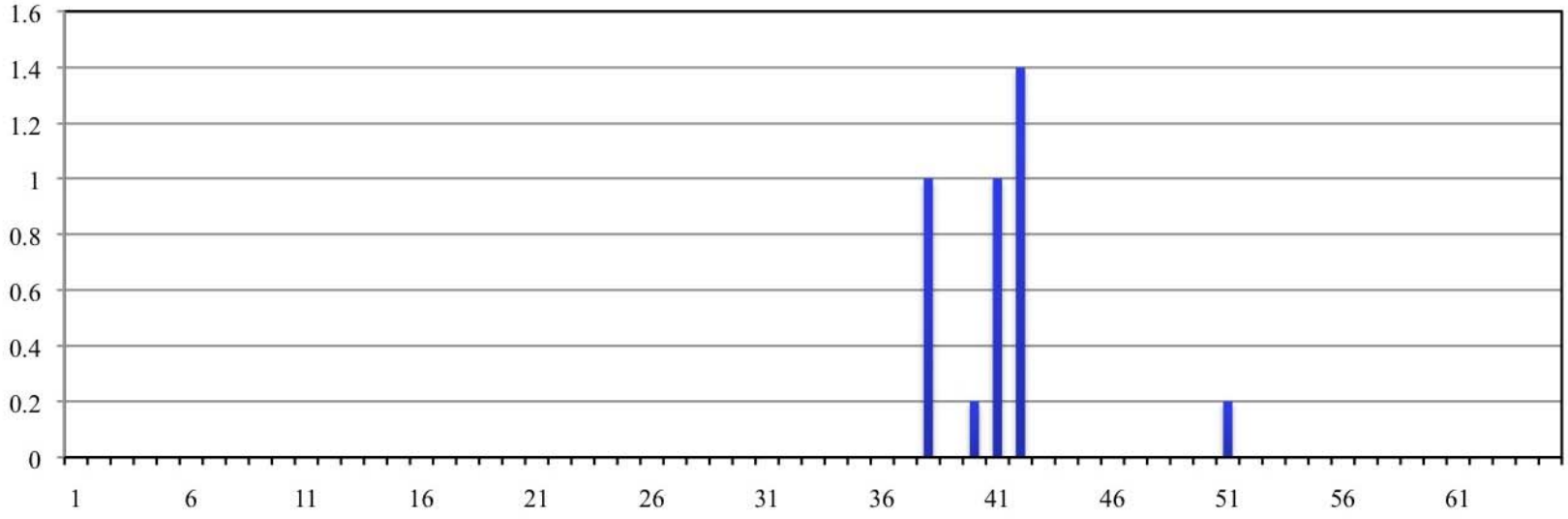


Beaver Mines, AB, Jan 2009

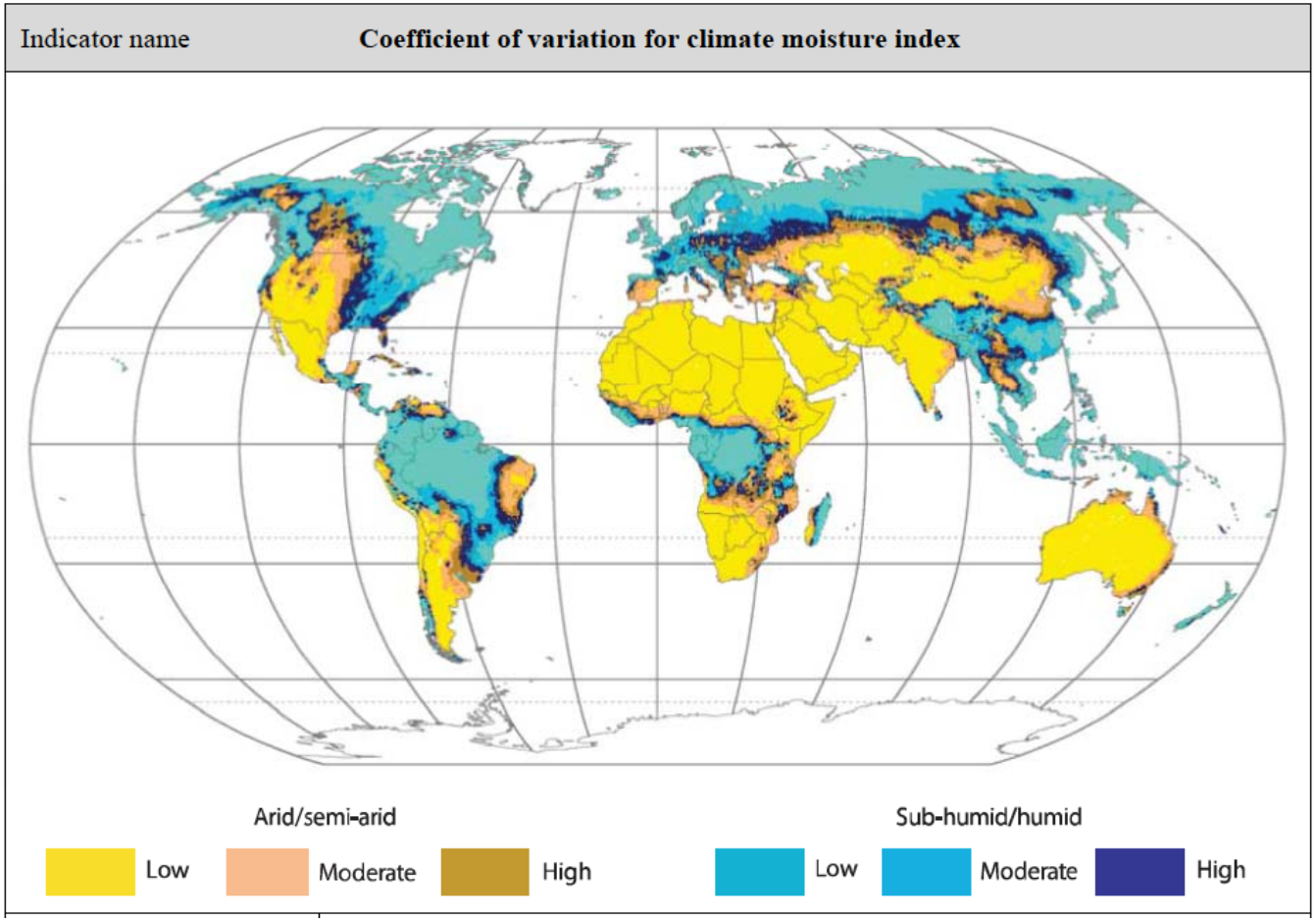
these during-the-same-week temperature extremes (+28C on Monday, and -29C on Friday) exceeds 100 degrees on the Fahrenheit scale - it's sounds more impressive than its Celsius equivalent - the spread of a "mere" 57 degrees C

David M, Burmis, 23 Jan 2009

Daily Precipitation (mm), Aug-Sep, 2001, Medicine Hat

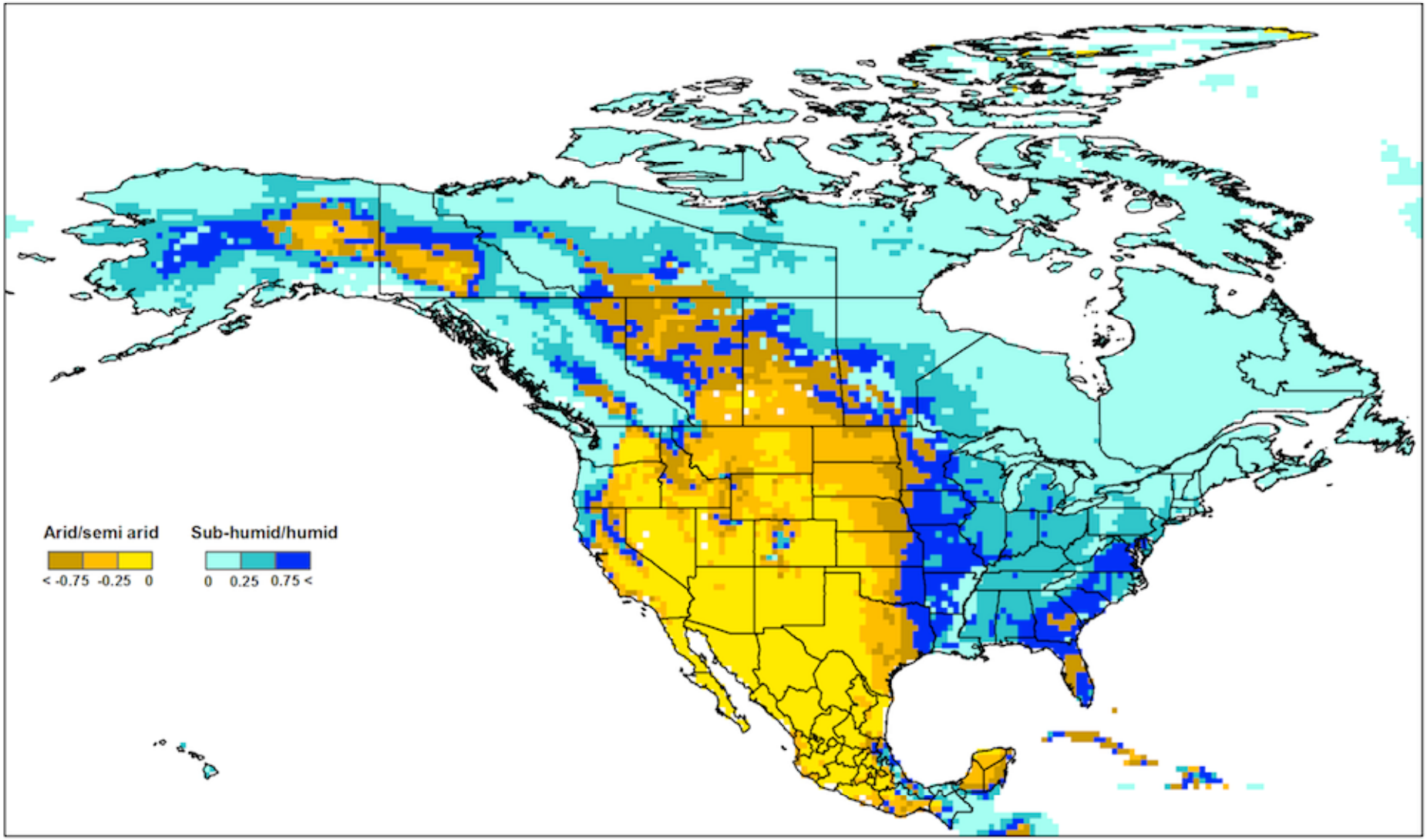


www.unesco.org



CMI is a measure of variability in the ratio of plant water demand to precipitation. It is an indicator of highly variable climates potentially vulnerable to periodic water stress.

