Climate Change Projections and Impacts in Alberta

Dave Sauchyn, Prairie Adaptation Research Collaborative

APEGGA - Engineers Canada Joint Workshop
Edmonton, April 16, 2010

6-9 Heavy Oil Upgraders planned for the Edmonton Industrial Heartland

Each upgrader would require **20-30,000 cubic metres per day** for evaporative cooling

Water Sources

- The **North Saskatchewan River** (new licences)
- Under-utilized existing licences
- Recycled Wastewater
- Produced water in the area

From - WATER: Alberta's Next Big Economic and Social Challenge (P. Kim Sturgess, P.Eng. FCAE - *www.apegga.org/Members/Events/.../APEGGAPDApr17-2008.ppt*

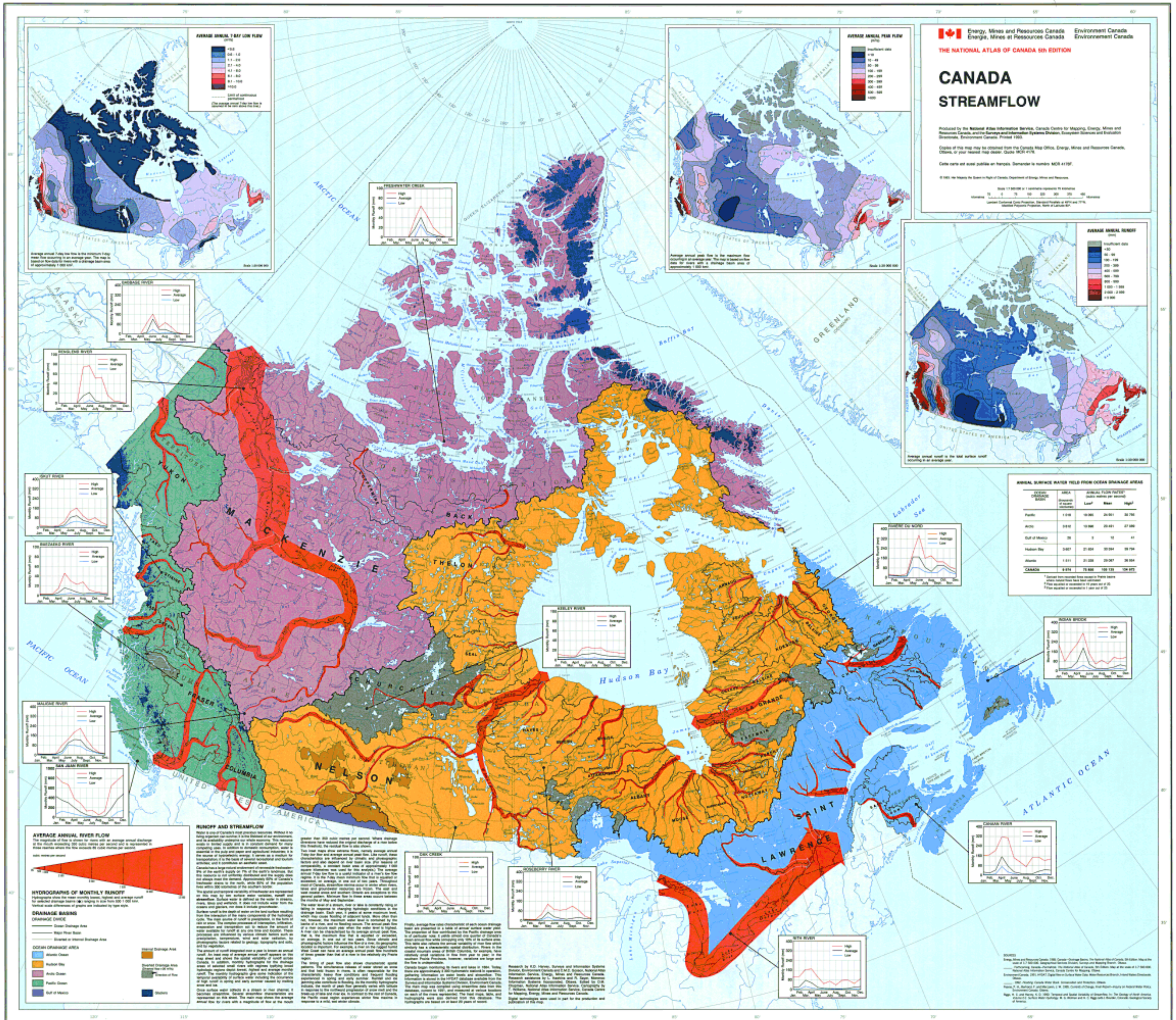
Bruce Power study eyes northwest Saskatchewan for new nuclear power plant

"the area on the **North Saskatchewan River** meets a lot of the criteria to support a nuclear power plant. "**It's got a good water source**"

