# Energia y Cambio Climatico

**Dave Sauchyn**
Prairie Adaptation Research Collaborative,
University of Regina, Canada

Camara de Construccion, La Serena, Chile, 26 April 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

WMO INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE UNEP

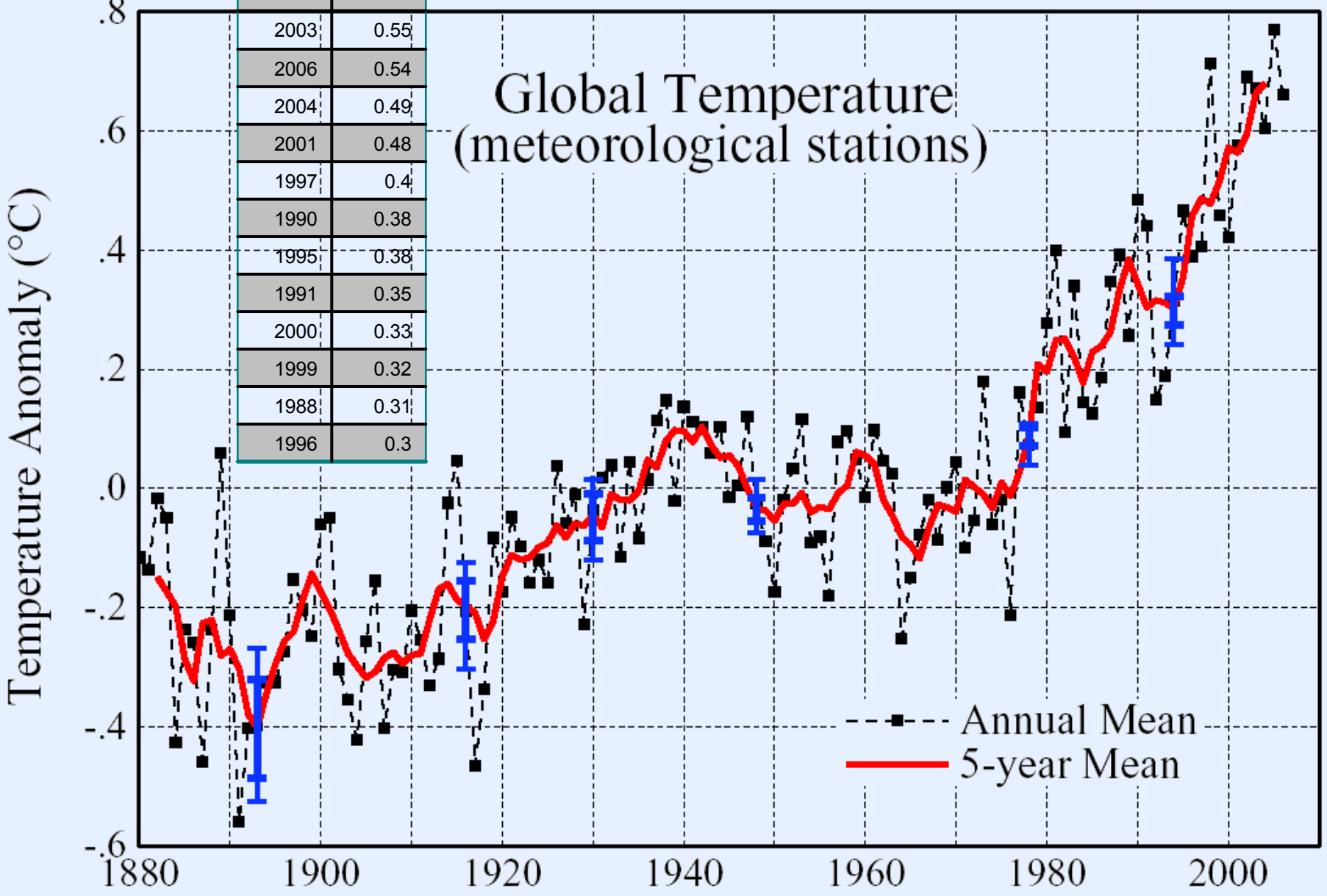
# 4th Assessment Report

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

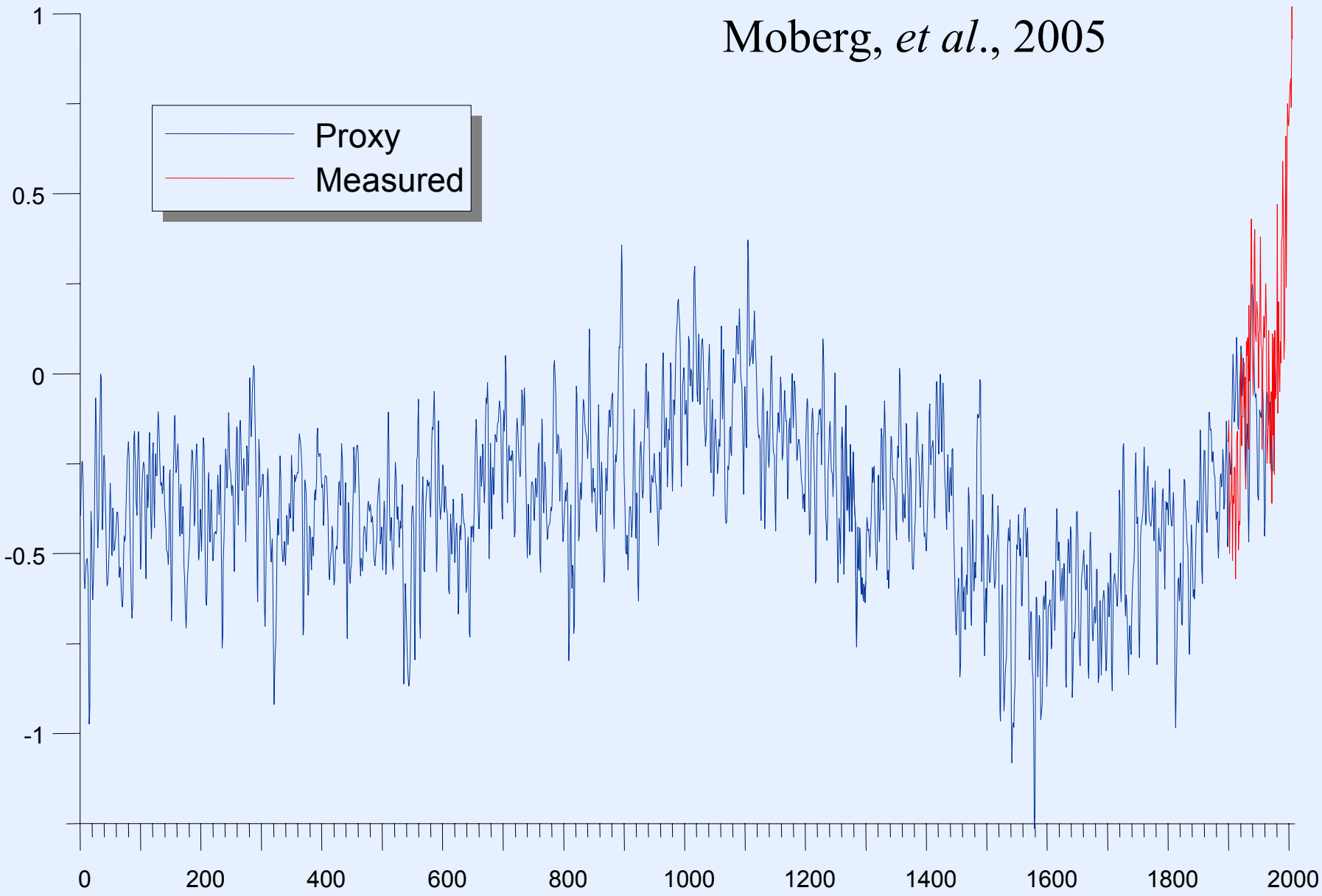
**Climate Change 2007: The Physical Science Basis - Summary for Policymakers, February 2, 2007**