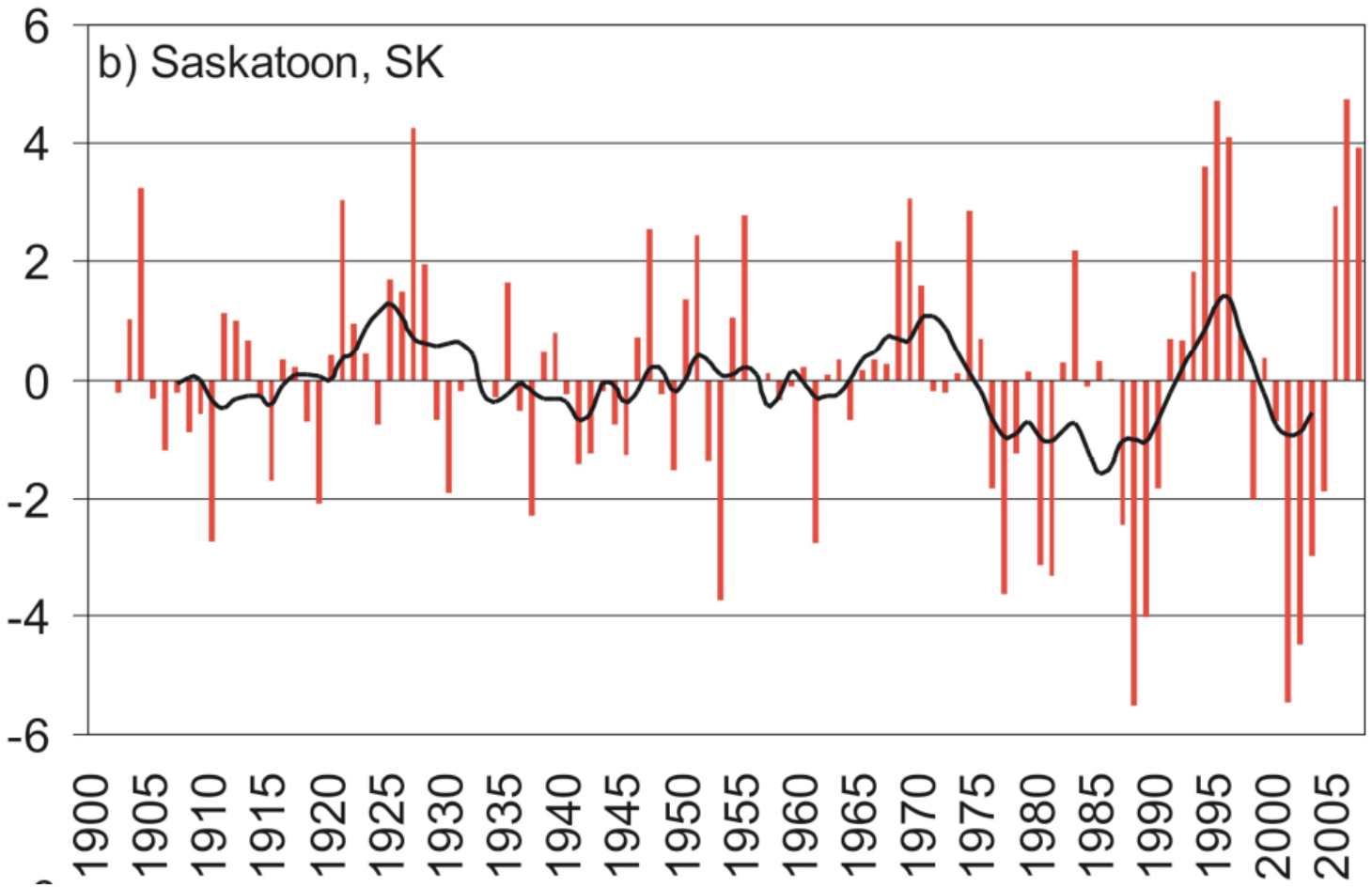
Inter-Annual Moisture Variability, North America



Cooking Lake, Alberta, 19 Sept 2008

Maple Creek, Saskatchewan, 19 June 2010

Palmer Drought Severity, Saskatoon 1900 - 2007



Bonsal et al., 2011; Sauchyn and Bonsal, In Press

Our responsibilities
- Emergency management
- National security
- Crime prevention
- Law enforcement policy
- Corrections policy

The Department
- Our Minister
- About us
- Newsroom
- Publications

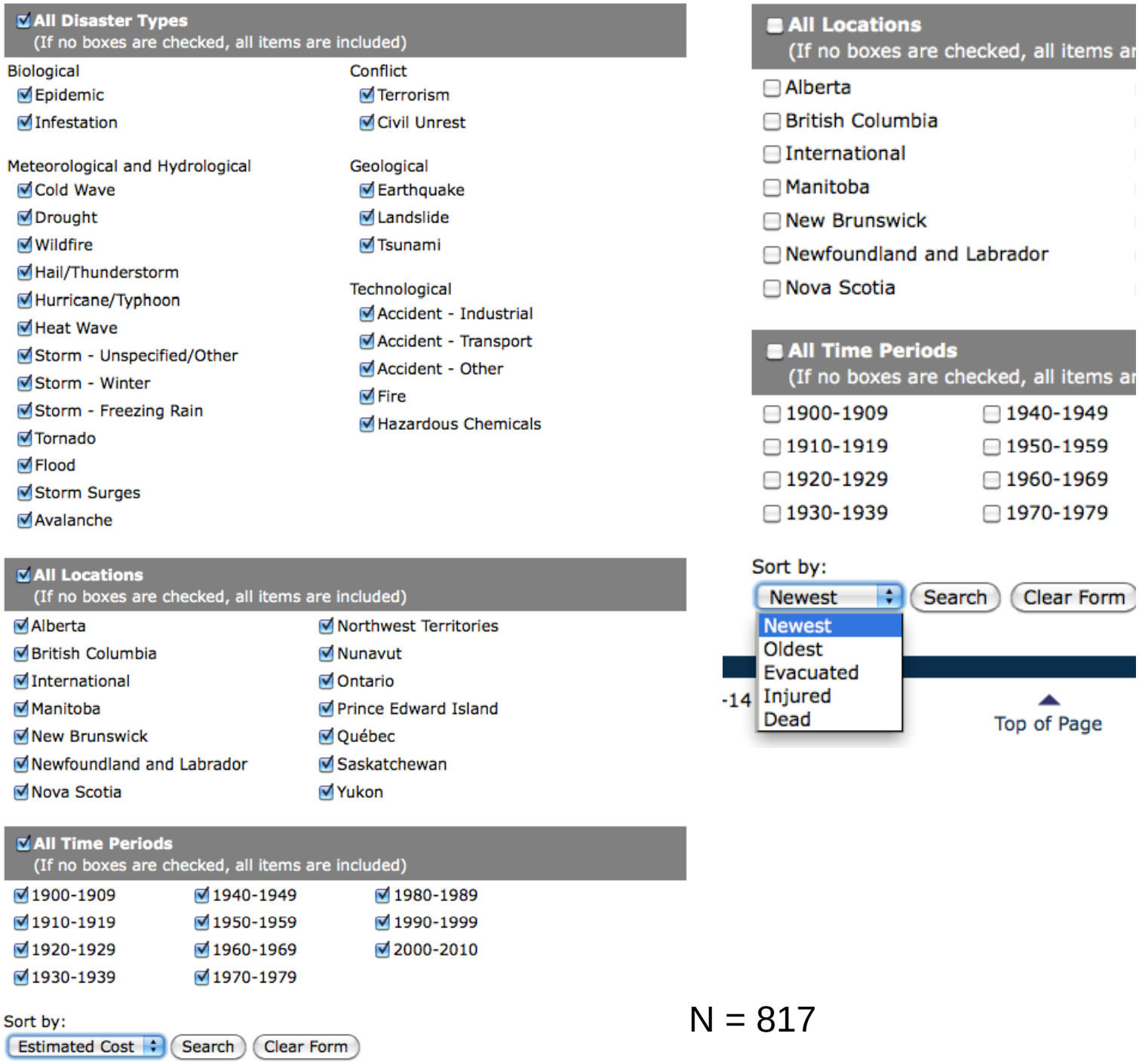
Services
- RSS Feeds
- Cyber warnings
- Daily Infrastructure Report

- Proactive disclosure

Canadian Disaster Database

The Canadian Disaster Database contains detailed disaster information on over 700 natural, technological and conflict events (excluding war) that have directly affected Canadians over the past century. The database helps citizens and government to better assess and manage risks. As well, it's a valuable resource for researchers and students to see how disasters and our vulnerability to them have changed over time.