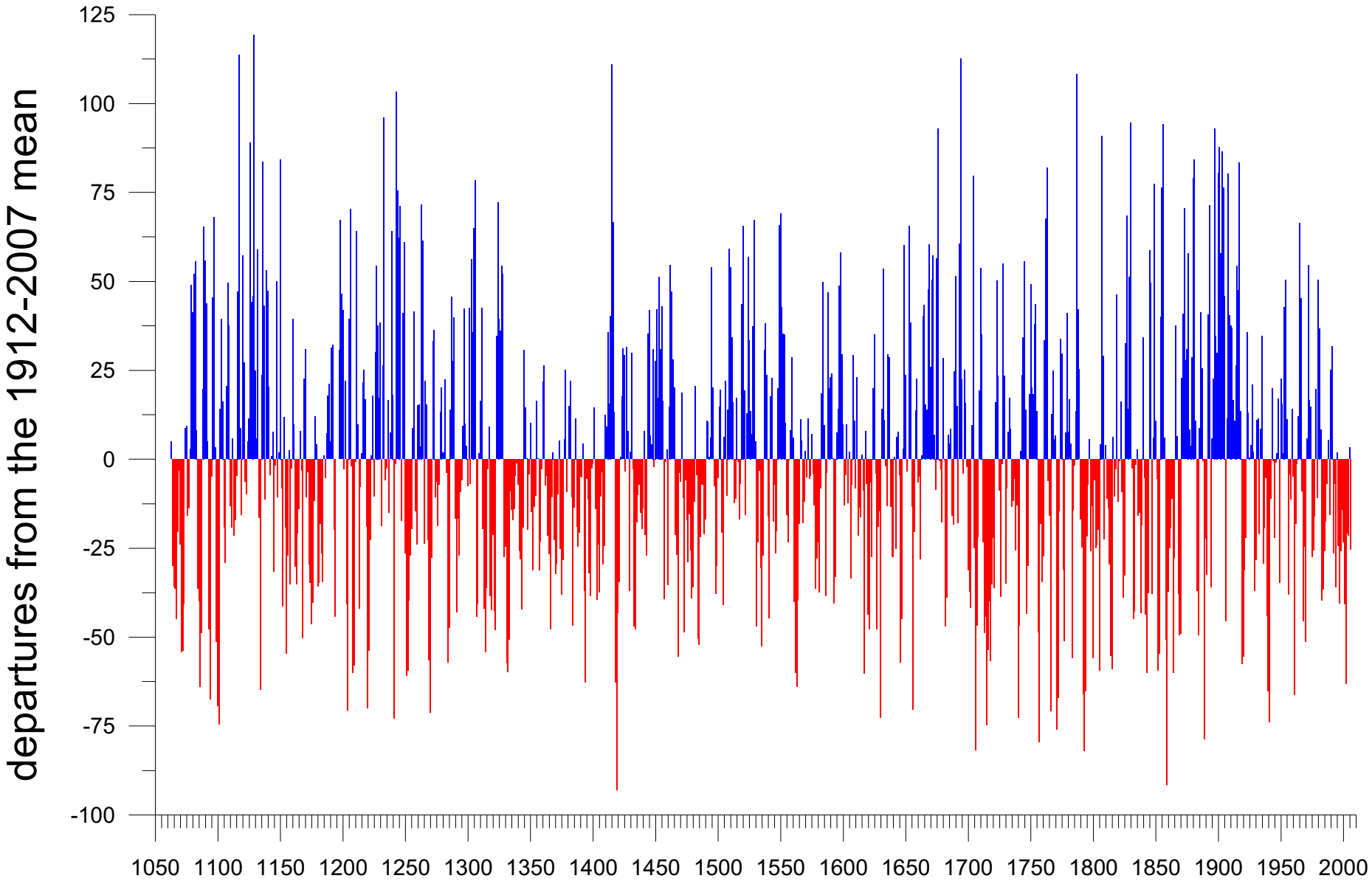
Duncan Hawthorne,
President and CEO
Bruce Power
The Canadian Press *27/11/08*

North Saskatchewan River

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


Energy, Mines and Resources Canada
Énergie, Mines et Ressources Canada
Environment Canada
Environnement Canada
THE NATIONAL ATLAS OF CANADA 5th EDITION
CANADA
STREAMFLOW
Copies of this map may be obtained from the Canada Map Office, Energy, Mines and Resources Canada, Ottawa, or your nearest map dealer.
Cette carte est aussi publiée en français.
ARCTIC OCEAN
PACIFIC OCEAN
ATLANTIC OCEAN
Hudson Bay
MACKENZIE
NELSON
SAINT LAWRENCE
GREENLAND
UNITED STATES OF AMERICA
AVERAGE ANNUAL RIVER FLOW
HYDROGRAPHS OF MONTHLY RUNOFF
DRAINAGE BASINS
RUNOFF AND STREAMFLOW
AVERAGE ANNUAL RUNOFF
Canada

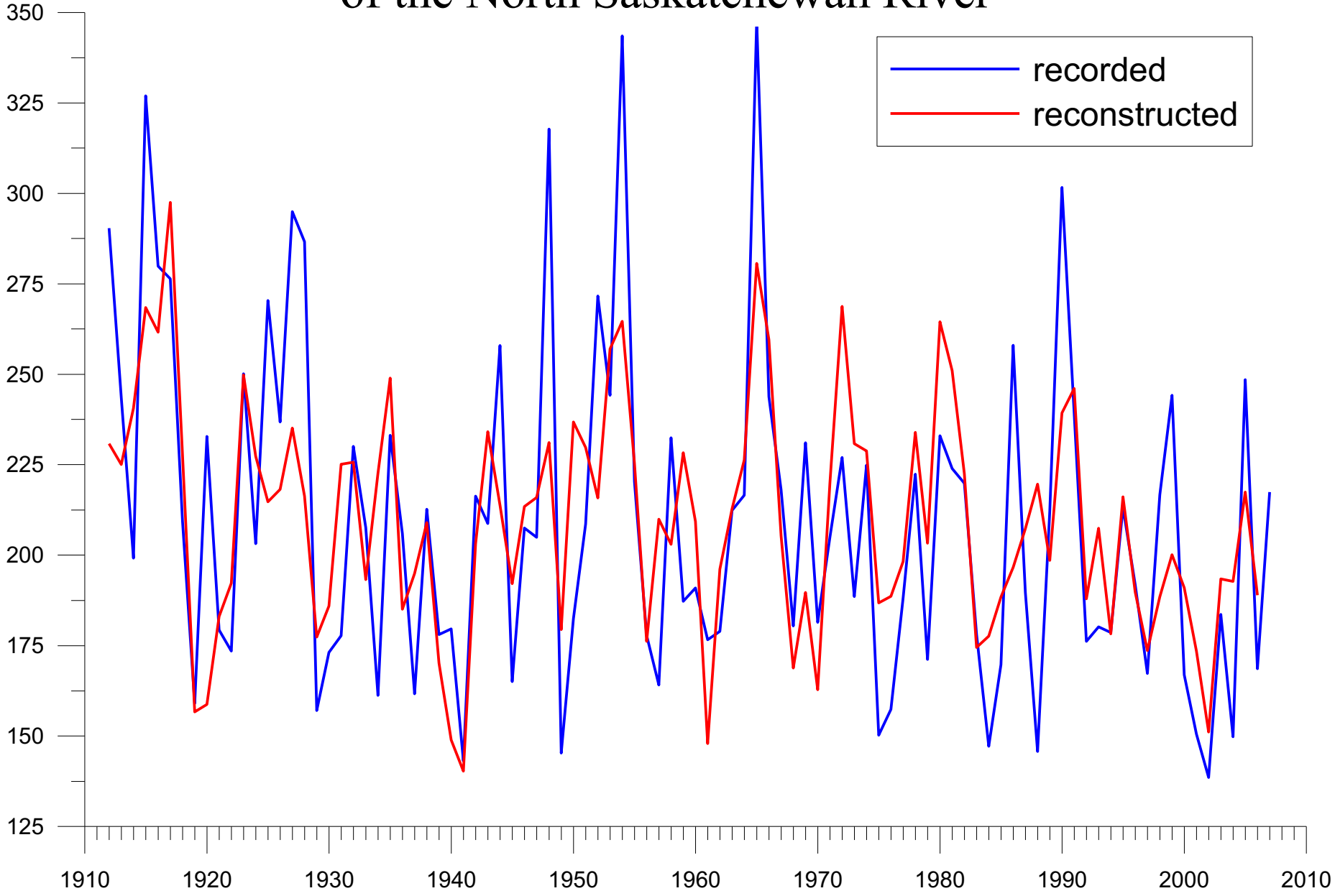
North Saskatchewan River at Edmonton, 1063-2006