| | |
|---|---|
| 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 |

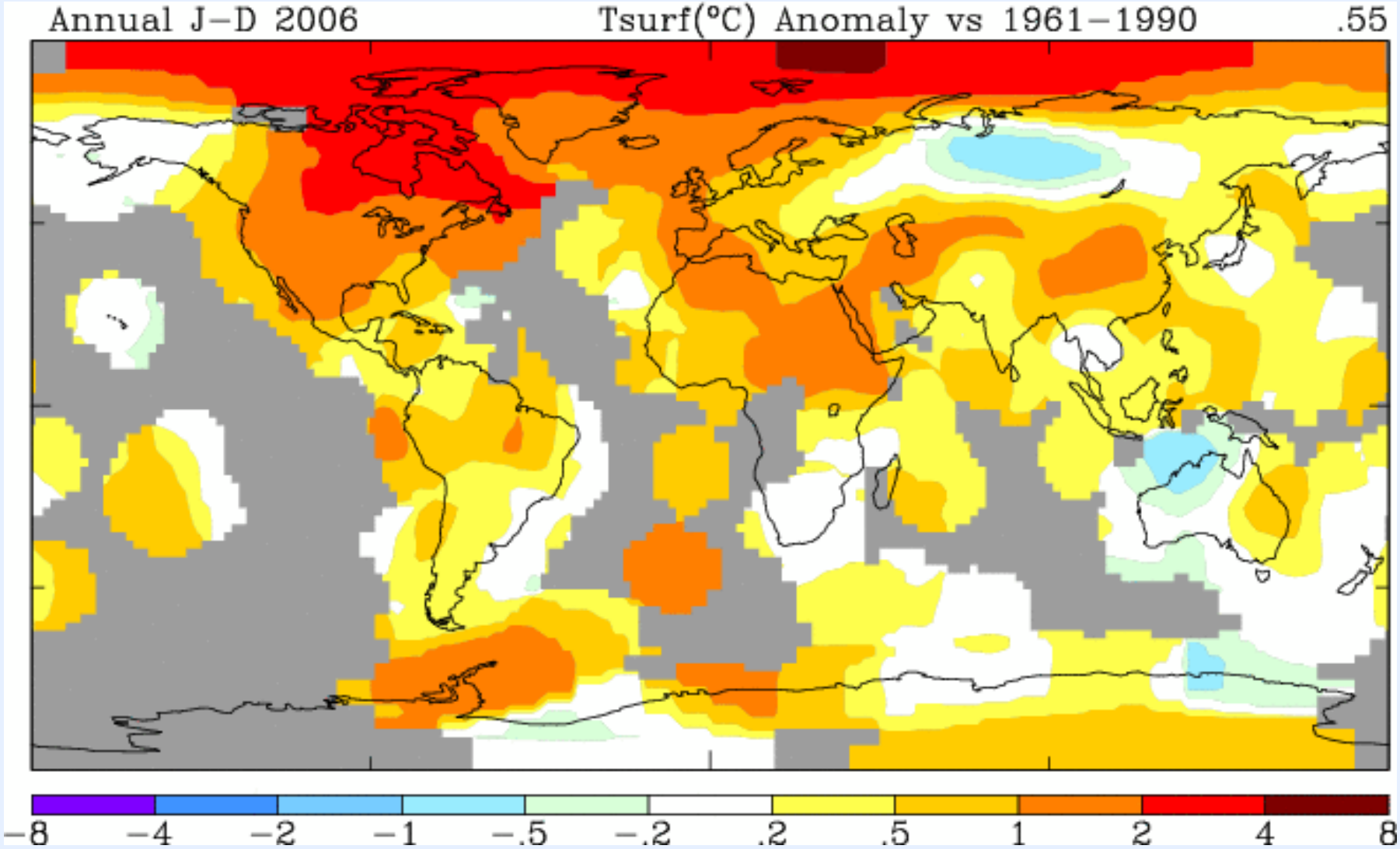
http://data.giss.nasa.gov/gistemp/



# Northern Hemisphere temperature, past 1000 years

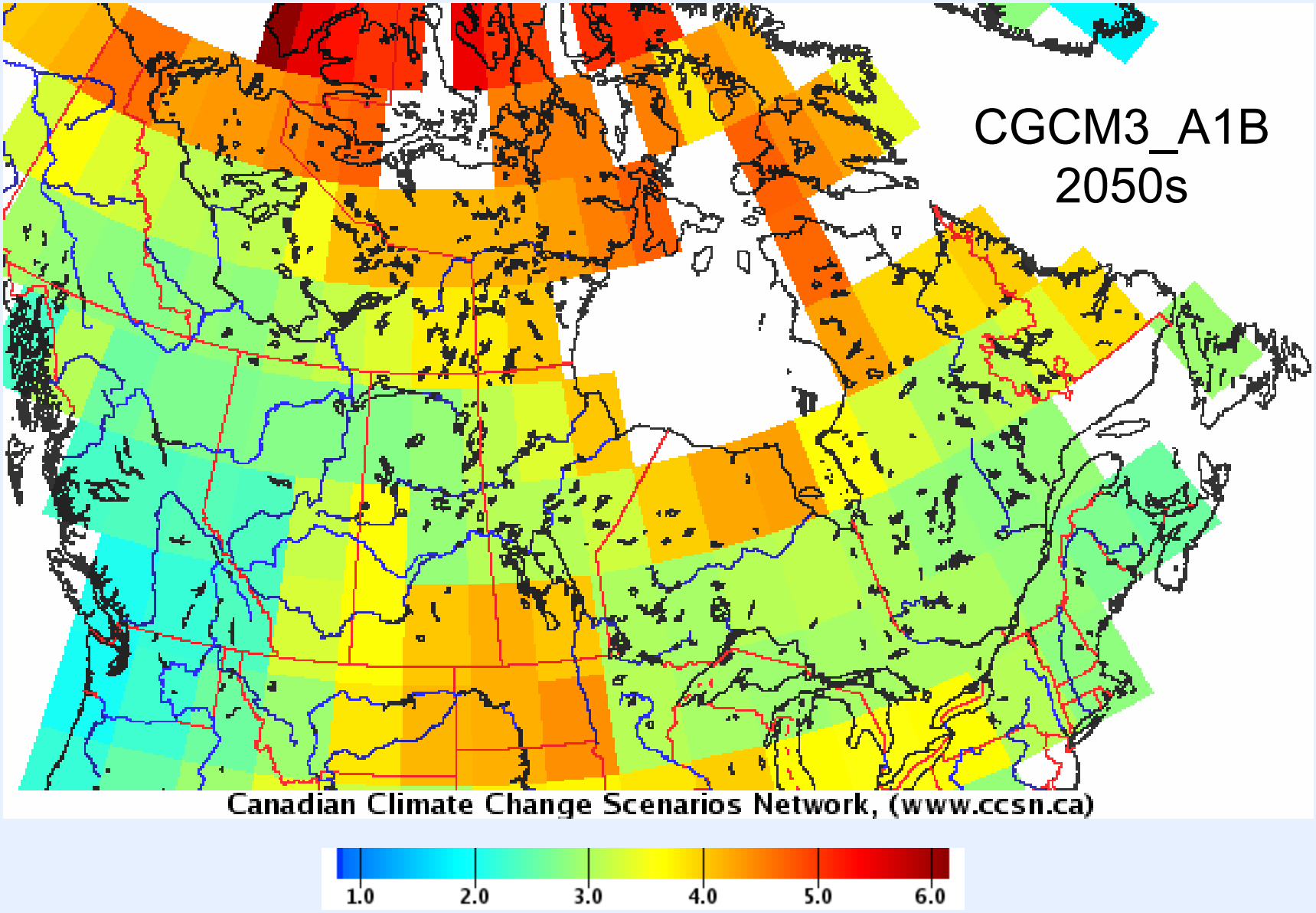


# 2006 Temperatures: Departures from Normal (1961-90)




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

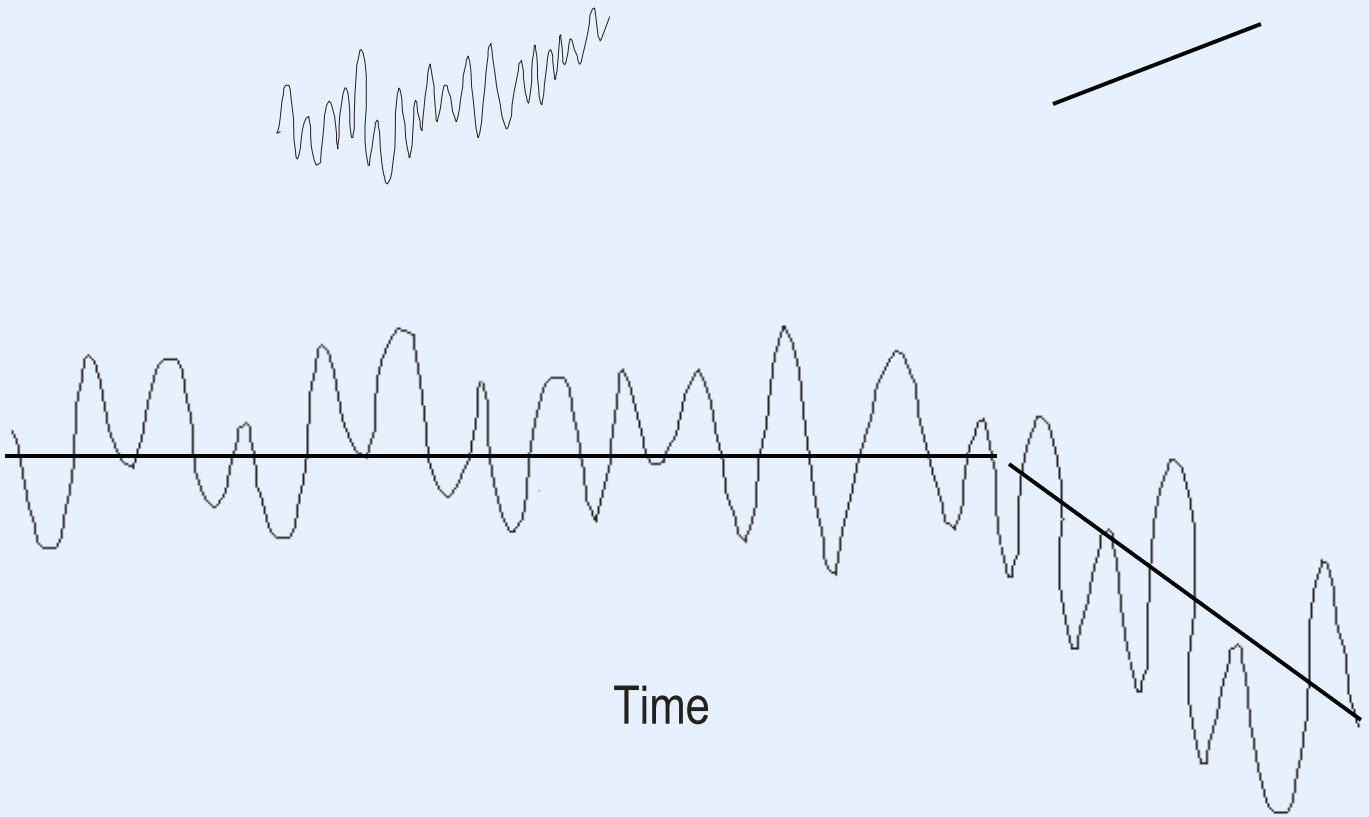
# Mean annual temperature (° C) 2050s vs 1961-90)