- Enter the Database
- Data criteria and disclaimer


All Disaster Types
(If no boxes are checked, all items are included)
Biological
Epidemic
Infestation
Meteorological and Hydrological
Cold Wave
Drought
Wildfire
Hail/Thunderstorm
Hurricane/Typhoon
Heat Wave
Storm - Unspecified/Other
Storm - Winter
Storm - Freezing Rain
Tornado
Flood
Storm Surges
Avalanche
Conflict
Terrorism
Civil Unrest
Geological
Earthquake
Landslide
Tsunami
Technological
Accident - Industrial
Accident - Transport
Accident - Other
Fire
Hazardous Chemicals
All Locations
(If no boxes are checked, all items are included)
Alberta
British Columbia
International
Manitoba
New Brunswick
Newfoundland and Labrador
Nova Scotia
Northwest Territories
Nunavut
Ontario
Prince Edward Island
Québec
Saskatchewan
Yukon
All Time Periods
(If no boxes are checked, all items are included)
1900-1909
1910-1919
1920-1929
1930-1939
1940-1949
1950-1959
1960-1969
1970-1979
1980-1989
1990-1999
2000-2010
Sort by:
Estimated Cost
Search
Clear Form
All Locations
(If no boxes are checked, all items ar
Alberta
British Columbia
International
Manitoba
New Brunswick
Newfoundland and Labrador
Nova Scotia
All Time Periods
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1900-1909
1910-1919
1920-1929
1930-1939
1940-1949
1950-1959
1960-1969
1970-1979
Sort by:
Newest
Search
Clear Form
Newest
Oldest
Evacuated
Injured
Dead
-14
Top of Page

N = 817

1. Drought: Prairie provinces, 1980

2. Freezing rain: Ontario to New Brunswick, Jan 6-10 1998

3. Drought: Prairie provinces
and Central and Southern ON, Jul 5-11 1988

4. Drought: Prairie provinces, 1979

5. Drought: Prairie provinces, 1984

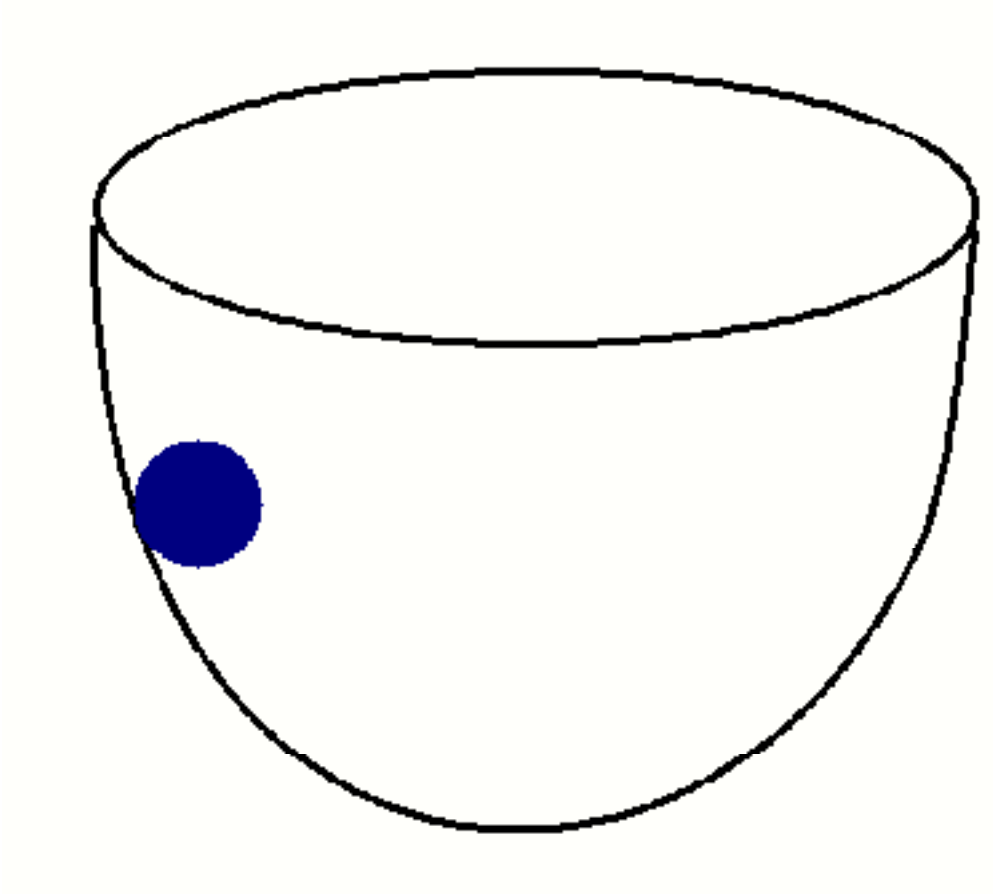
* Drought, 2001-02: $5.8 (Wheaton et al. 2008)
* Excess water, 2011: > $1 B

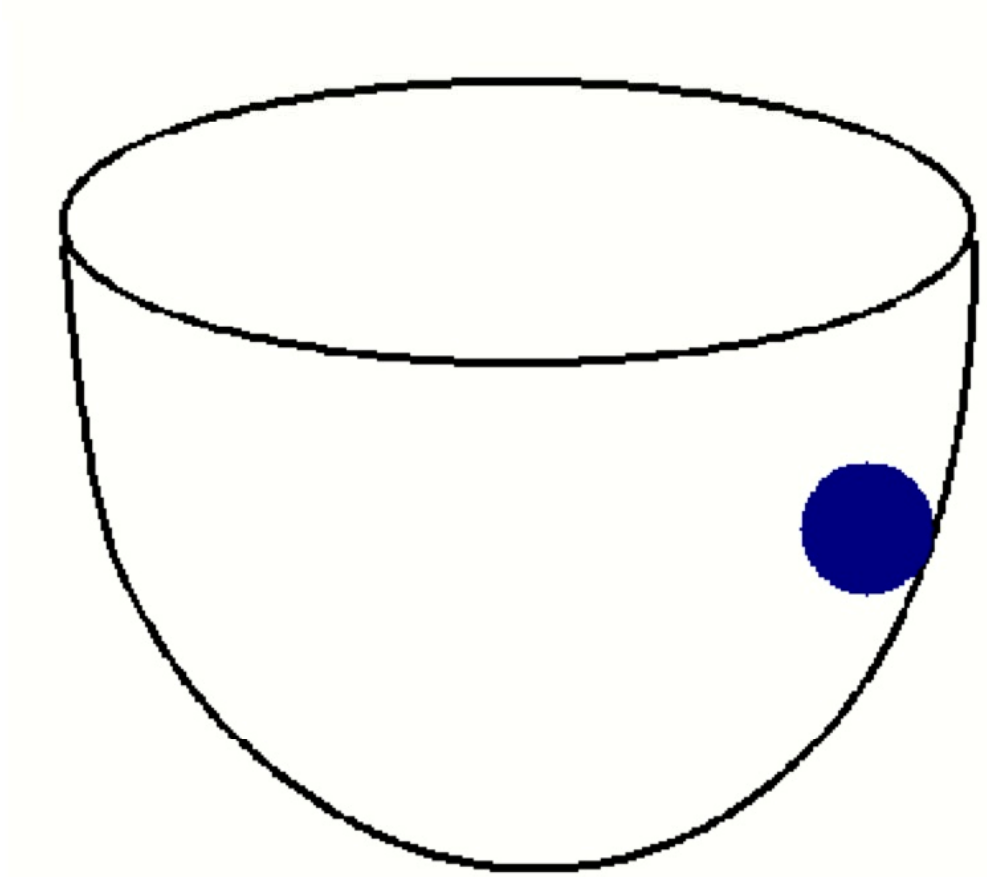
9. Drought: Prairie Provinces, 1931-1938
10. Drought: Prairie Provinces, 1989
11. Hailstorm: Calgary AB, Sept 7 1991
12. Drought: Prairie Provinces, 1961
13. Flood: Assiniboine, Red and Winnipeg Rivers MB, May 1997
14. Drought: Western Canada, 1985
15. Tornado: Edmonton AB, Jul 31 1987
16. Drought: Prairie Provinces, 1977
17. Drought: Prairie Provinces, 1990
18. Drought: Prairie Provinces, 1992