earlywood
late wood
one tree ring

Vanstone et al.

Nine hundred year streamflow reconstruction of the North Saskatchewan River



Old Wood
Headwaters, NSRB

- 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

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.

UNIVERSITY OF REGINA

PARC

The Alberta Vulnerability Assessment Project

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

- Barrow and Yu, 2005. Climate Scenarios for Alberta.
- Sauchyn et al. 2007. Alberta Biophysical Impact Assessment
- Sauchyn, Barrow and Lapp. 2008. Climate Variability in Alberta: Pas Present and Future
- Weber, Davidson and Sauchyn, 2008. Integrated Vulnerability Assessment

Alberta Environment

PARC

FROM IMPACTS to ADAPTATION
Canada in a Changing Climate 2007

VIVRE AVEC LES CHANGEMENTS
climatiques au Canada : édition 2007

Government of Canada | Gouvernement du Canada

Canada

CHAPTER 7
Prairies

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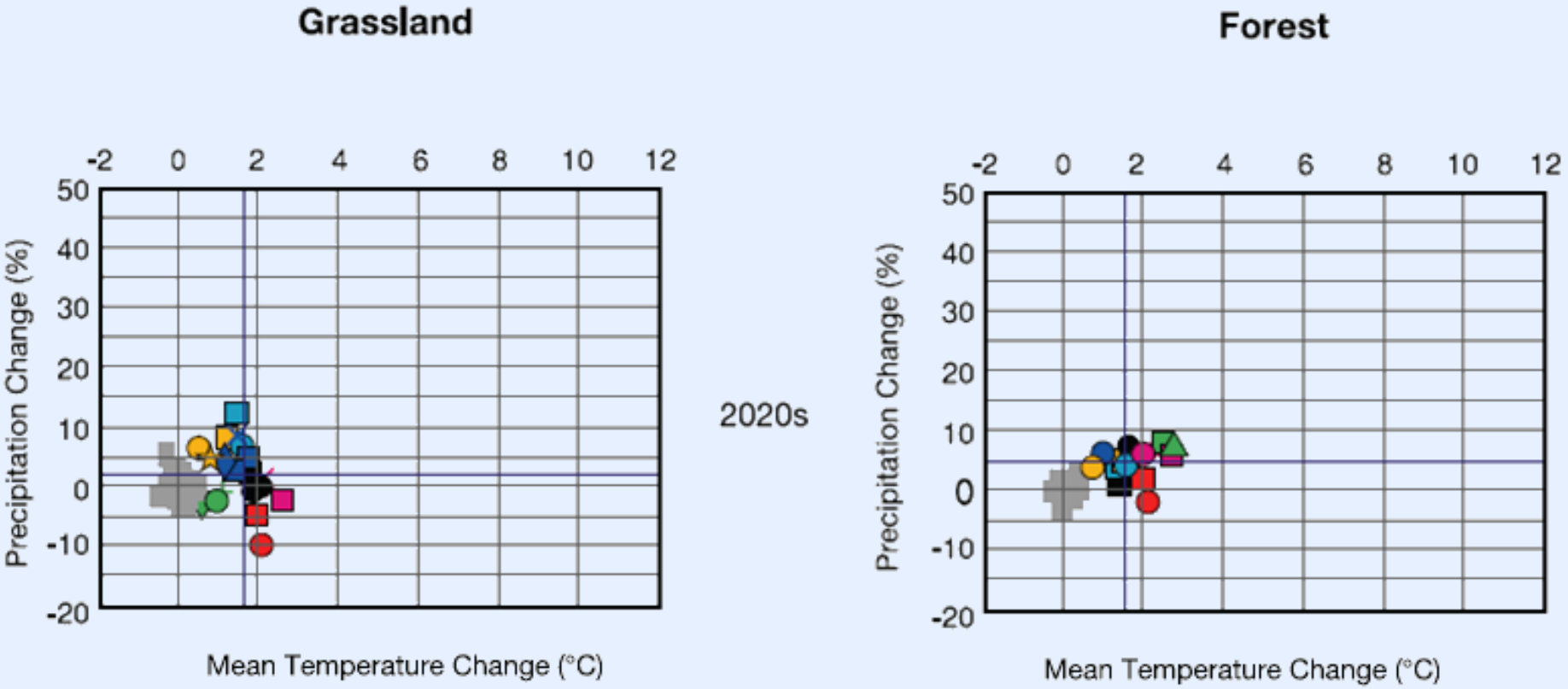
Projected changes in mean annual temperature and precipitation



The coloured symbols are the projected from global climate models; the grey squares show the 'natural' climate variability simulated by a long control run of the CGCM2.