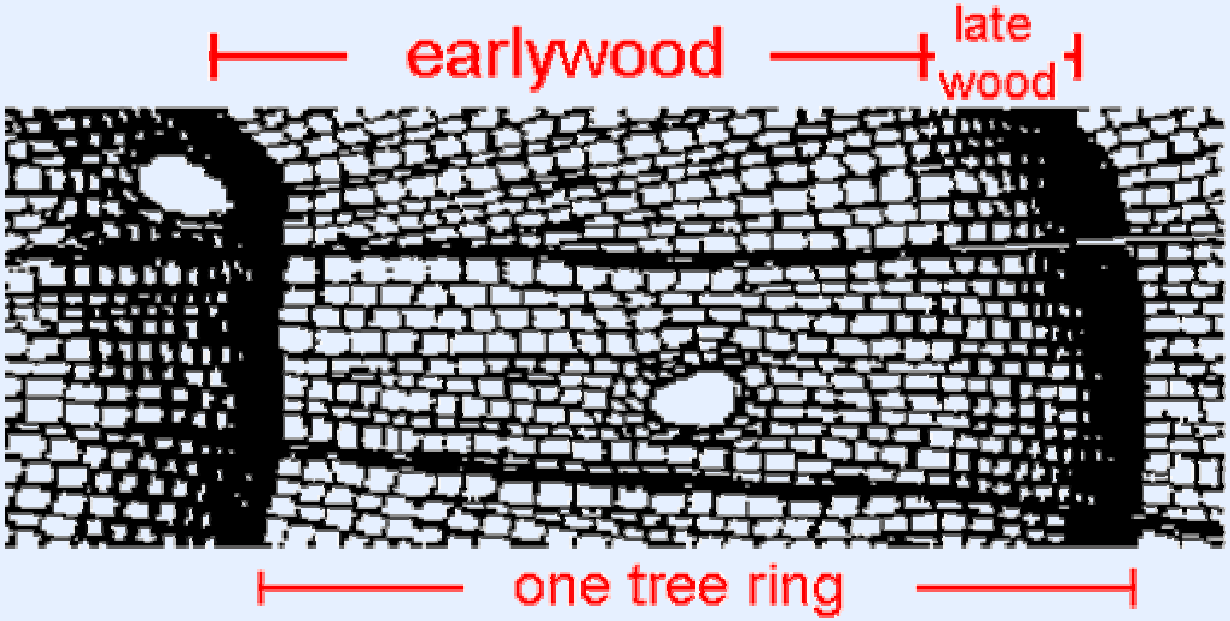


# Trend (change) versus Variability

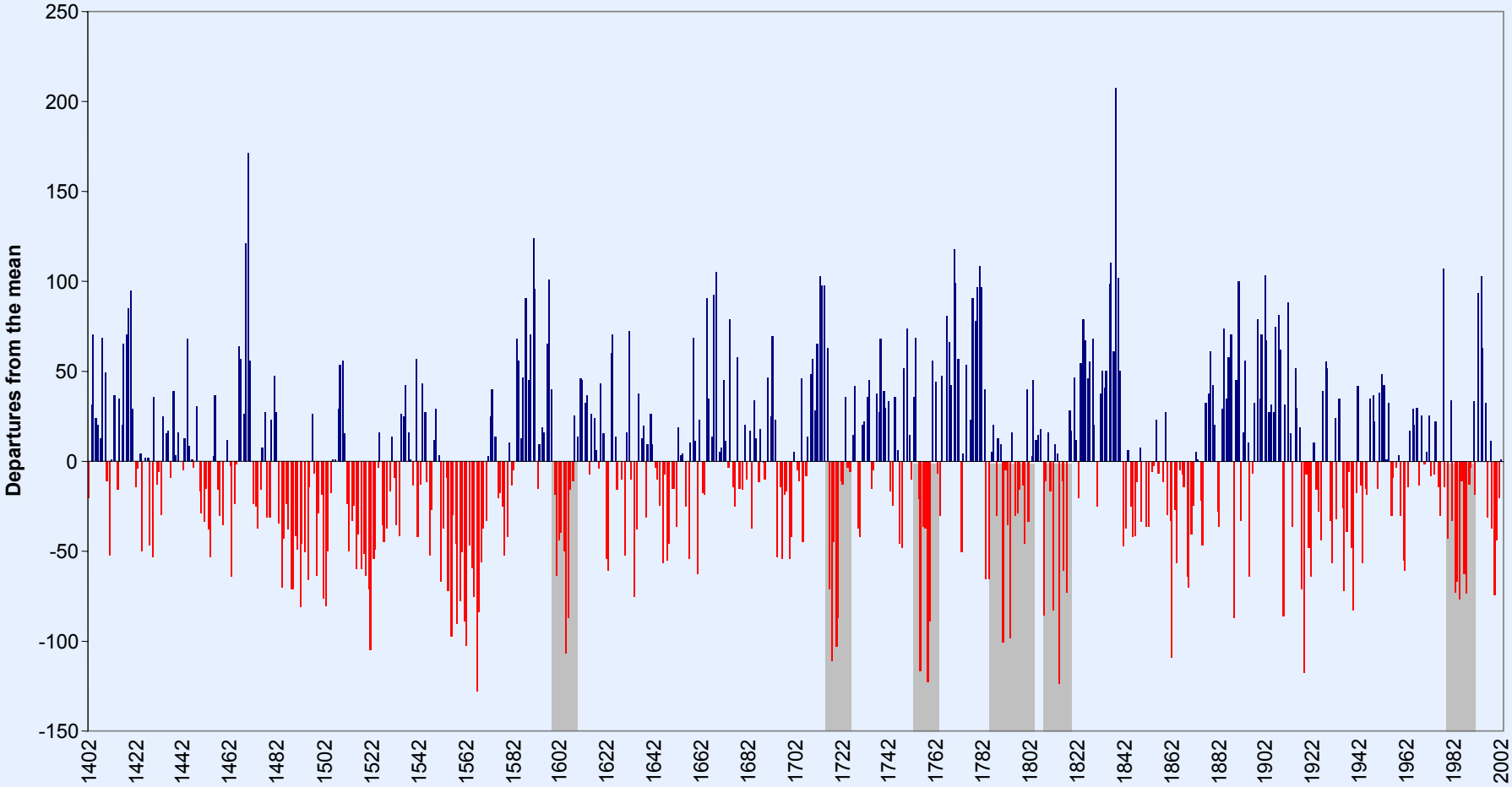
Climatic variability

Climatic change



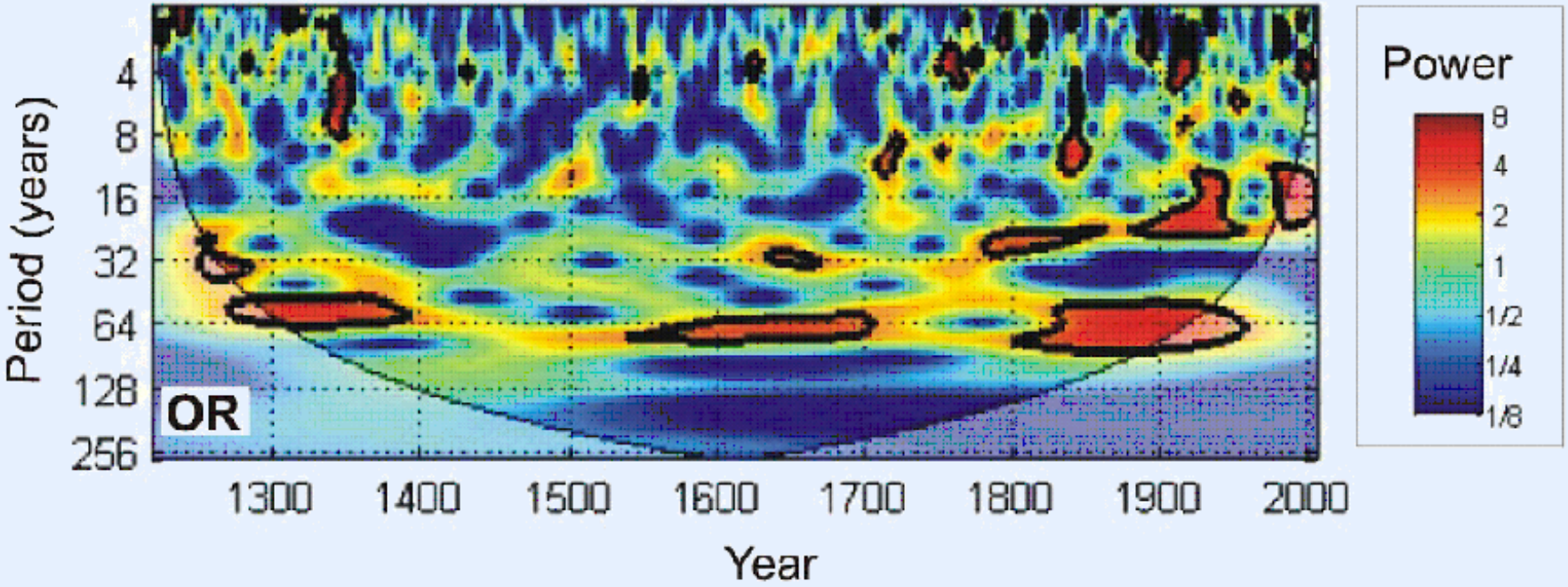

earlywood
late wood
one tree ring

# South Saskatchewan River at Medicine Hat, Alberta,1402-2004



# Wavelet power spectrum

*Pinus flexilis*



Collaborative Research
David Sauchyn-ULS-Laboratorio
Dendrocronología Universidad Austral de Chile

3th Progress Report

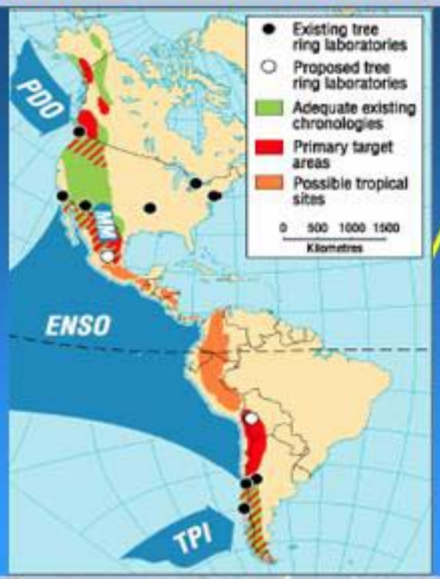
# 2nd Dendrochronological Collection: Concluding the fieldwork