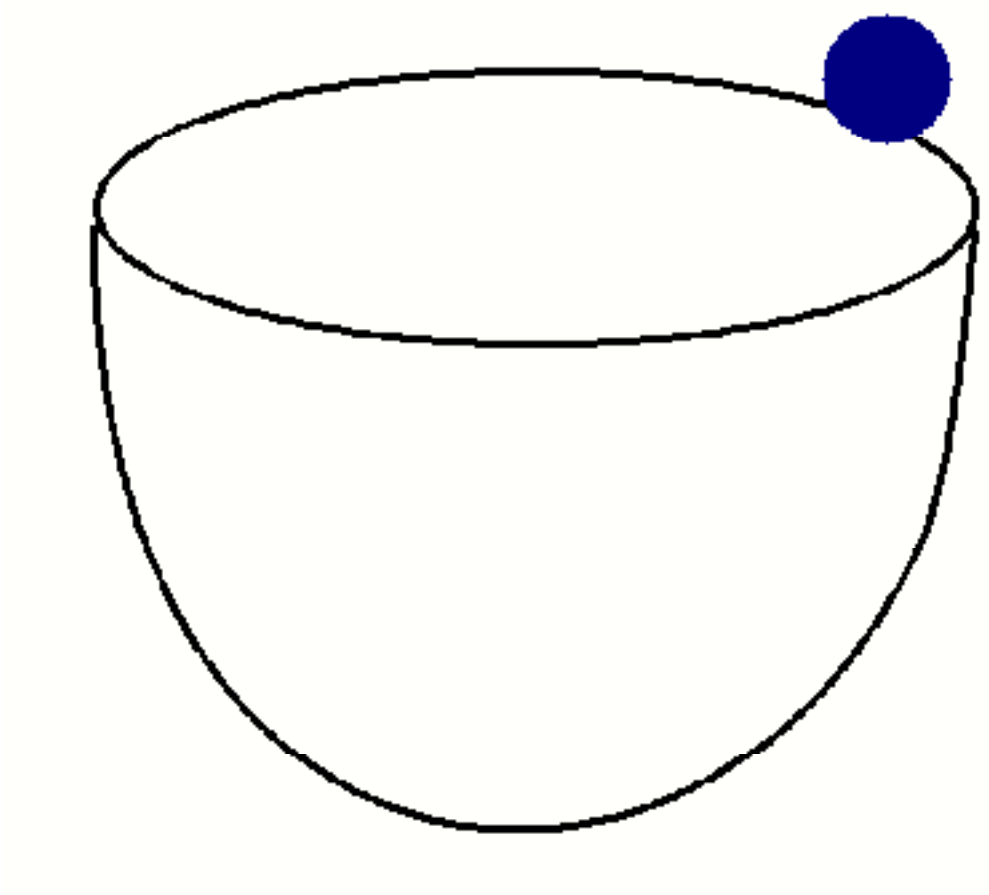
Climate change, Trends and Variability

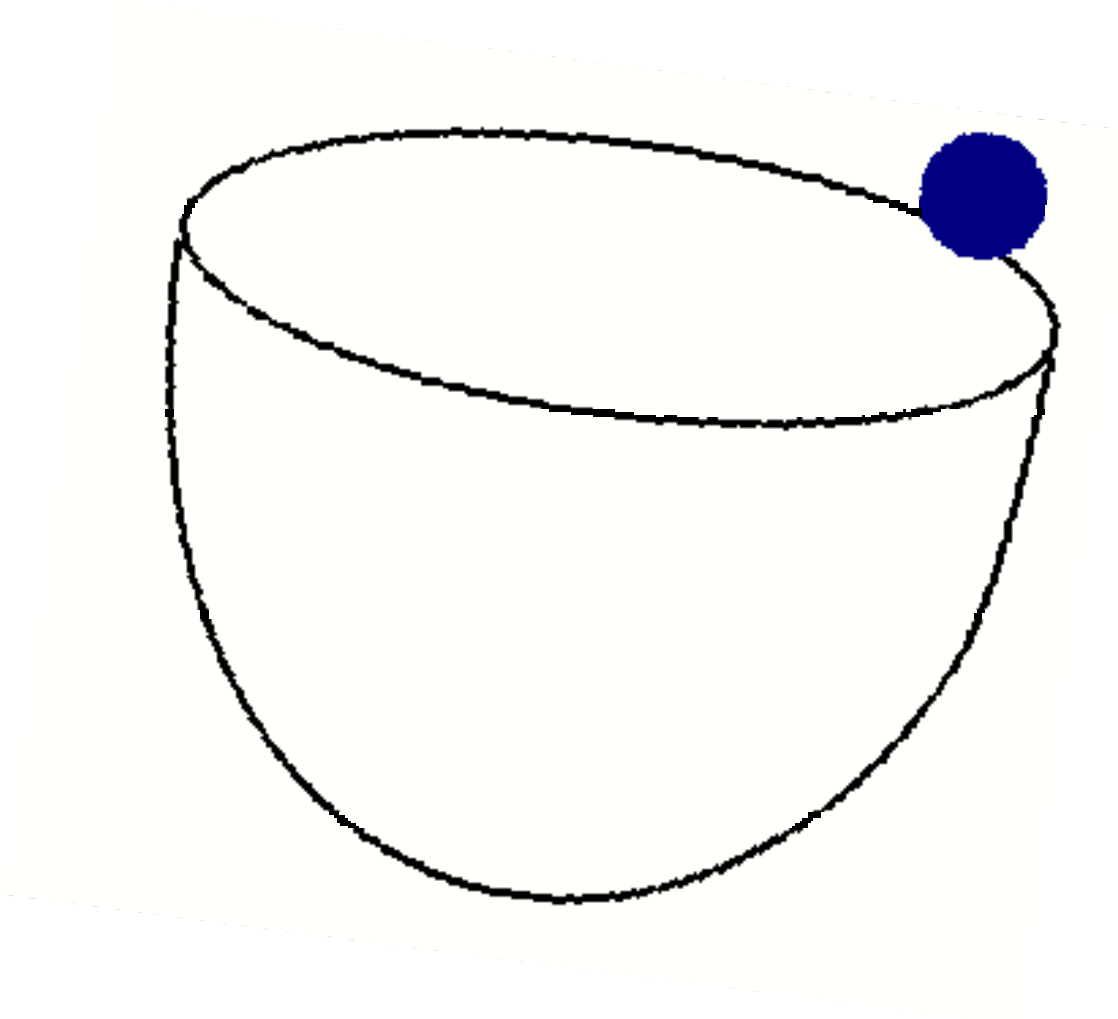
Dave Sauchyn, Prairie Adaptation Research Collaborative

"Best Management Practices: For the Agricultural Climate of Tomorrow"
Parkland Conservation Farm, Vegreville, AB, March 26, 2009