Global warming -- it's not all bad

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

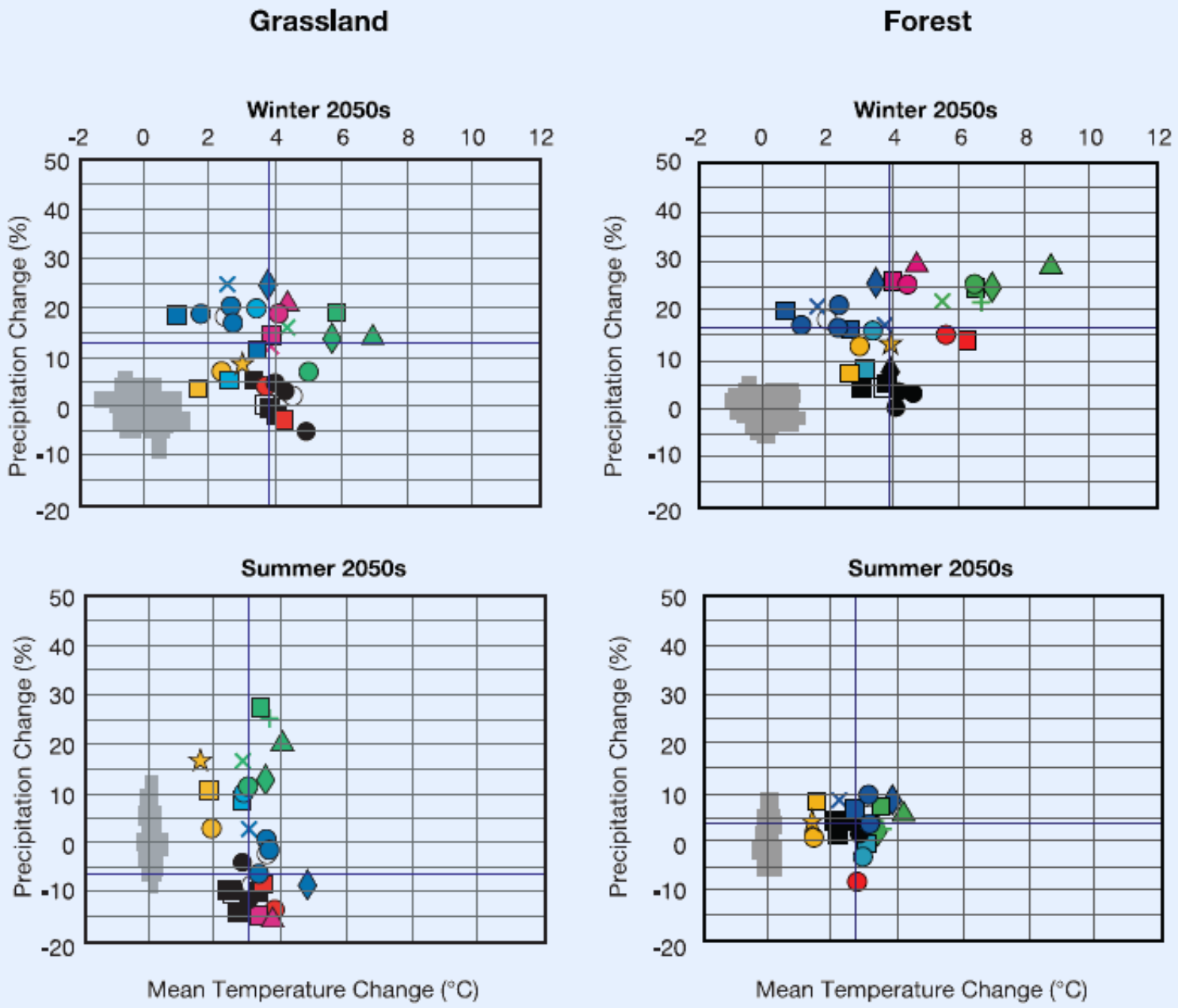
David Staples, The Edmonton Journal
Sunday, November 23, 2008

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.“**

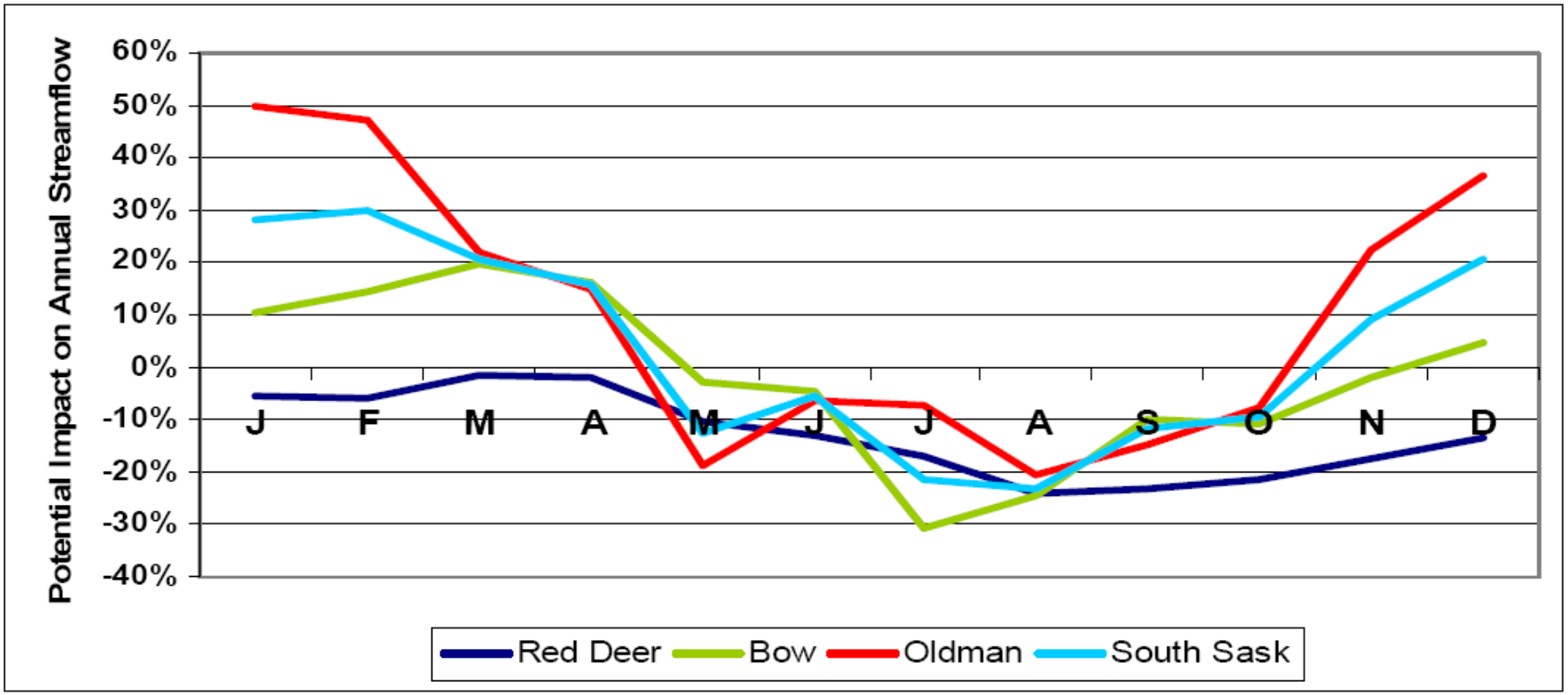
There will be opportunities for Canadian farmers going forward, **Sauchyn says** … "The most challenging impact of climate change is not going to be a shift in average conditions …”