by

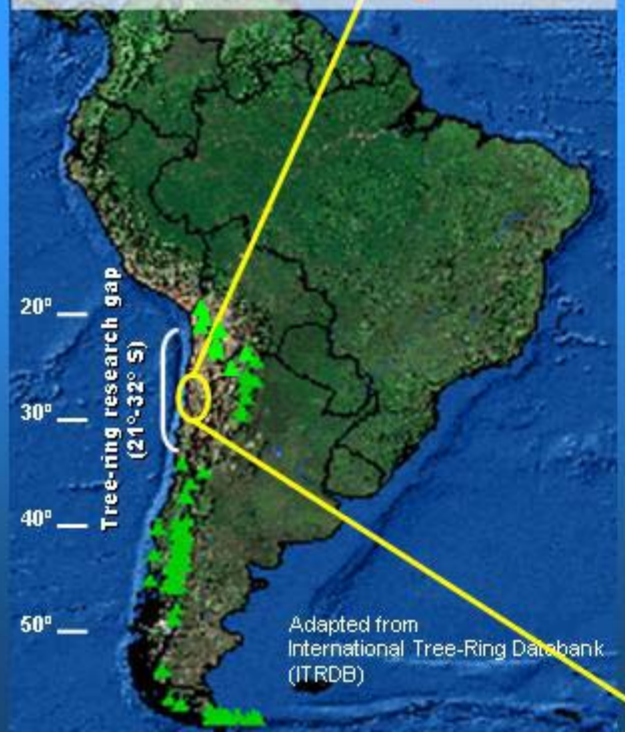
**Jonathan Barichivich**

Valdivia, May 2006

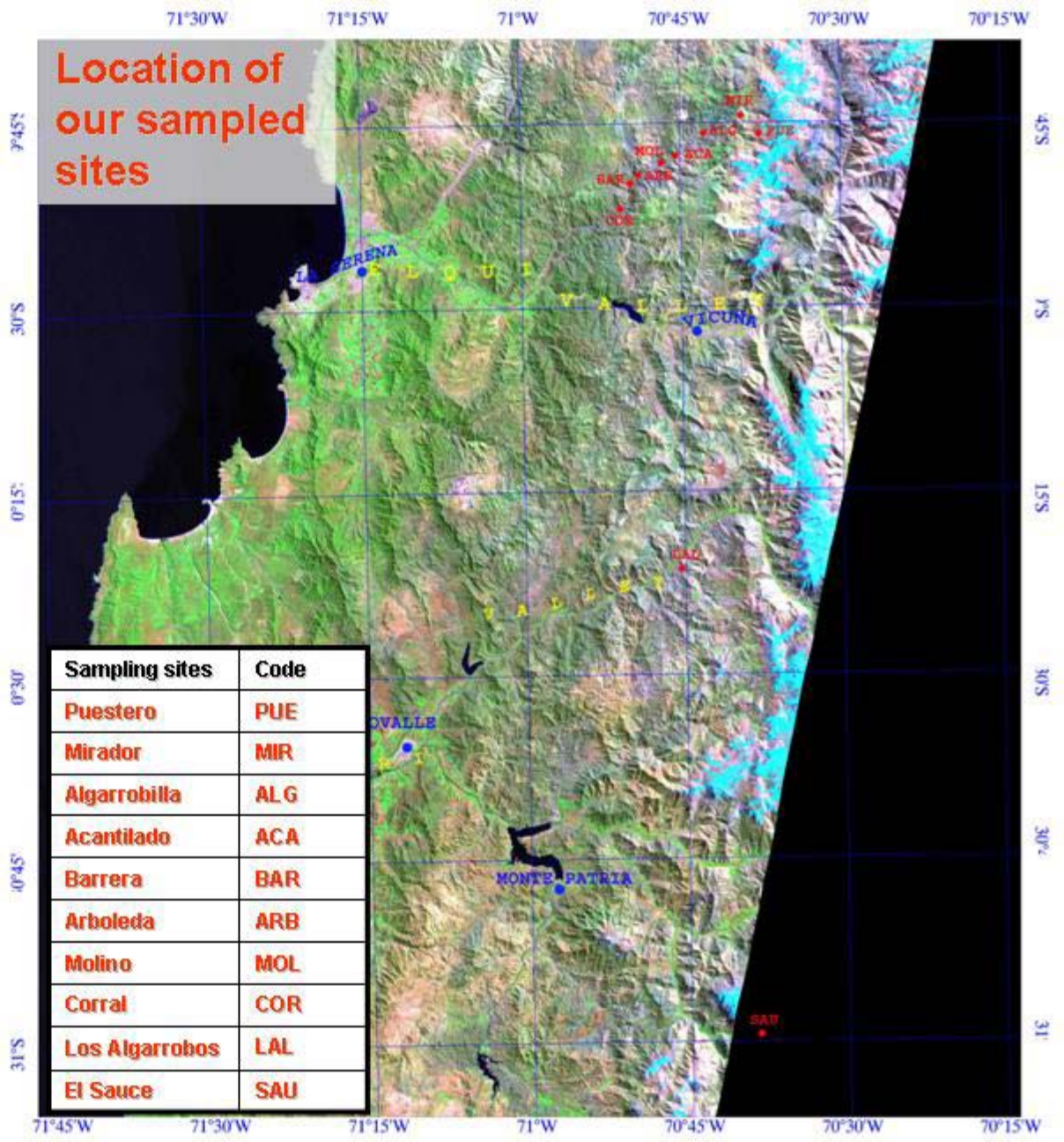
## Dendrochronological coverage and climate forcings in the Western Americas




## South American Tree-Ring Network




## Location of our sampled sites




| Sampling sites | Code |
|---|---|
| Puestero | PUE |
| Mirador | MIR |
| Algarrobilla | ALG |
| Acantilado | ACA |
| Barrera | BAR |
| Arboleda | ARB |
| Molino | MOL |
| Corral | COR |
| Los Algarrobos | LAL |
| El Sauce | SAU |

# Sampling sites

| No. | Site | Area | Latitude (South) | Altitude (m a.s.l.) | Species | No. Trees | No. Cores | No. Cross-sections | Total |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Puestero | Elqui basin | 29º 45' | 2553 | *Fabiana imbricata* | 15 | - | 24 | **24** |
| 2 | Mirador | Elqui basin | 29º 44' | 2137 | *Proustia cuneifolia* | 15 | - | 22 | **22** |
| 3 | Algarrobilla | Elqui basin | 29º 45' | 1449 | *Balsamocarpon brevifolium* | 10 | - | 13 | **13** |
| 4 | Acantilado | Elqui basin | 29º 47' | 1239 | *Proustia ilicifolia* | 20 | - | 21 | **21** |
| 5 | Barrera | Elqui basin | 29º 49' | 900 | *Geoffroea decorticans* | 7 | 8 | - | **8** |
| 6 | Arboleda | Elqui basin | 29º 49' | 966 | *Geoffroea decorticans* | 8 | 8 | - | **8** |
| 7 | Molino | Elqui basin | 29º 48' | 1120 | *Prosopis chilensis* | 16 | 13 | 15 | **28** |
| 8 | Corral | Elqui basin | 29º 51' | 750 | *Prosopis chilensis* | 15 | 15 | 22 | **37** |
| 9 | Los Algarrobos | Limarí basin | 30º 21' | 1014-1040 | *Prosopis chilensis* | 16 | 8 | 11 | **19** |
| 10 | El Sauce | Limarí basin | 30º 59' | 1638-1725 | *Kageneckia angustifolia* | 25 | 7 | 25 | **32** |
| | | | | | **TOTAL** | **147** | **59** | **153** | **212** |

**We collected a total of 212 samples from 7 species and 10 sites covering the western Andean slope Ranging from 29º 44' to 30º 59' S and 750 to 1725 m a.s.l.**

# *Kageneckia*'s site

Sampling of living branches to solve crossdating problems found in the last decades

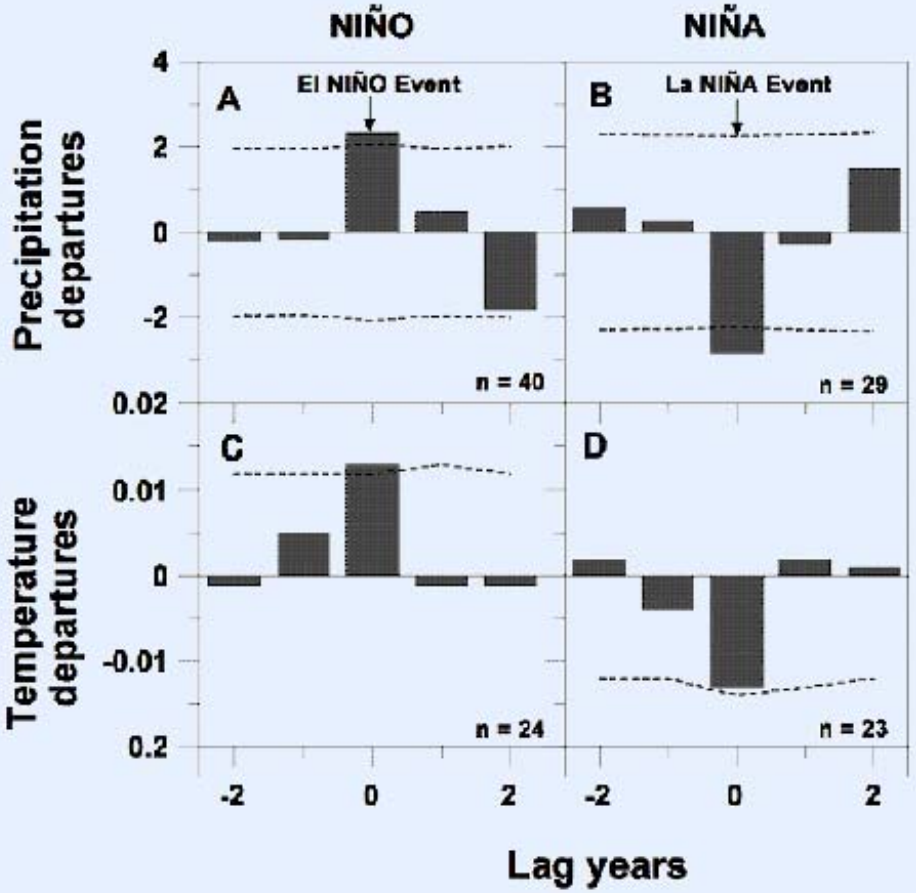
Sampling of old dead wood to extend the chronology into the past