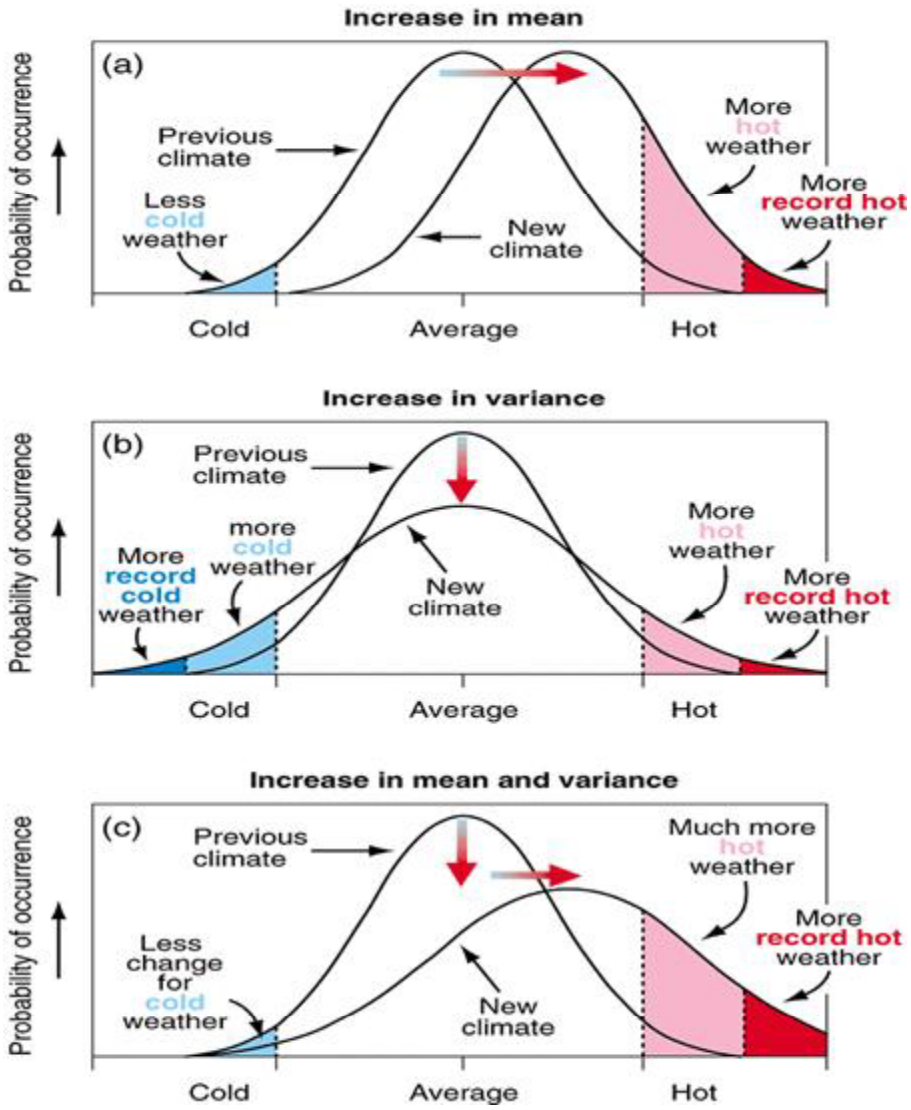








Climate Change



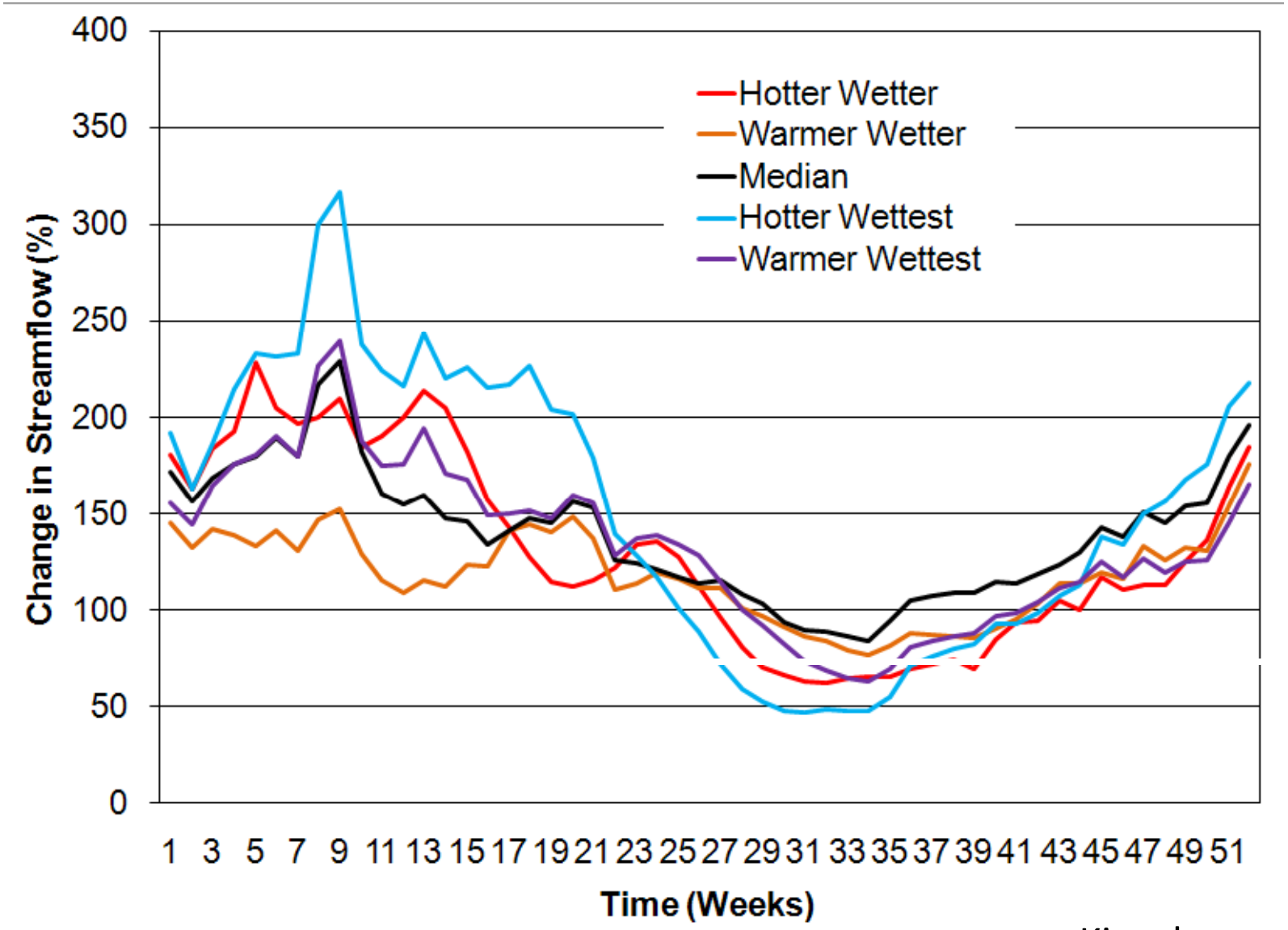
- EPCOR Water Services Inc. (EWSI) provides water, wastewater, and distribution services to over one million people in more than 50 communities across Western Canada.

- 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

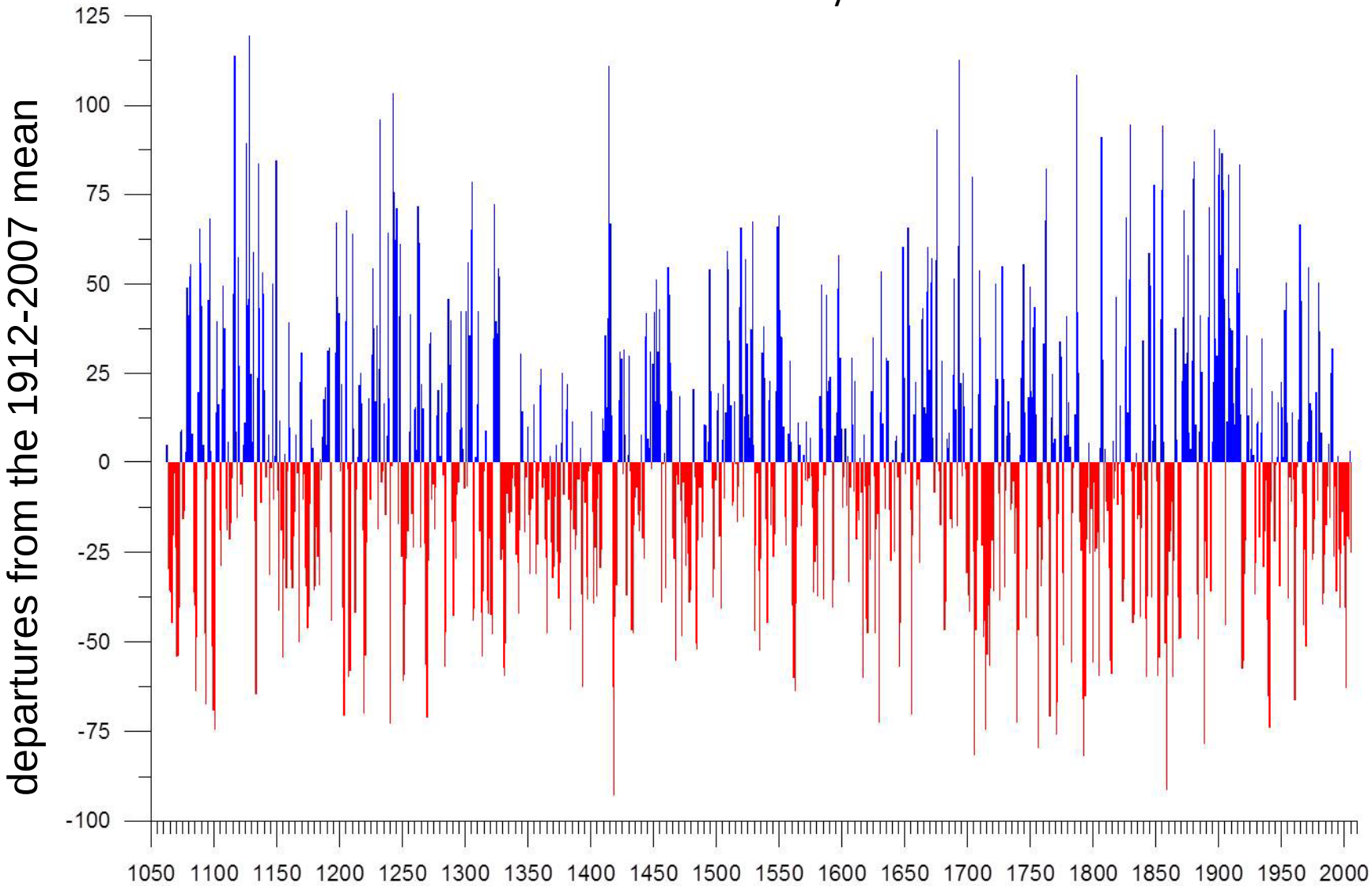
Upper North Saskatchewan River: Change in Streamflow (%) 2050