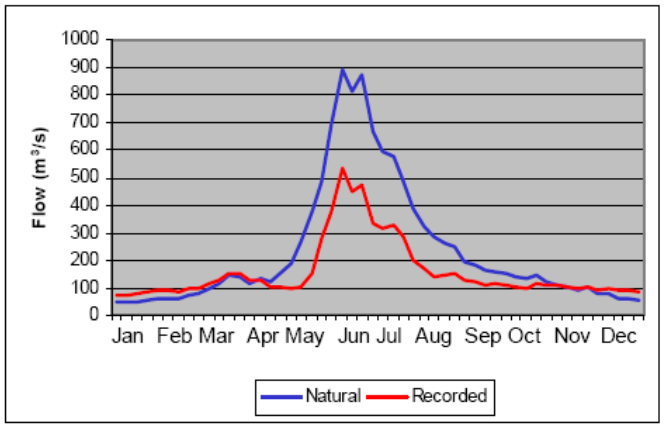
We are losing the advantage of a cold winter

Seasonal Scenarios



Potential Climate Change (%) Impacts on Natural Flows in the SSRB





AMEC. 2009. South Saskatchewan River Basin in Alberta: Water Supply Study. Alberta Agriculture and Rural Development.
Martz et al. (2007)

Extra water will be available in winter and spring, while summers generally will be drier

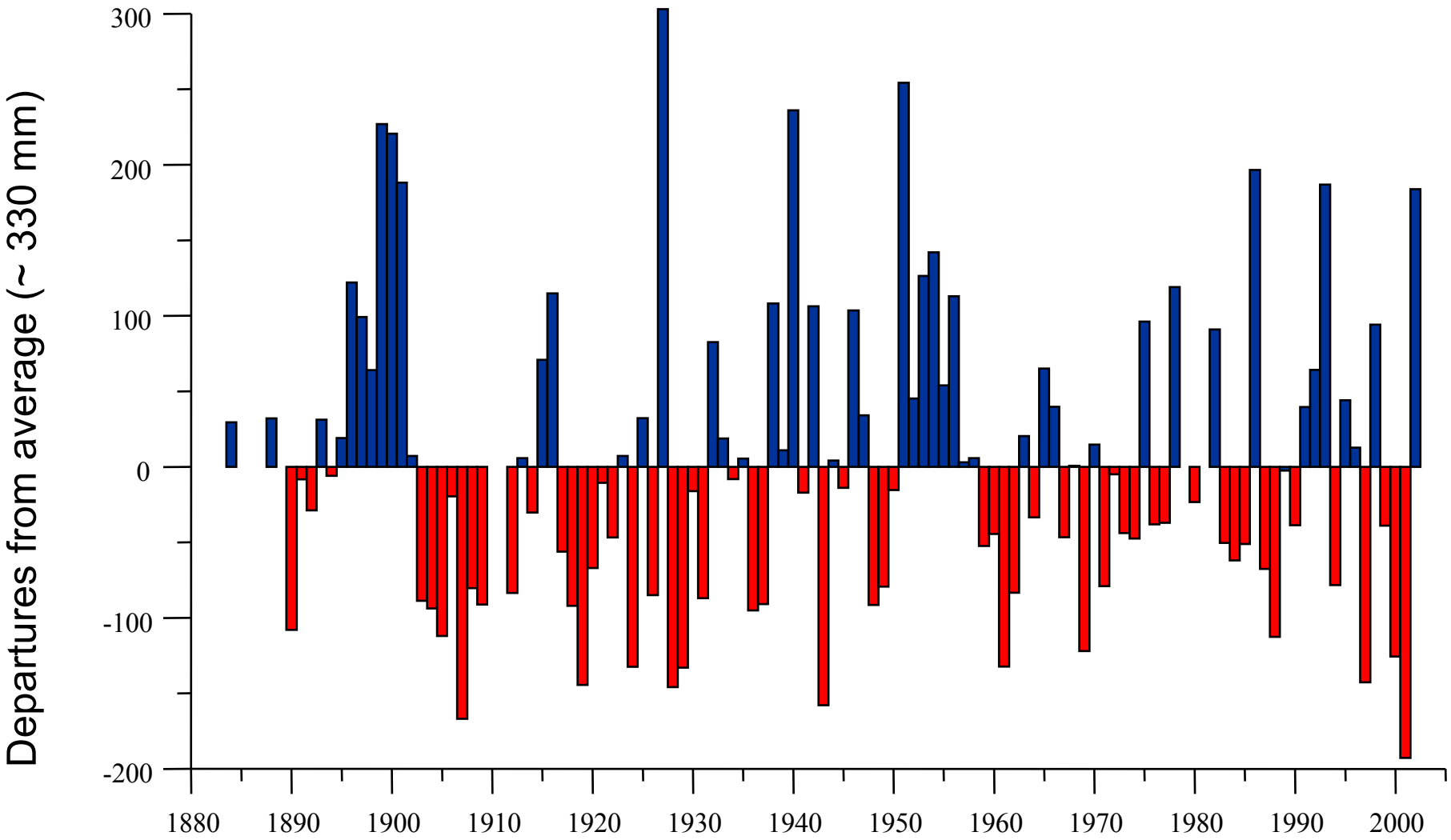
Major changes in ecological goods and services are expected