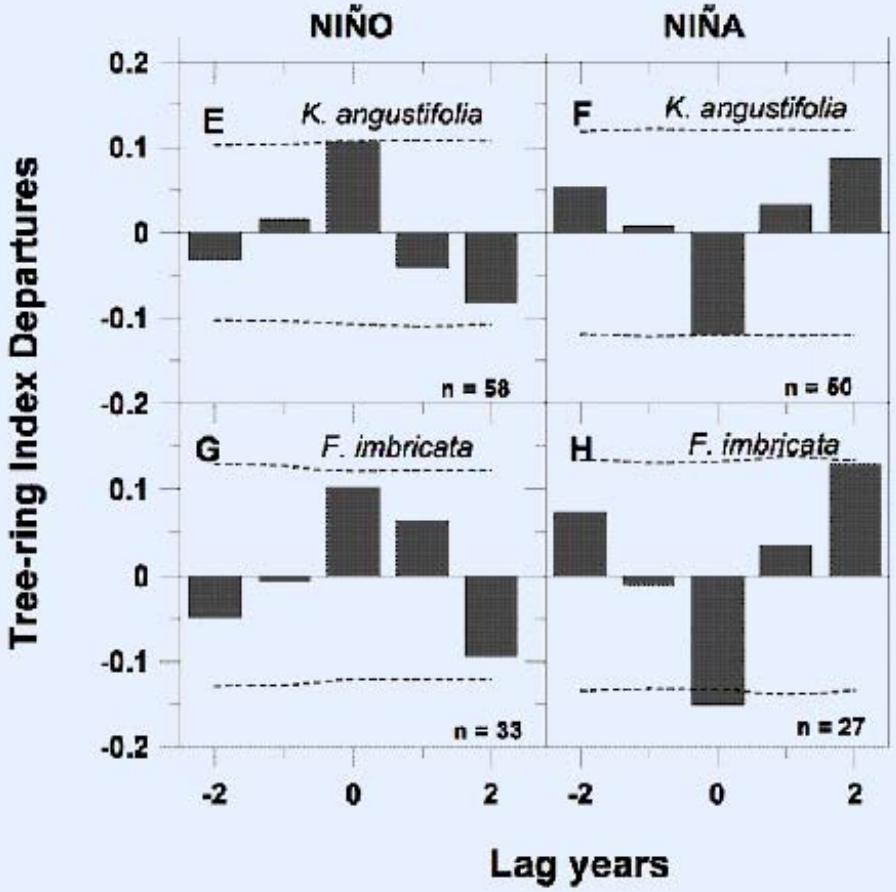
# Wood and Tree-rings

***Kageneckia angustifolia***
**(Pulpica – Small tree)**

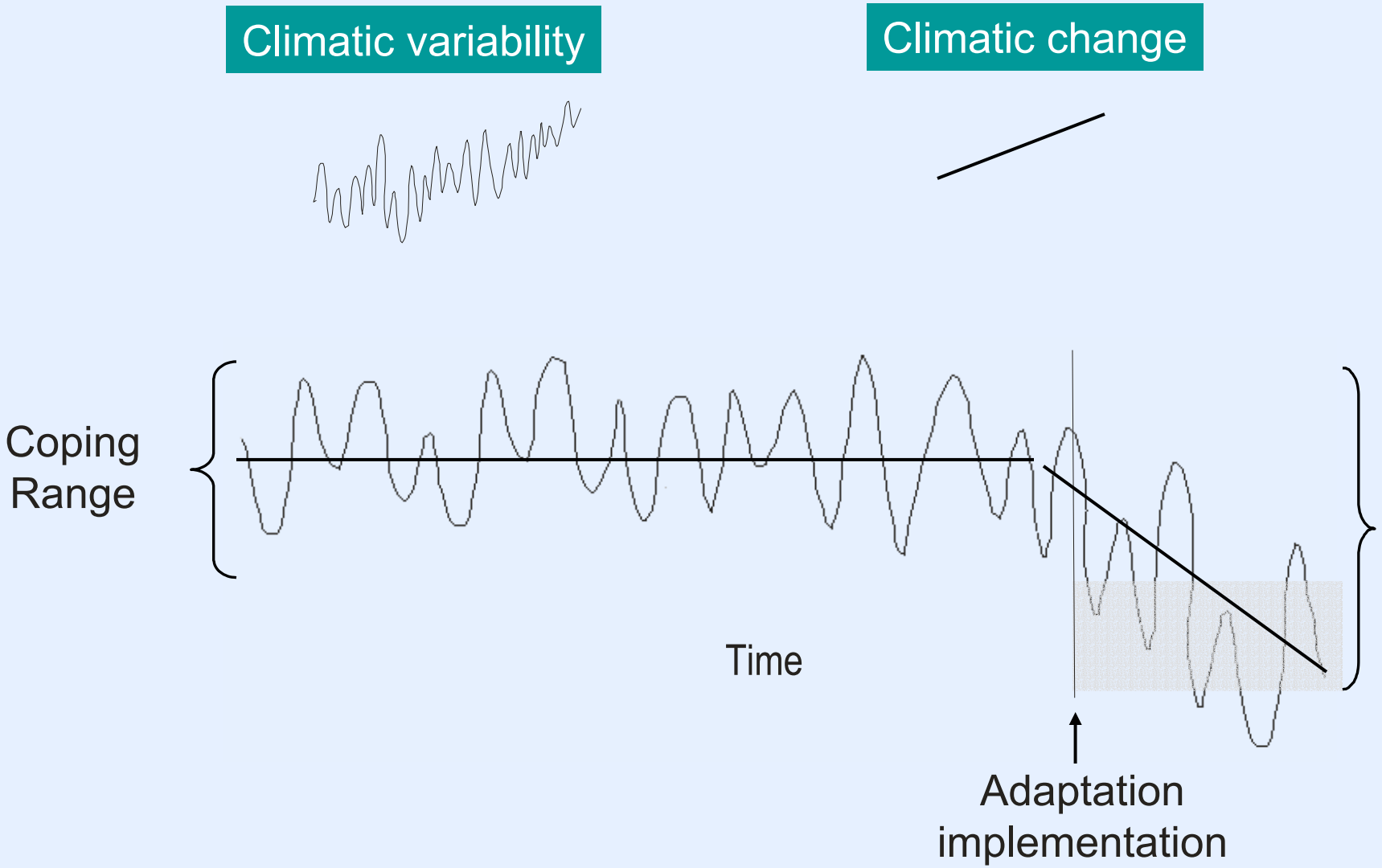

**Ring definition: Good**
**Dating difficulty: Moderate**
**Lifespan: ~130 yr**

# Region IV Dendrochronology – ENSO signal



# Trend (change) versus Variability



# Canadian National Assessment –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

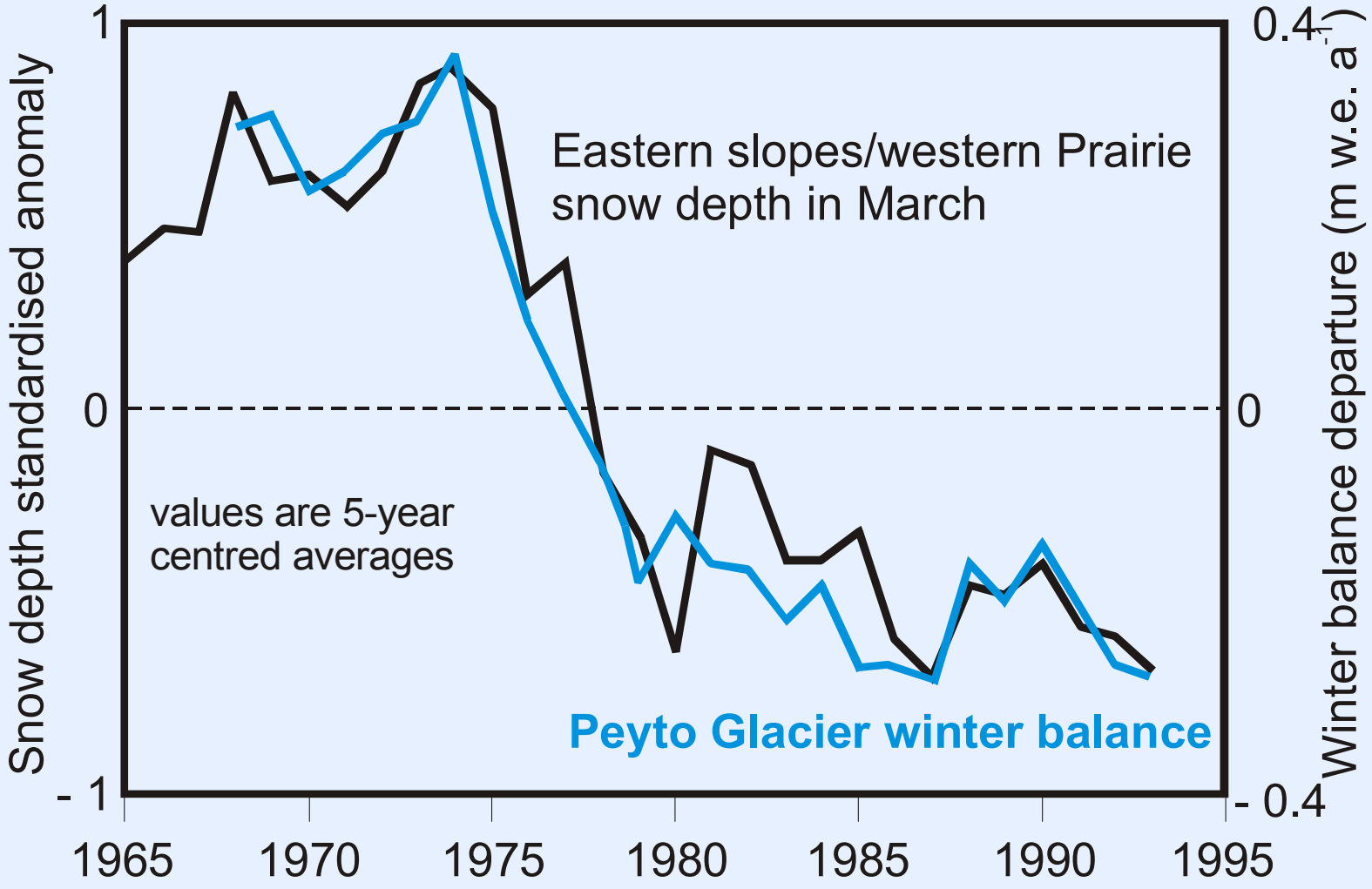
# Major ecosystem shifts are expected

They will be most visible in the mountains and at the margins of the northern and western forests.