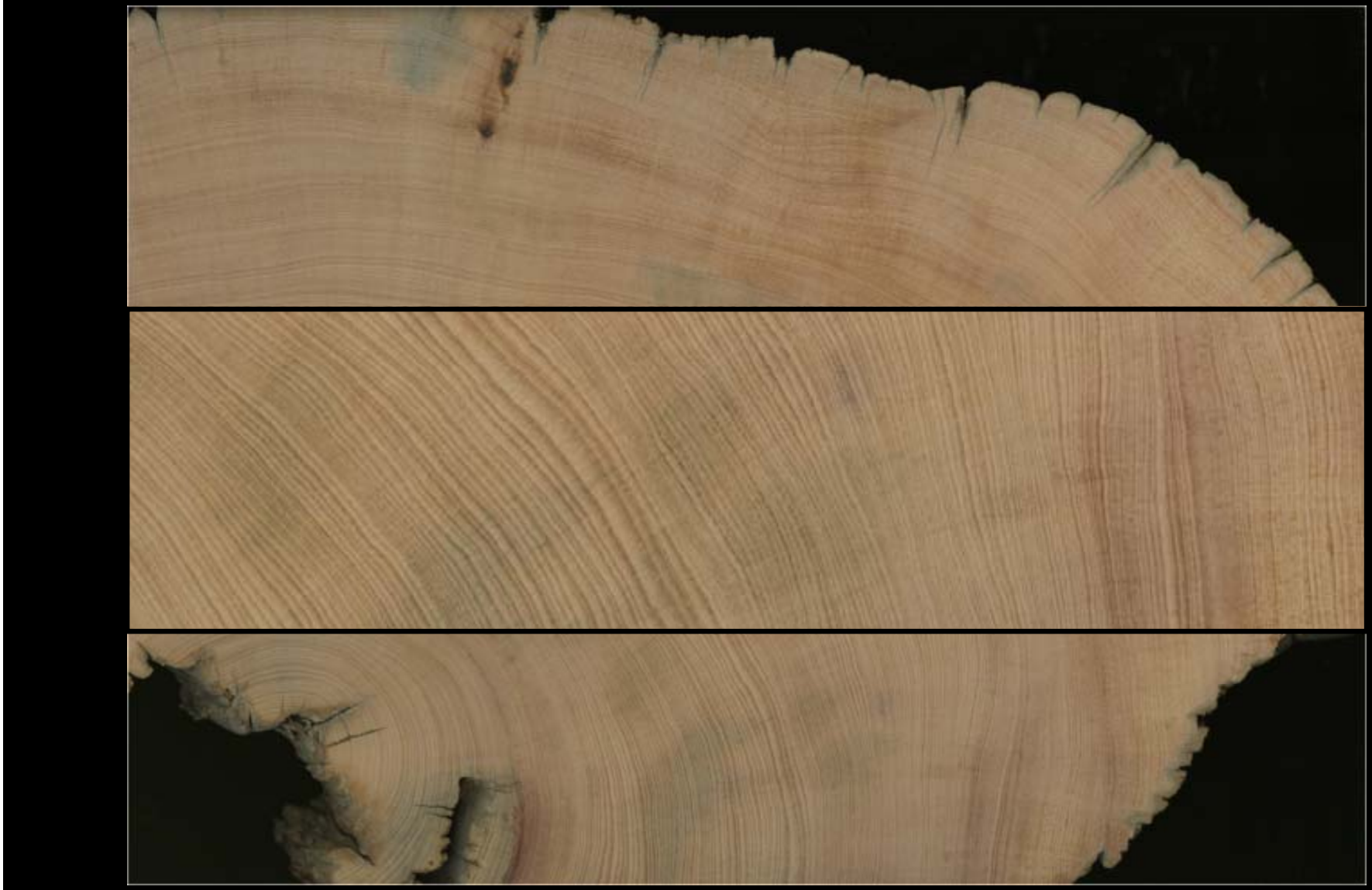


Kienzle, et al., 2011

North Saskatchewan River at Edmonton, 1063-2006

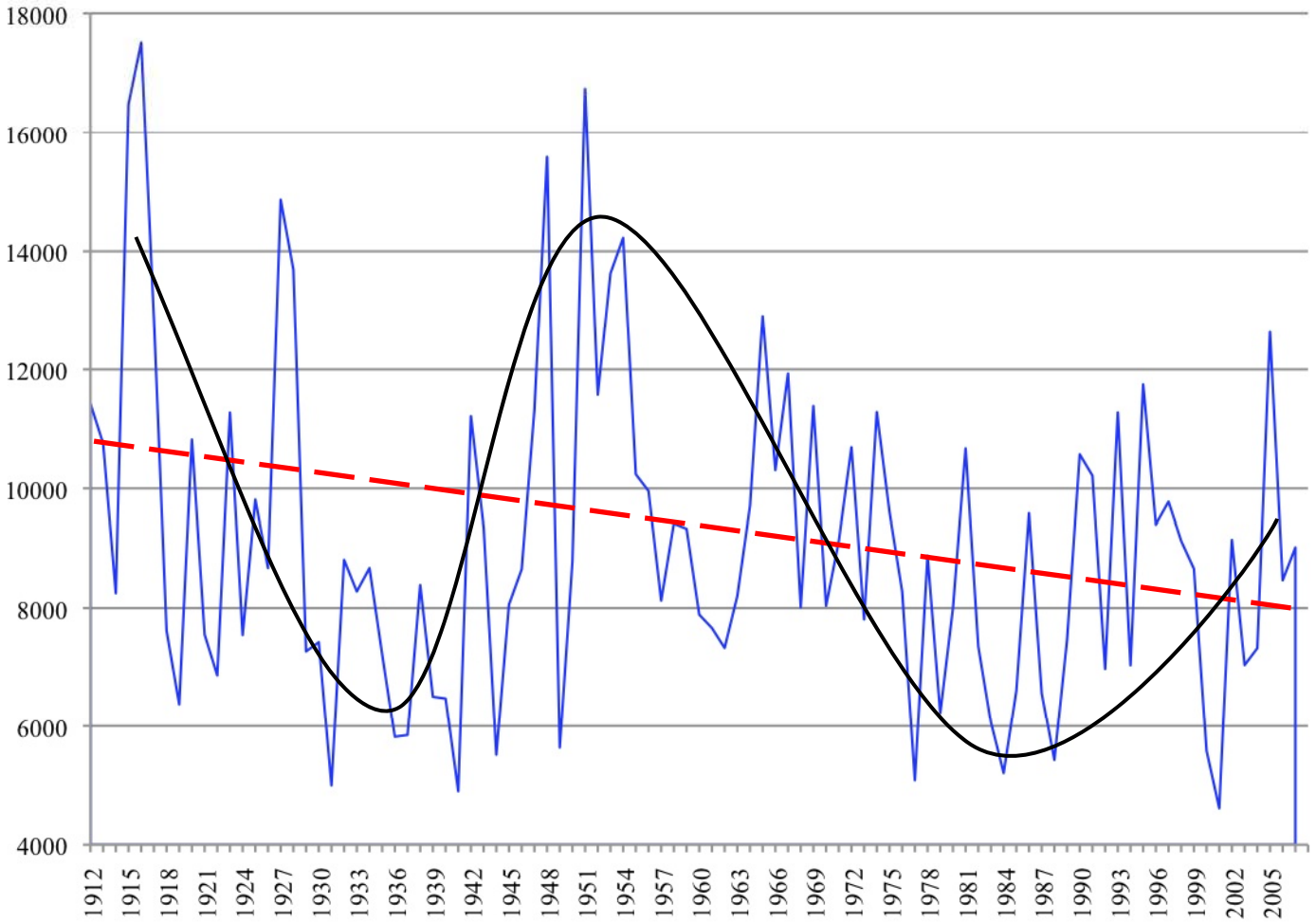
Sauchyn et al. 2011



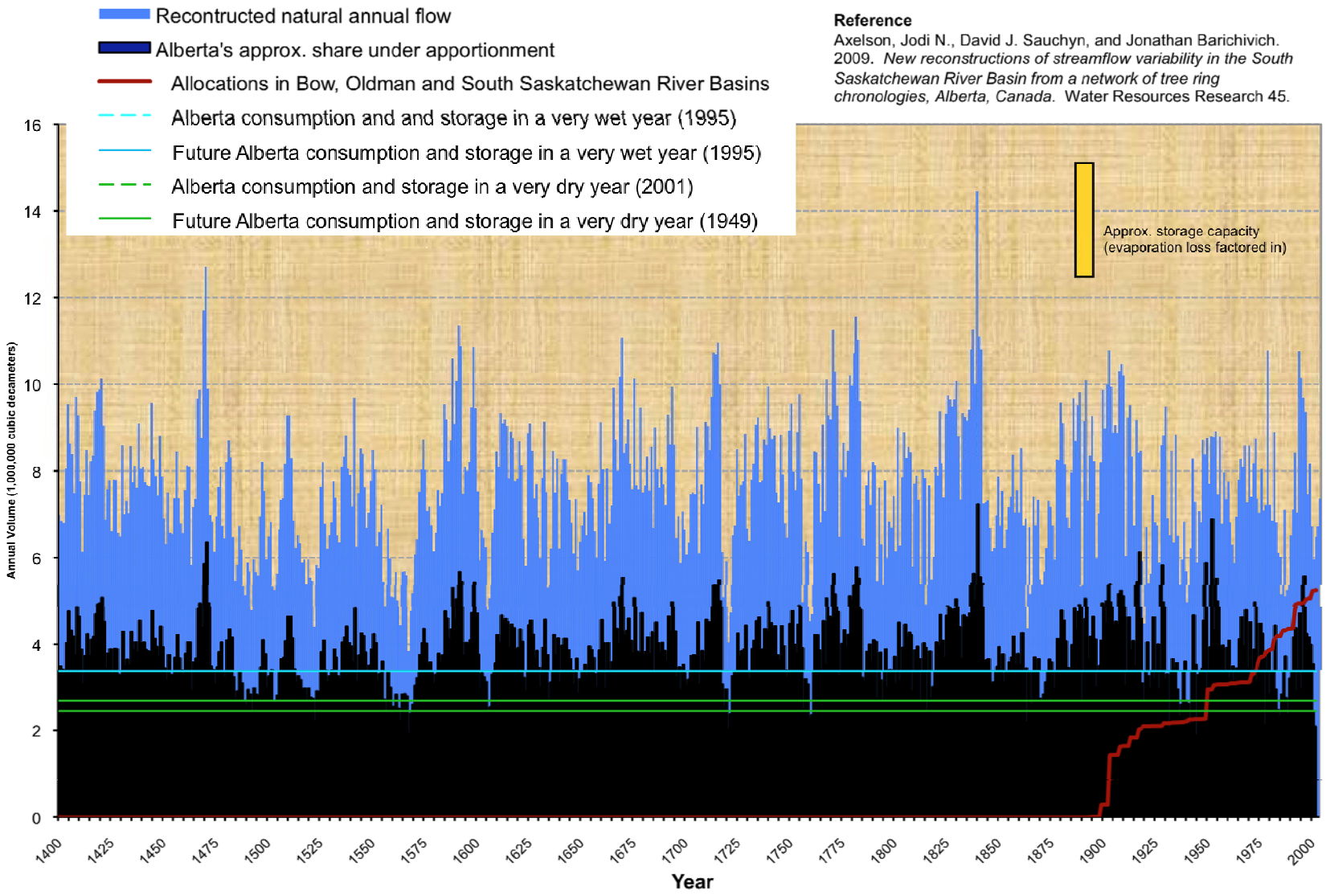



ORLEANS LAKES
DUCK FACTORY NO. 163
BUILT 1945-46 BY
DUCKS UNLIMITED AND
COOPERATING CANADIANS
TO ESTABLISH WATERS FOR THIS
COMMUNITY AND FOR THE DUCKS.
FUNDS CONTRIBUTED BY DUCK HUNTERS OF
NEW ORLEANS, LOUISIANA, U.S.A.
LAND, WATER AND COOPERATION
PROVIDED BY CANADIANS.