Extreme weather and climate are “wild cards”

There will be greater variation in water and climate

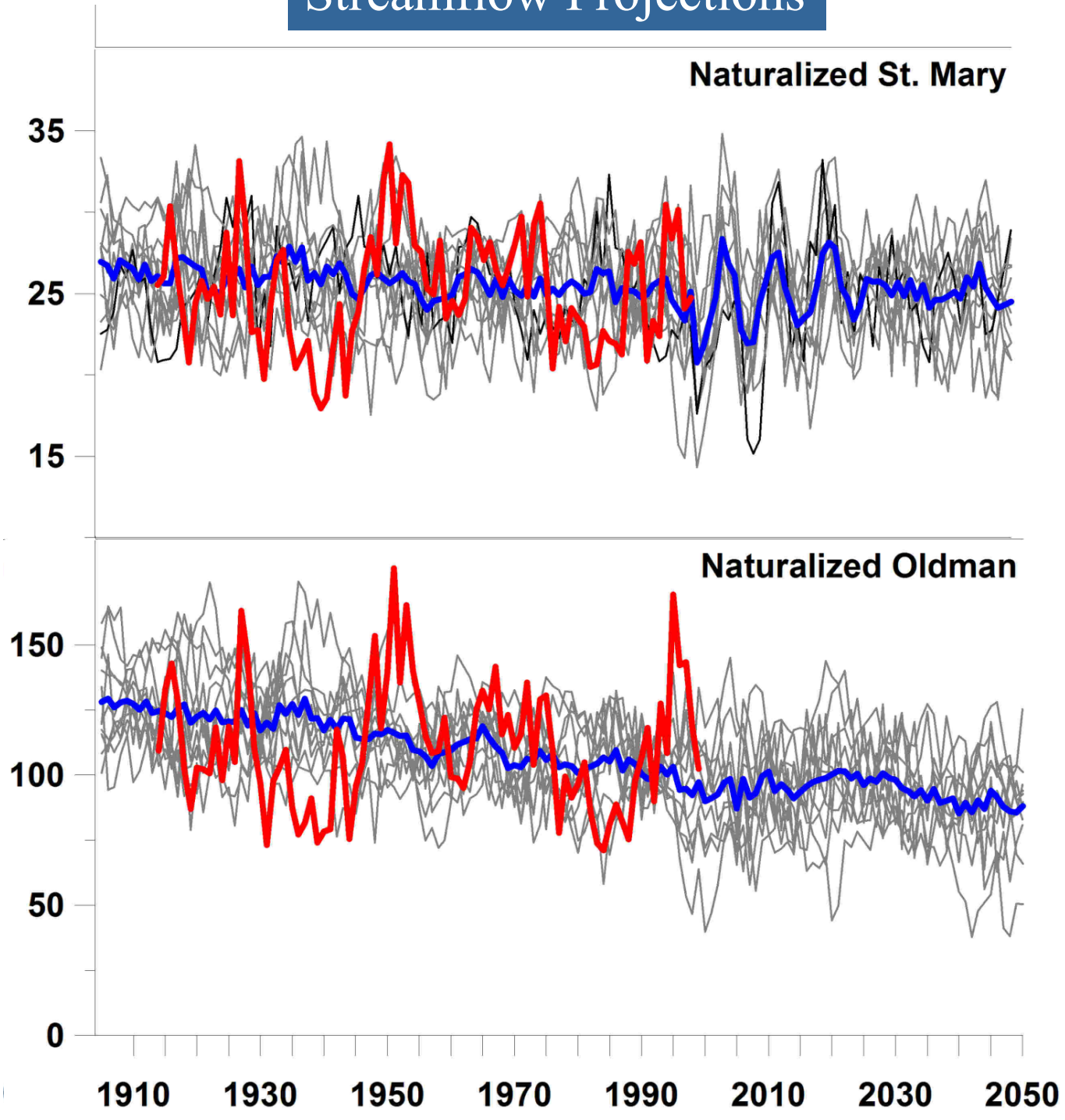
Both drought and unusually wet years could occur with greater frequency and severity