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

*There are advantages and disadvantages to a shorter winter*



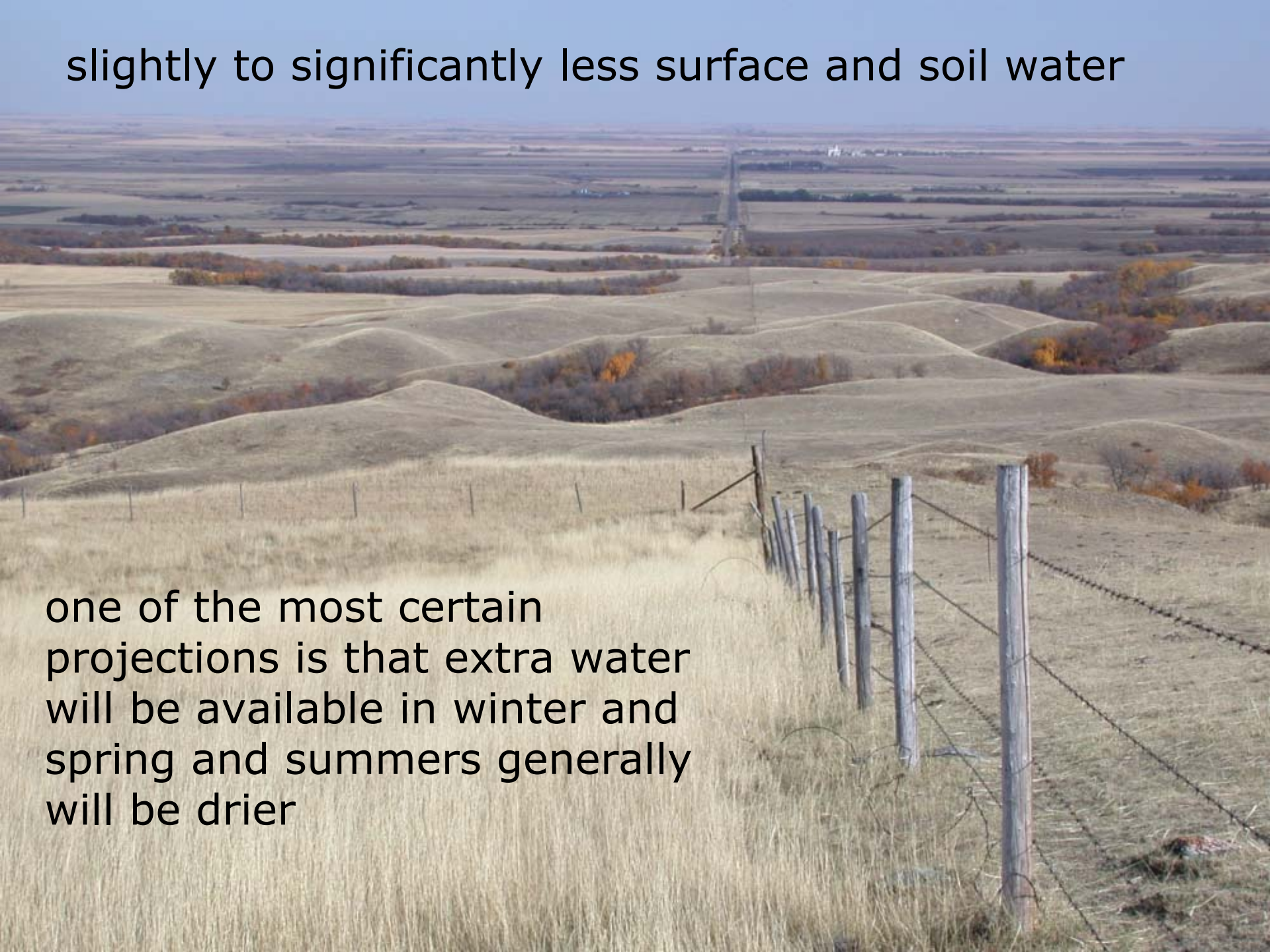

Demuth and Pietroniro, 2001

Peyto Glacier

2006

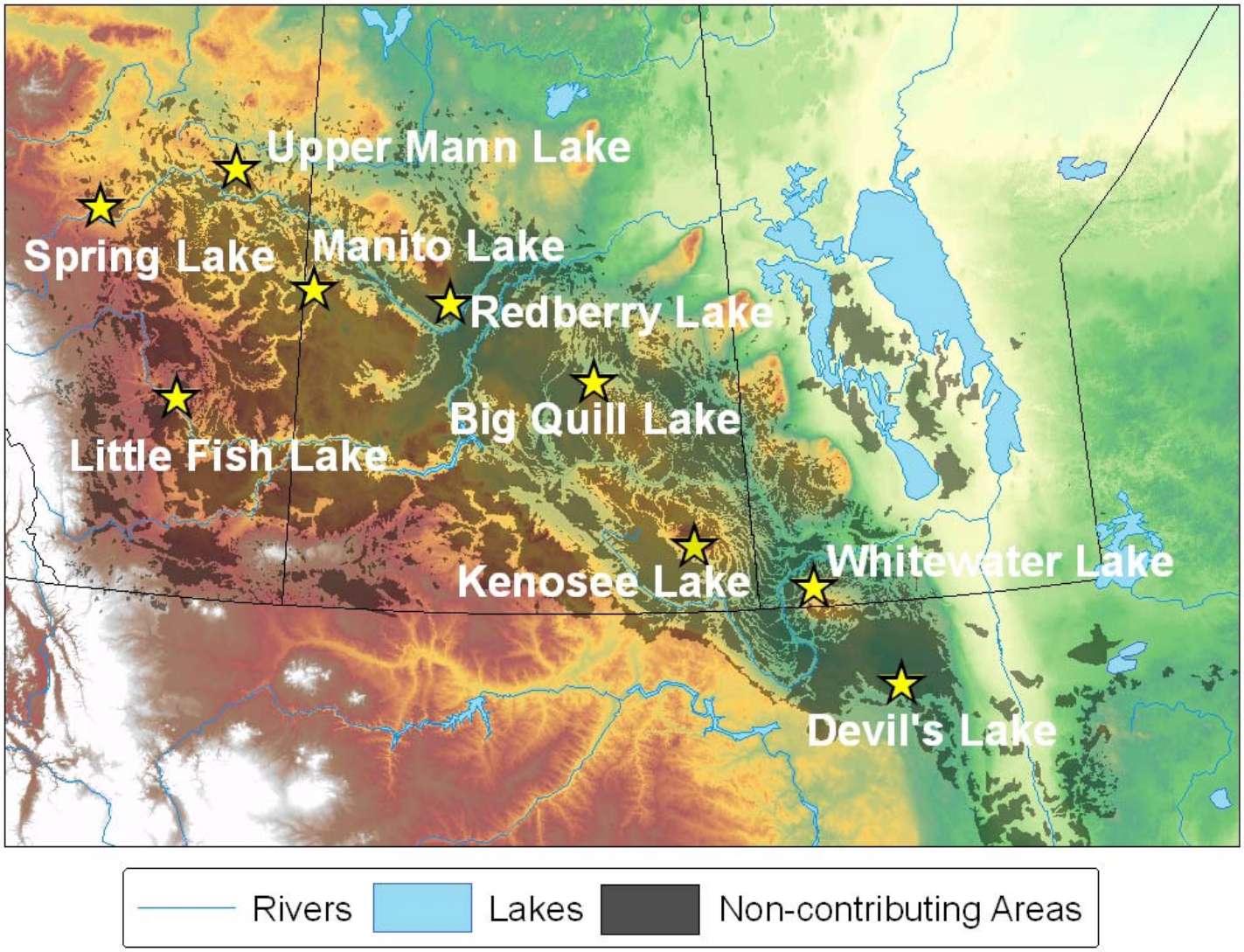
M.N. Demuth

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

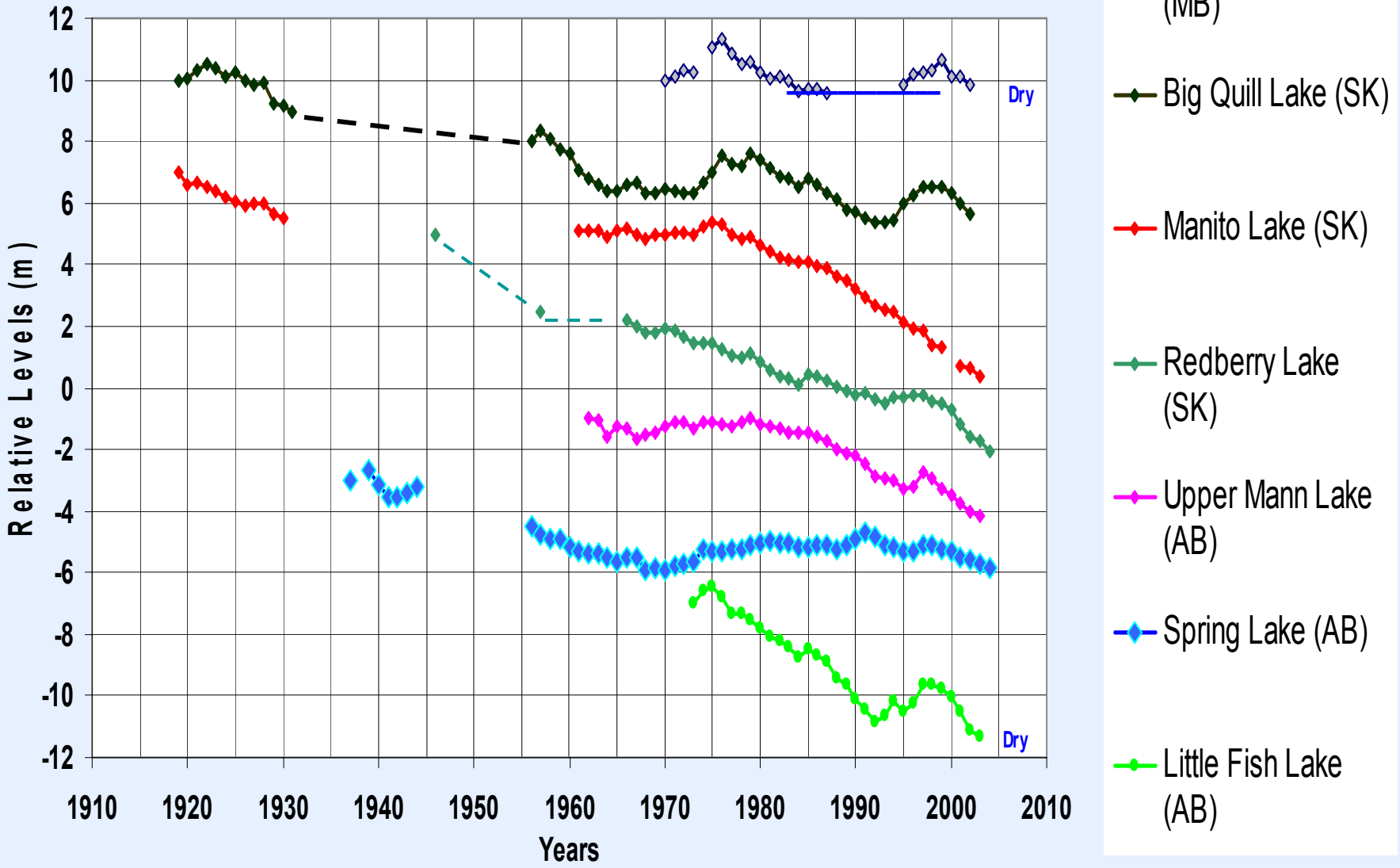
# Closed-basin Prairie Lakes




van der Kamp *et al.*)

# Closed-basin prairie lakes

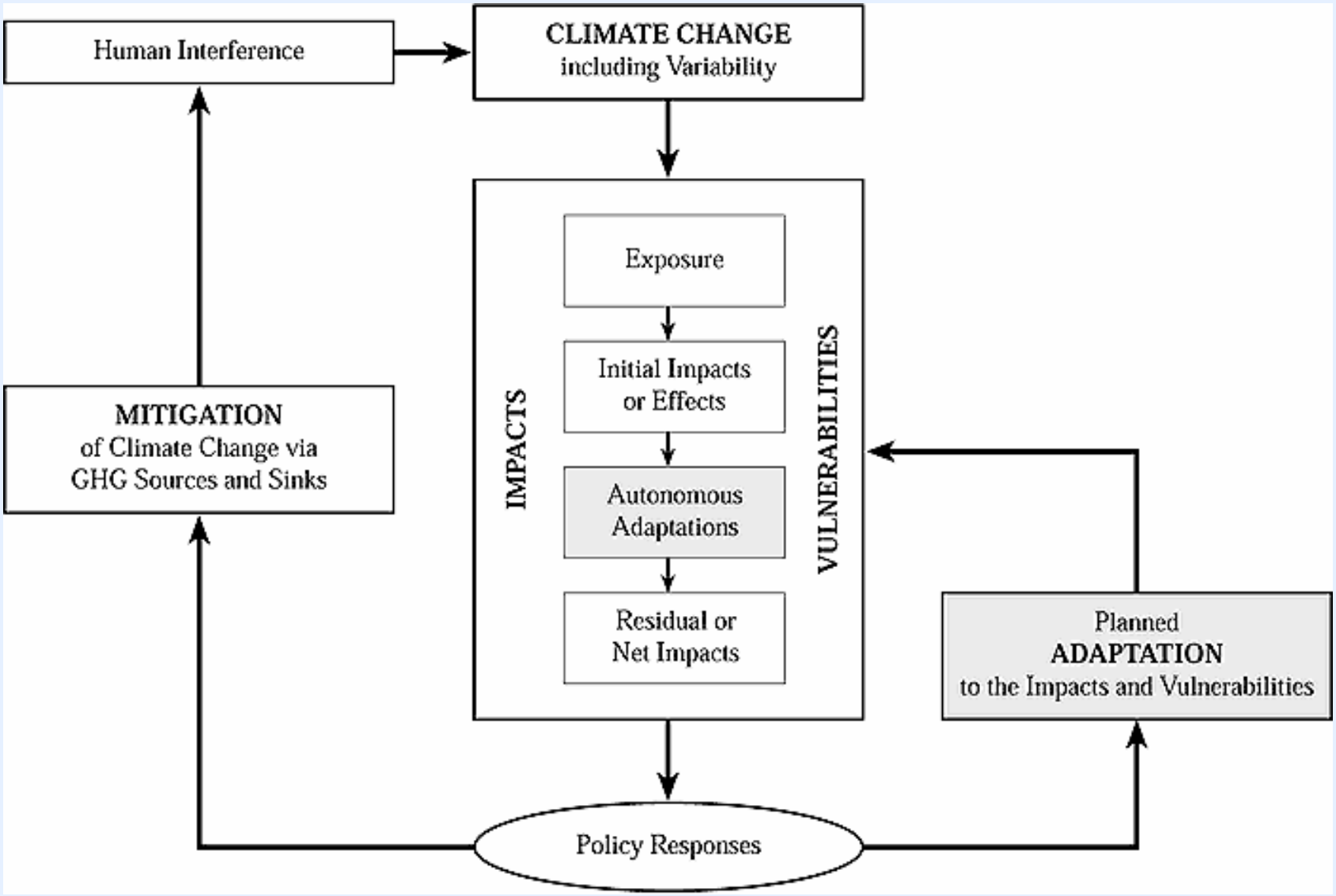
Water level changes, 1918-2004 (van der Kamp *et al.*)