Annual natural flow, South Saskatchewan River at Medicine Hat



source: PPWB



Since August 2006, the **Alberta government no longer accepts applications for new allocations of water** in the Oldman, Bow, and South Saskatchewan sub-basins. (Doug Ohrn, AB Environment)

Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

EXTREME CLIMATE EVENTS PREPAREDNESS AND ADAPTATION (EXTRA) PROJECT

Invitational Drought Tournament

Prepared by: Shanda Buchanan, Monica Hadarits, Harvey Hill, Nancy Lee and Rick Rieger

Having doubts about harvest

OXBOW TIMES | JULY 2013

Unseasonably cool weather coupled with limited water deliveries this spring displaced farmers and delayed seeding, causing expenses and hurdles leading up to harvest.

"We have heard continuously from producers that they didn't know what kind of water supply they were going to have this year until late," said Tim Goodman, regional manager for the Oxbow Water Resources Department. "Making decisions on crops, settling up contracts, that's all very difficult when they don't now what kind of water supply they're going to have."

Producer Bill Hayes from Concepcion said they are collectively hoping the weather cooperates and their harvest yields enough to cover this year's extra expenses – travelling to leased fields, and fertilizing and watering them, for example.

But grain cuttings were light, and overall farmers are expecting lower yields, which results in less revenue at the end of the season.

With added expenses for producers this year, their profitability is greatly impacted.

STREAMFLOW

- Streamflow conditions (Table 1, see page 4)
  - 20% of water demands cannot be satisfied because there is a shortage of 768 million cubic meters (MCM) in streamflow.
  - The shortage is due to a lack of precipitation in winter and low spring runoff, and is occurring primarily in summer, the season with highest demand.
- Impacts
  - There are widespread impacts on the entire basin, as there are a number of water users who will not have access to the water they require to carry out their respective activities.

Table 1: Streamflow and water demand in 2013 in the Oxbow Basin (Million Cubic Meters, MCM)

A) **Natural streamflow**			2986
	B) **Demands**	**Municipal** (e.g., drinking water, household use) (14%)	526
		Agriculture (e.g., irrigation, livestock watering) (75%)	2816
		Industry (e.g., energy, mining, tourism, recreation) (4%)	150
		Other (e.g., in-stream flow needs, habitat) (7%)	262
		Total	3754
Water balance (A-B)			-768
Storage			1314
Additional water made available through adaptation option:			
Additional water made available through adaptation option:			

FUTURE PROBABILITIES

Table 3 shows the probabilities of next year's (2014) streamflow and soil moisture conditions falling in categories 1 through 5 based on the conditions experienced this year (2013). Since 2013 was a category 1 ('very low'), there is a 36.36% chance 2014 will be a category 1 ('very low'). Similarly, there is a 5.79% chance 2014 will be a category 5 ('very high'). This information provides insights into next year's conditions based on probabilities from the historical record.

***2013 STREAMFLOW AND PDSI FALL IN

CATEGORY 1: VERY LOW ***

Table 3: Forecasted probabilities for 2014

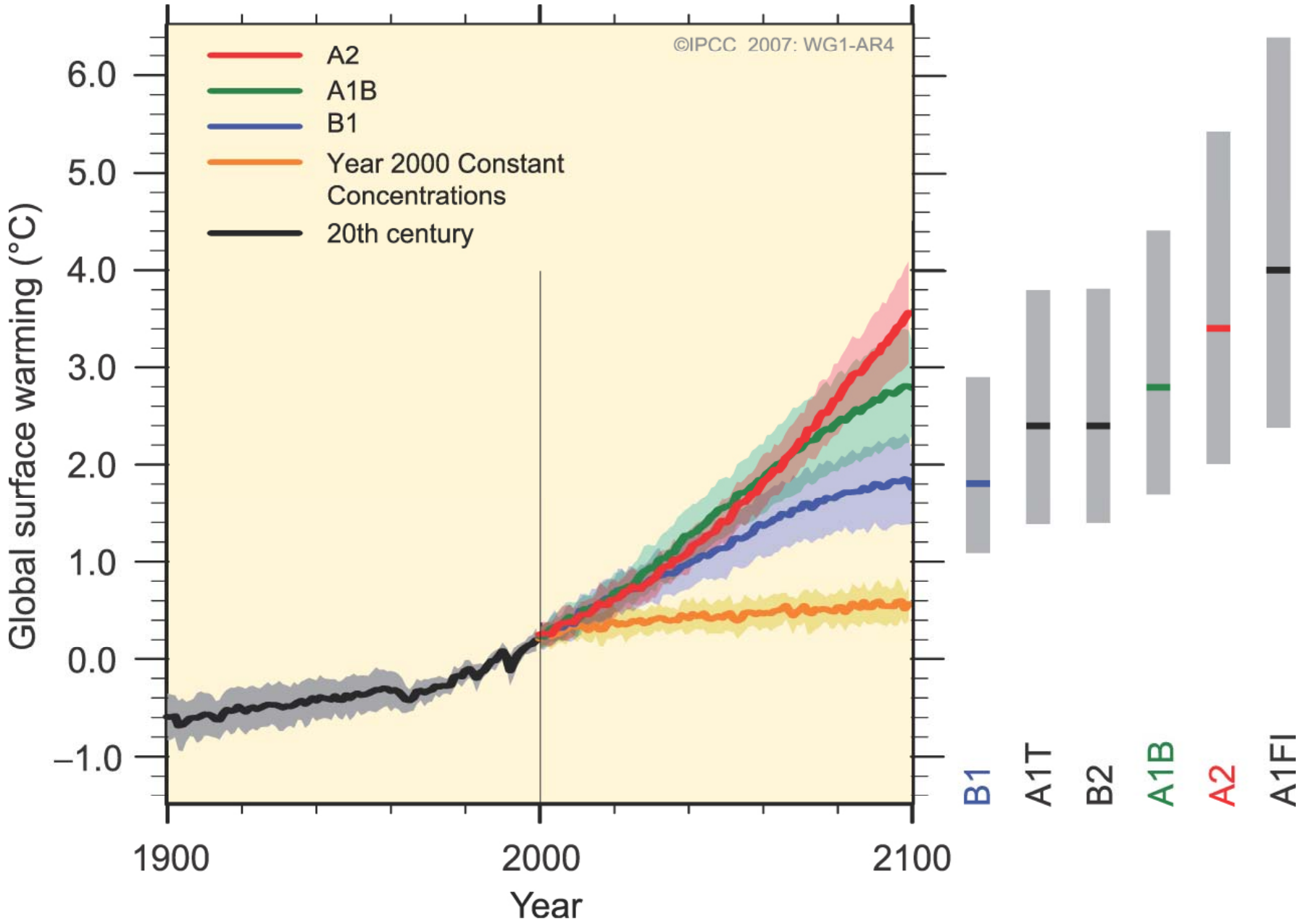
	1: Very low	2: Low	3: Average	4: High	5: Very high
2014	36.36%	25.62%	20.66%	11.57%	5.79%

BUDGET

Teams have the following budget to implement adaptation options listed in the next section.