Precipitation at Medicine Hat,1884-2002

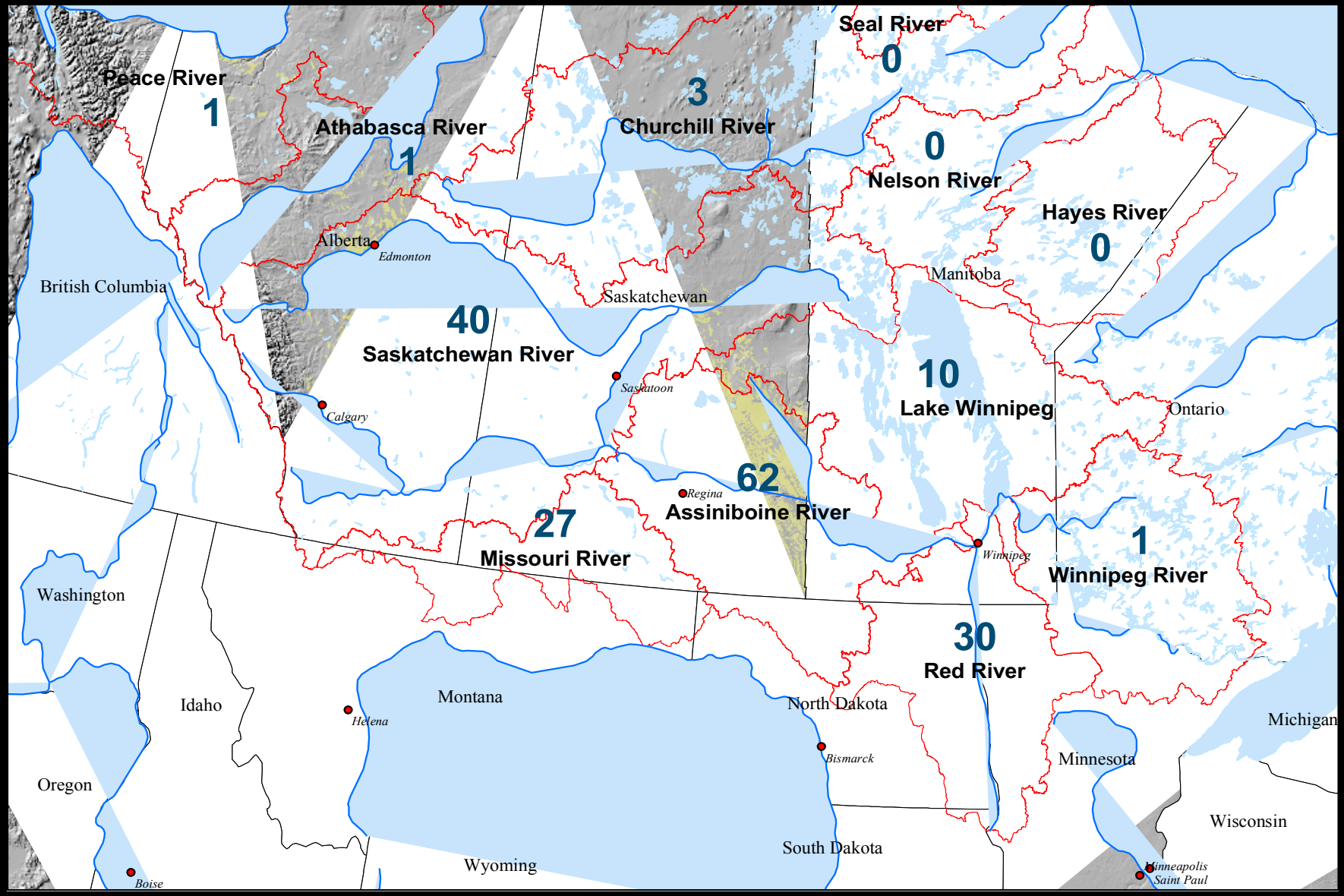


Global Warming Amplifies Hydro-Climatic Variability

Streamflow Projections



Prairie Drainage Basins



(source: AESB – formerly PFRA)

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

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

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

9. **Drought: Prairie provinces, 1931**
Prairie provinces, 1931-1938. The "dirty thirties"; dust storms, plant rust, heat waves, grasshopper plagues and water shortages plagued western Canada for almost... more information.
Dead: 0 **Injured:** 0 **Evacuated:** 0

10. **Drought: Prairie provinces, 1989**
Prairie provinces, 1989. Cereal crop drought occurred in parts of 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

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

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

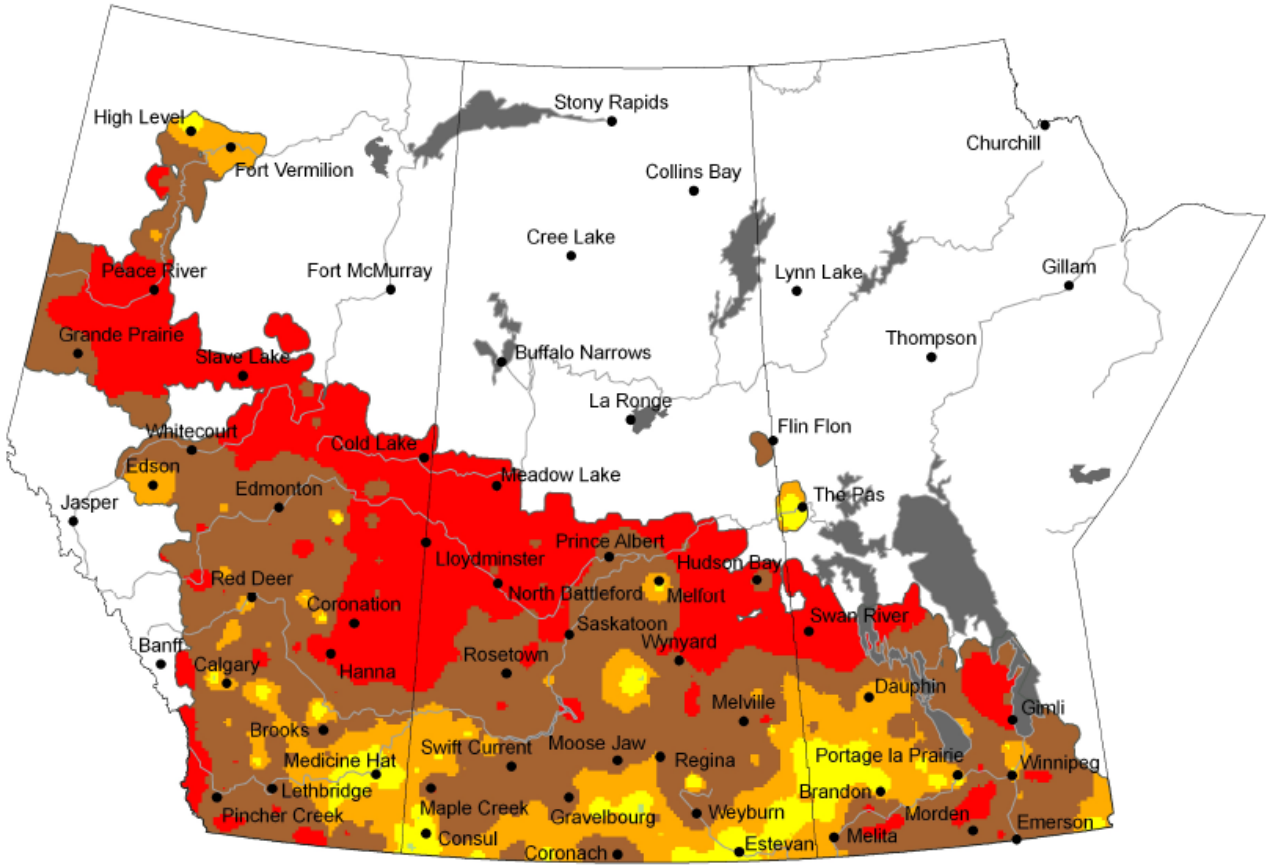
18. **Drought: Prairie provinces, 1992**
Prairie provinces, 1992. Livestock yields were low in northern Alberta and Saskatchewan due to dry conditions; severe and widespread surface water droughts reported... more information.

Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

Canada

Precipitation Compared to Historical Distribution (Prairie Region)

November 1, 2009 to March 11, 2010



- 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.

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: 03/12/10
www.agr.gc.ca/drought

North American Drought Monitor

February 28, 2010

Released: Monday March 22, 2010

http://www.ncdc.noaa.gov/nadm.html

Analysts:

Canada - Trevor Hadwen
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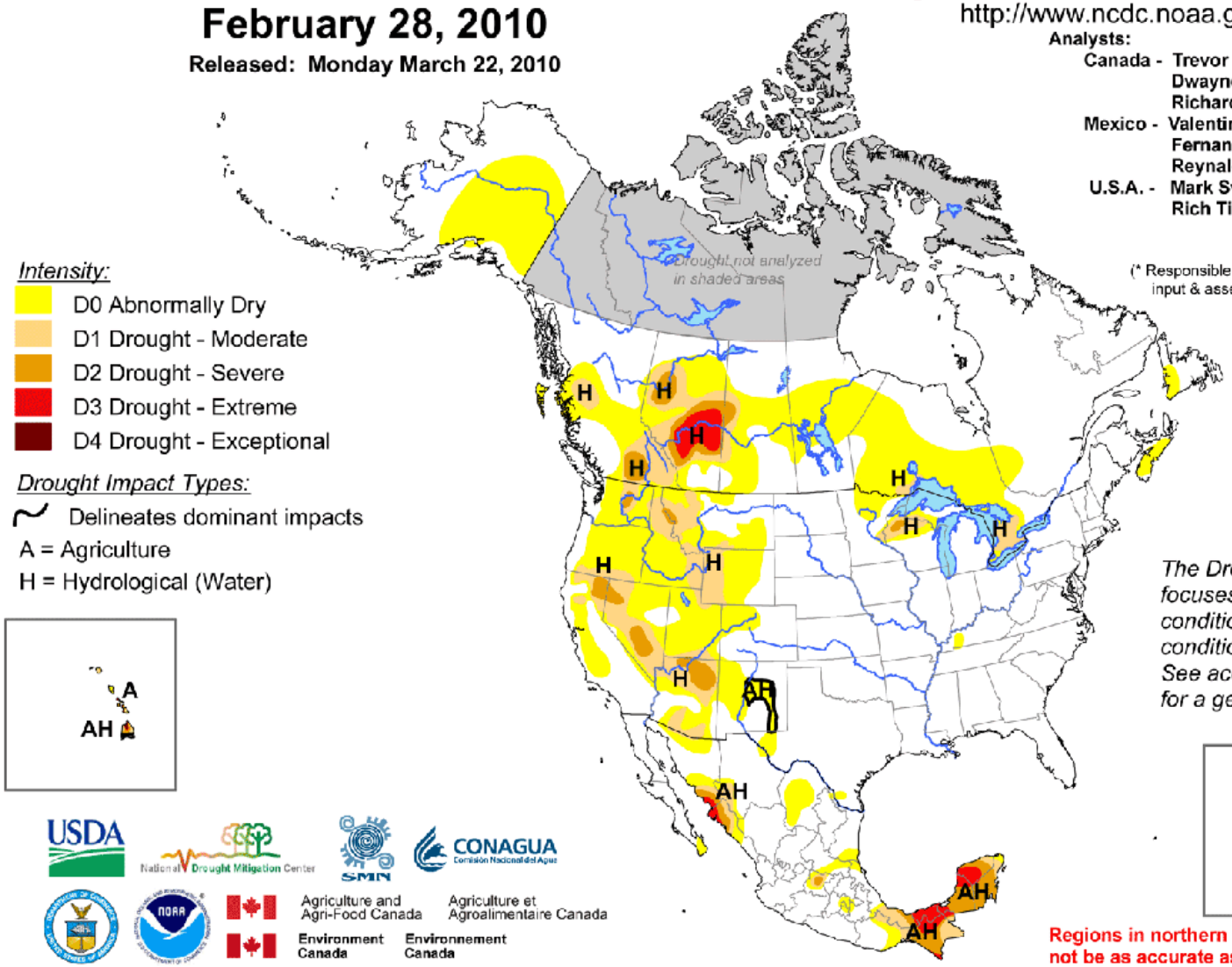
Fernando Romero
Reynaldo Pascual
U.S.A. - Mark Svoboda*
Rich Tinker

(* Responsible for collecting analysts' input & assembling the NA-DM map)



Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

Drought Impact Types:

Delineates dominant impacts

A = Agriculture

H = Hydrological (Water)

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text for a general summary.

Regions in northern Canada may not be as accurate as other regions due to limited information.

USDA | National Drought Mitigation Center | SMN | CONAGUA Comisión Nacional del Agua | NOAA | Agriculture and Agri-Food Canada / Agriculture et Agroalimentaire Canada | Environment Canada / Environnement Canada

The net impacts of climate change are not clear

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