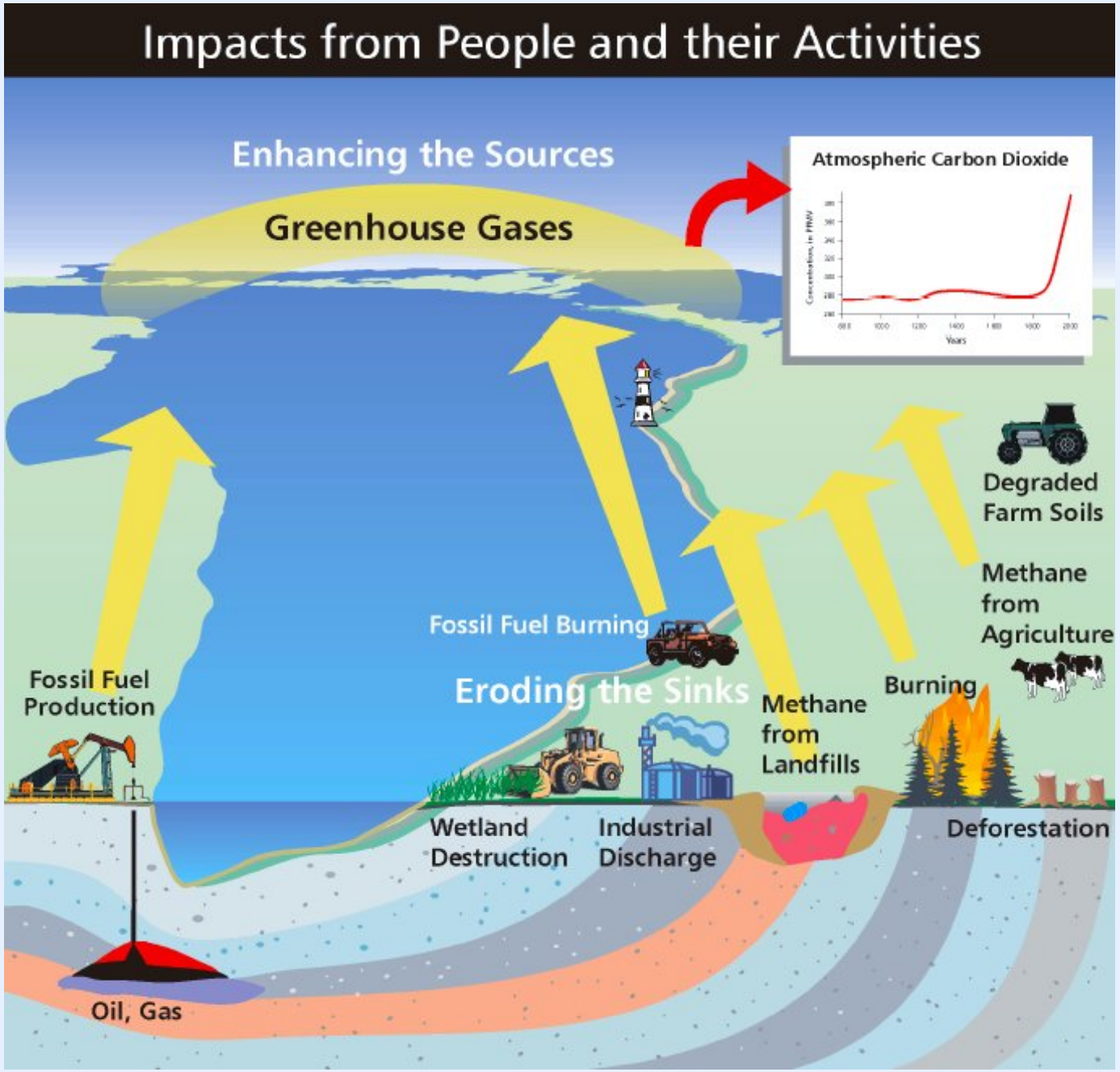


Most impacts are adverse because economies and activities are not adapted to change


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

# Policy Responses





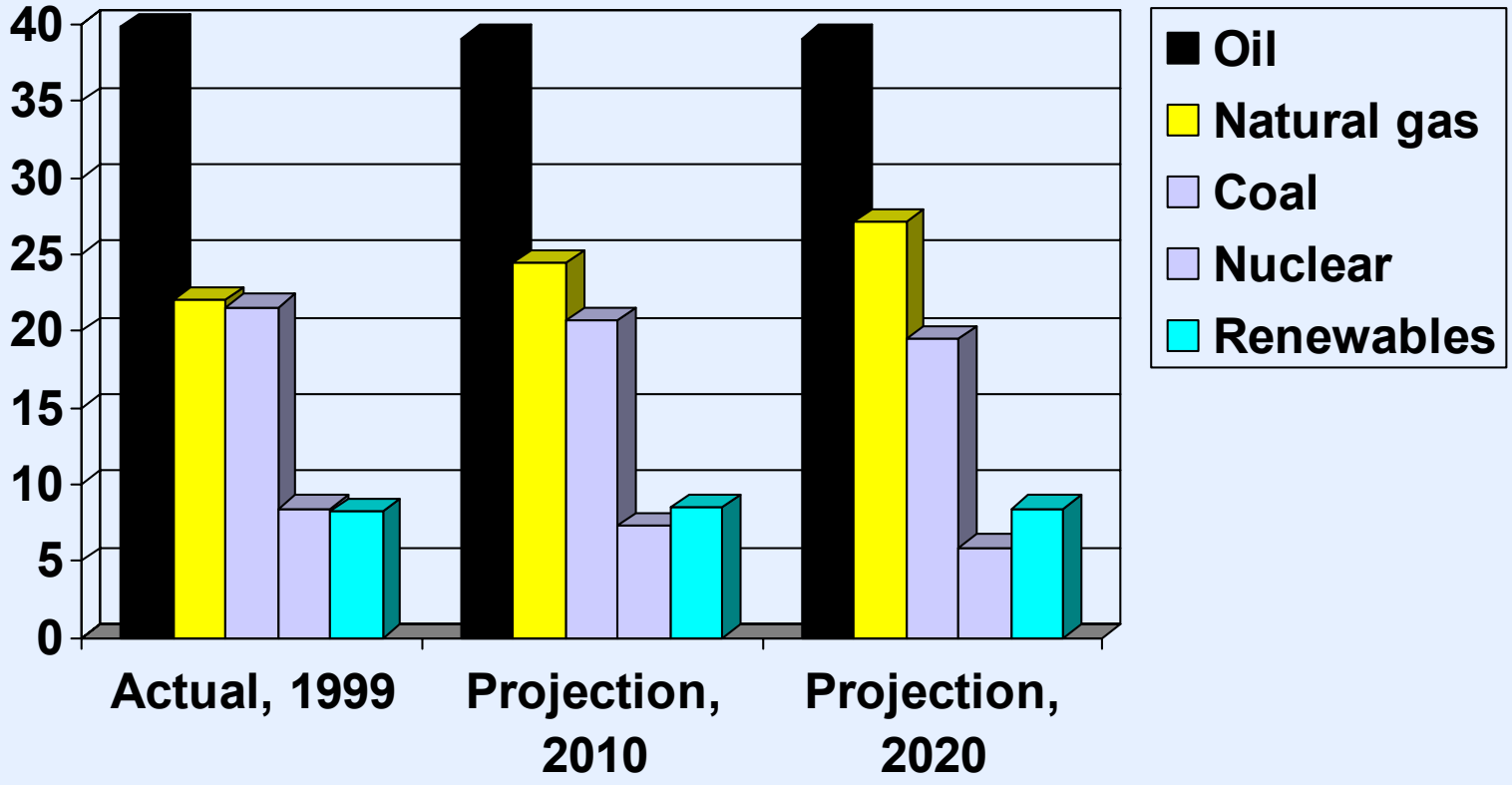

http://www.lakehuron.on.ca/IsTheCoastClear/climate-change_685x657.jpg

# CO2 Capture issues

- Global warming – Green house gas emissions.
- Kyoto global protocol to control Green house gas emissions
- Canada signatory to Kyoto
- Carbon Credit economy
- Governments introducing tax, tariffs and funding initiatives.
- Industry reacting, carbon liability impact statement, demands by Shareholders.