Budget: **$950,000,000 + Pre-drought carry forward (if any)**

Total budget for 2013: _____


©IPCC 2007: WG1-AR4
A2
A1B
B1
Year 2000 Constant Concentrations
20th century
Global surface warming (°C)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
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B1
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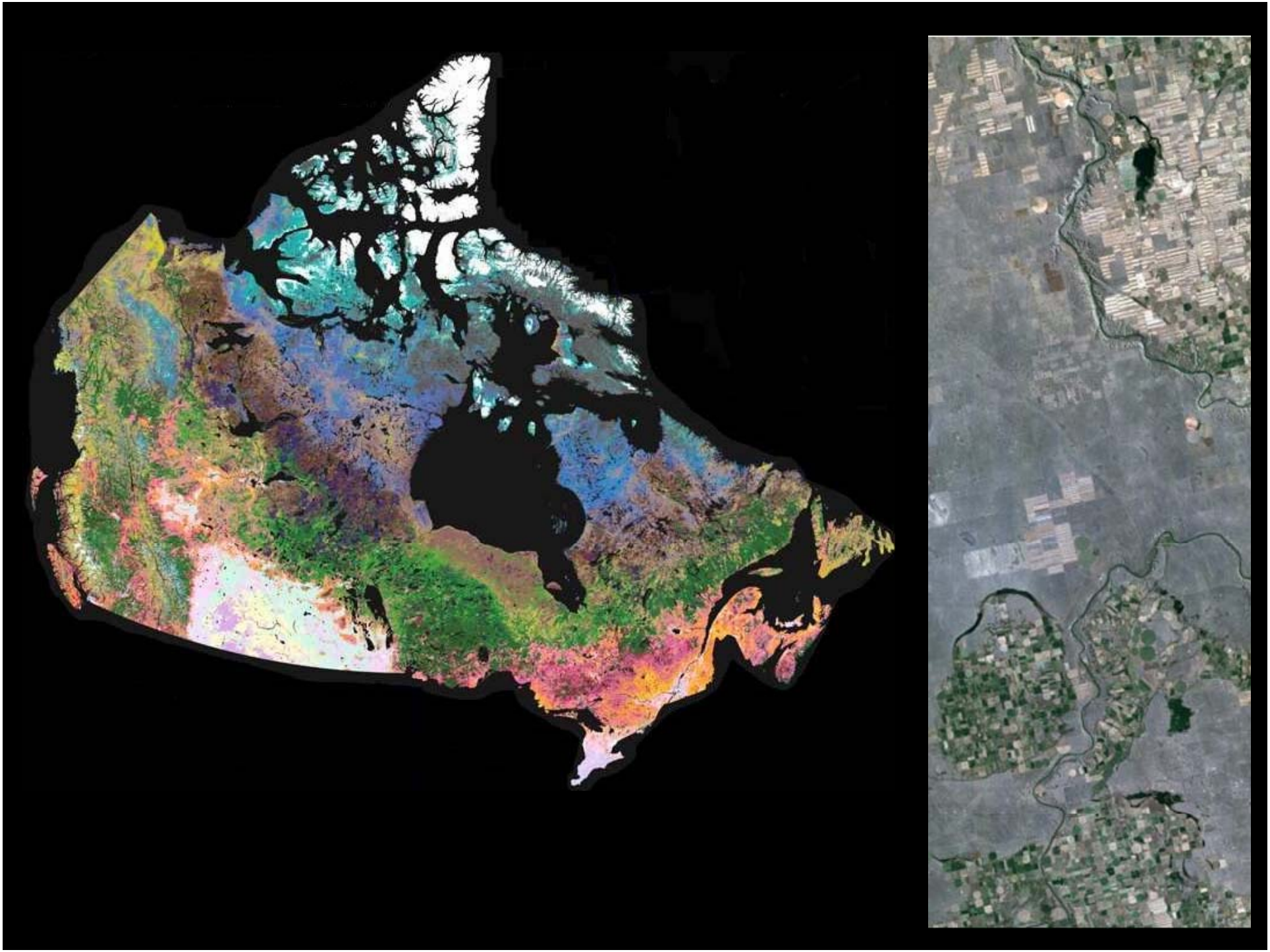
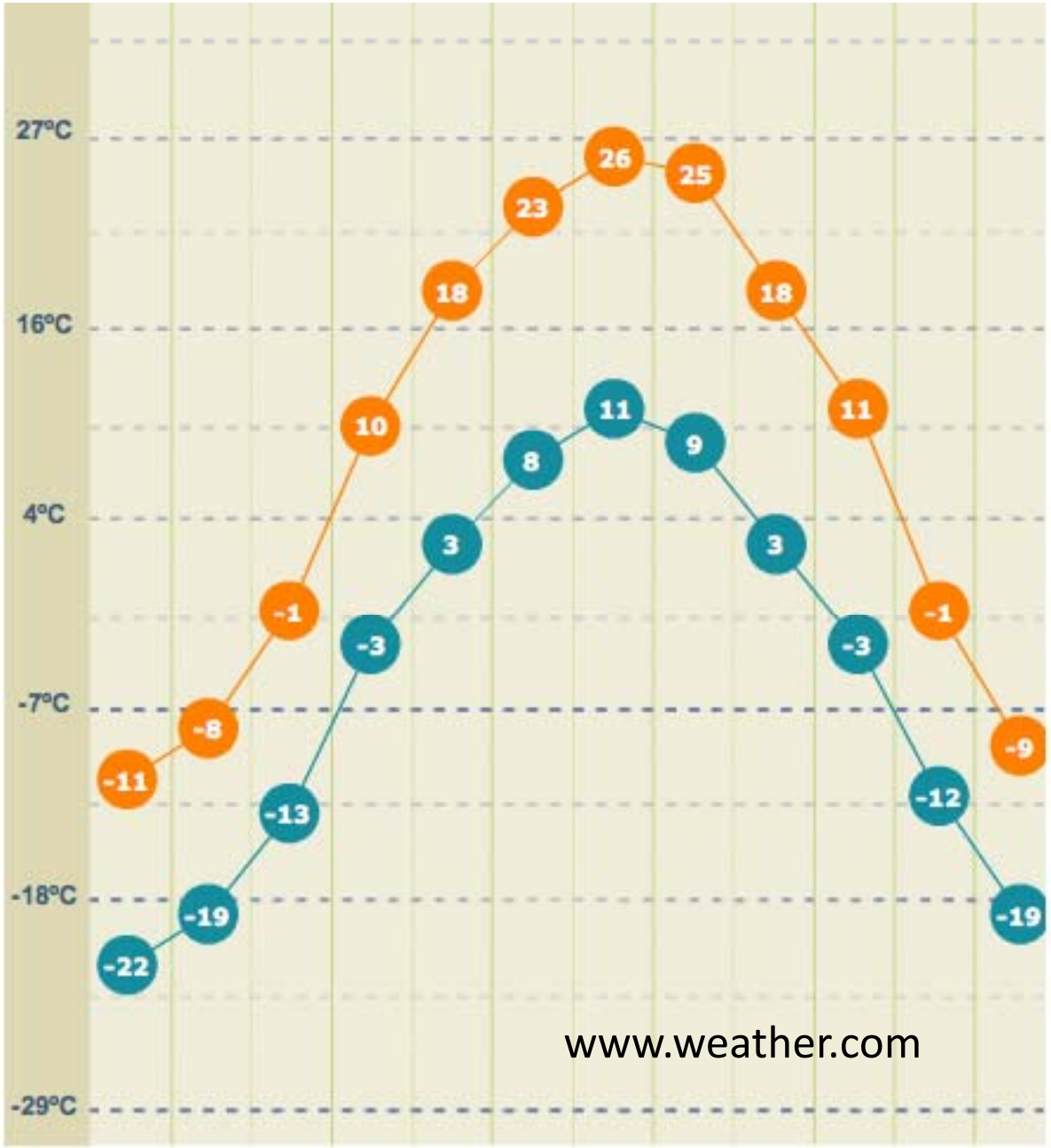
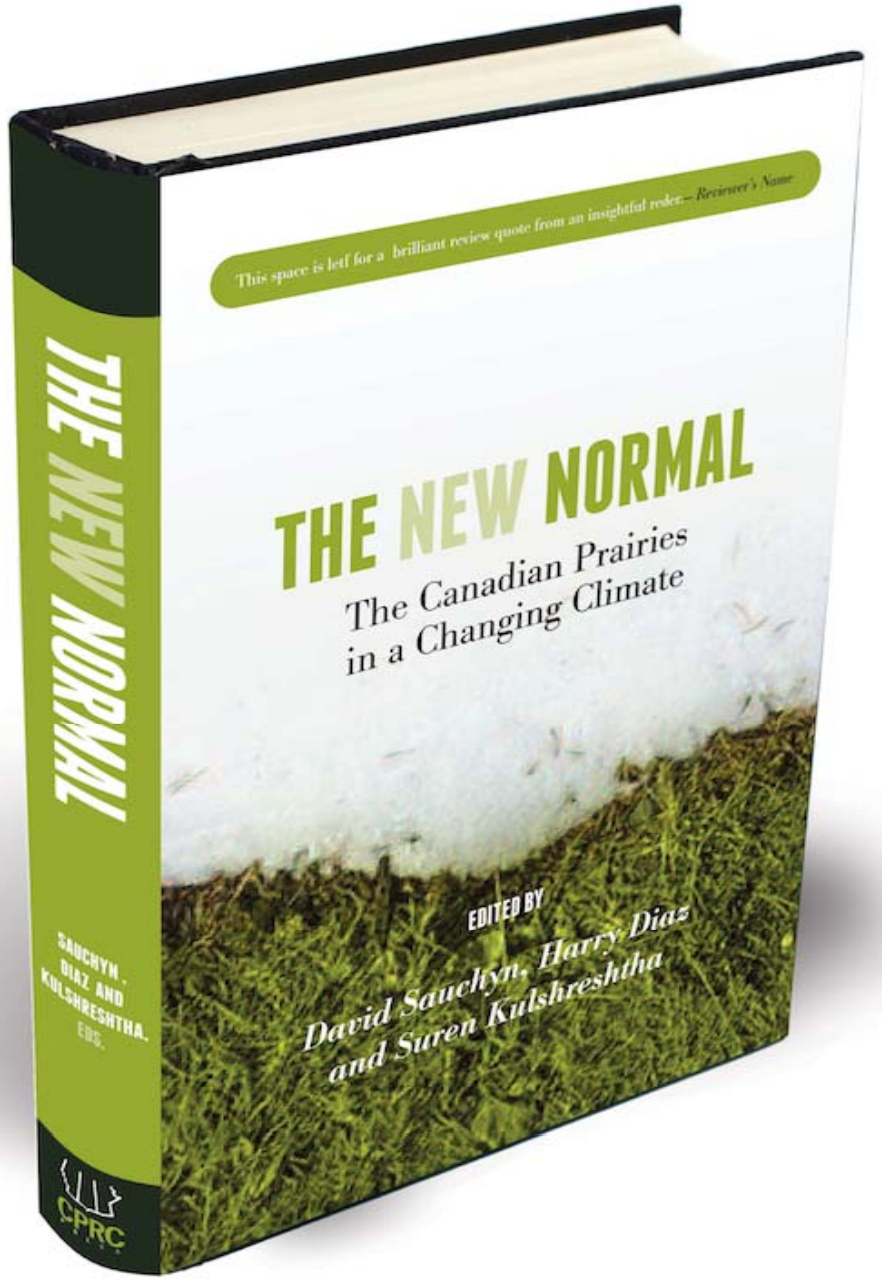


Monthly Temperature Normals, Regina, SK





Thank You!

www.youtube.com/user/CPRCPRESS