# World energy consumption shares by fuel types

(Energy Information Administration, 2001)



# The Technology Challenge

## Stabilising Greenhouse Gas Concentrations in the Atmosphere

Vehicles: Efficiency, Bio-fuels, Hydrogen Fuel Cells

Renewable Energy Technologies

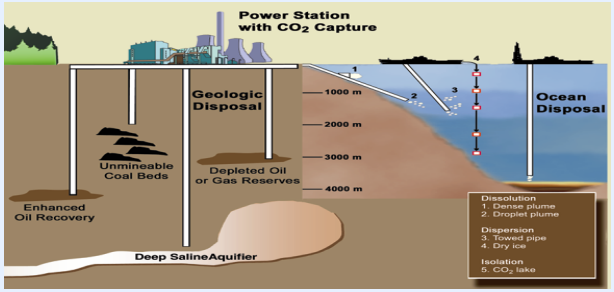
***Different***

- regions
- markets
- scale-up requirements
- infrastructures
- resources
- preferences
- technology timing

Zero Net Emission Bldgs., Industrial Efficiency, CHP

Bio-Fuels and Power

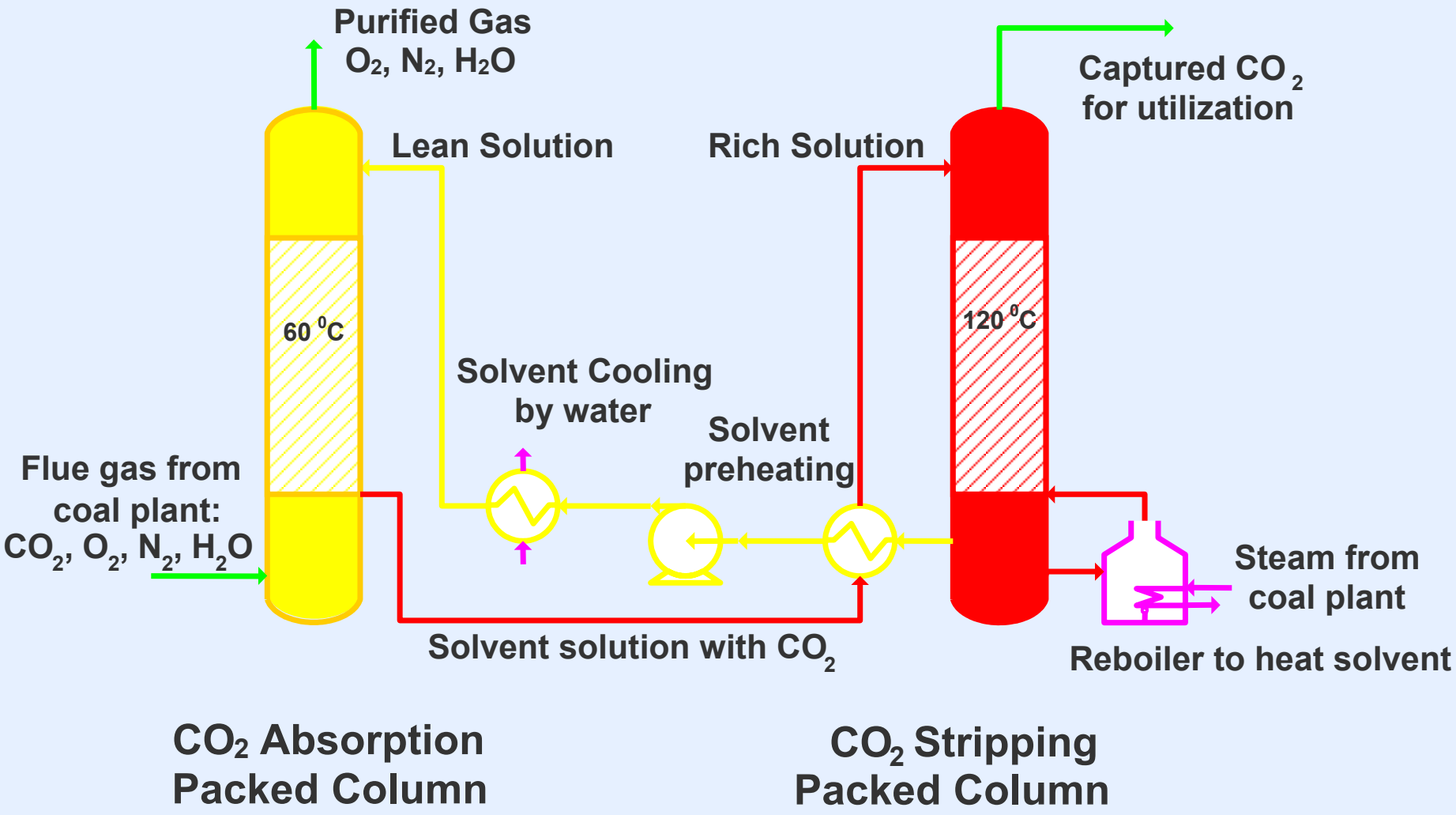
Nuclear Power Generation IV




Carbon ($CO_2$) Sequestration

Advanced Power Grids

# $CO_2$ Removal Process

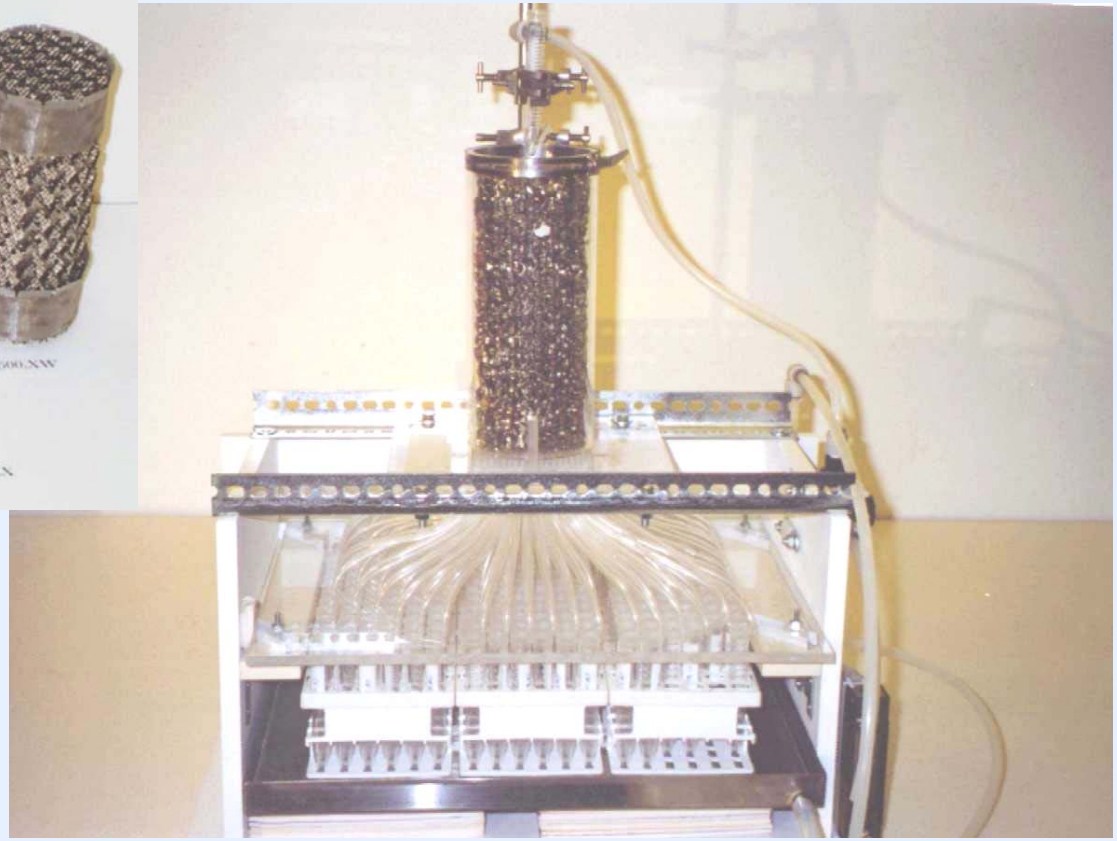


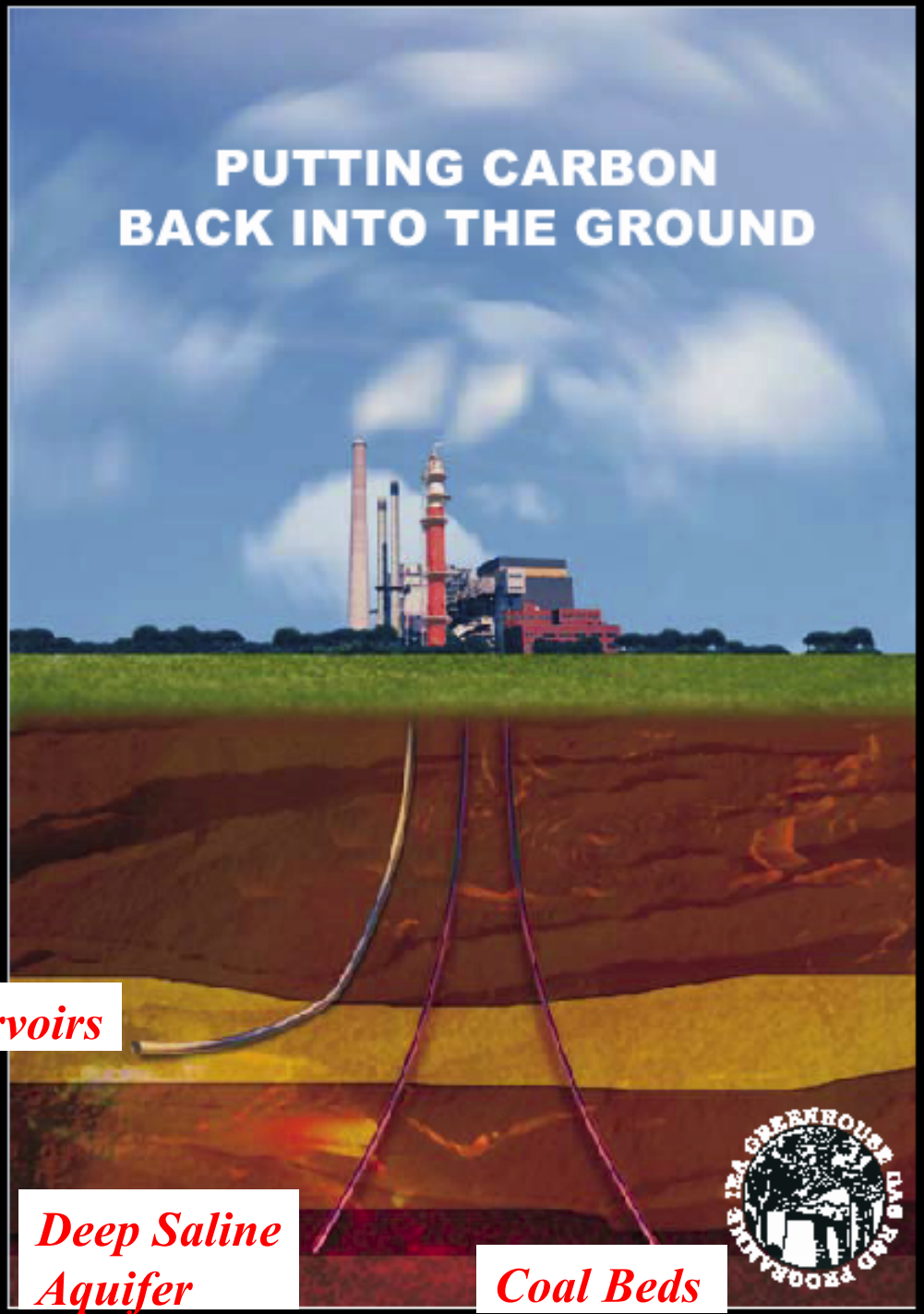
# $CO_2$ Capture Facility in Operation in Saskatchewan

Boundary Dam Pilot Plant

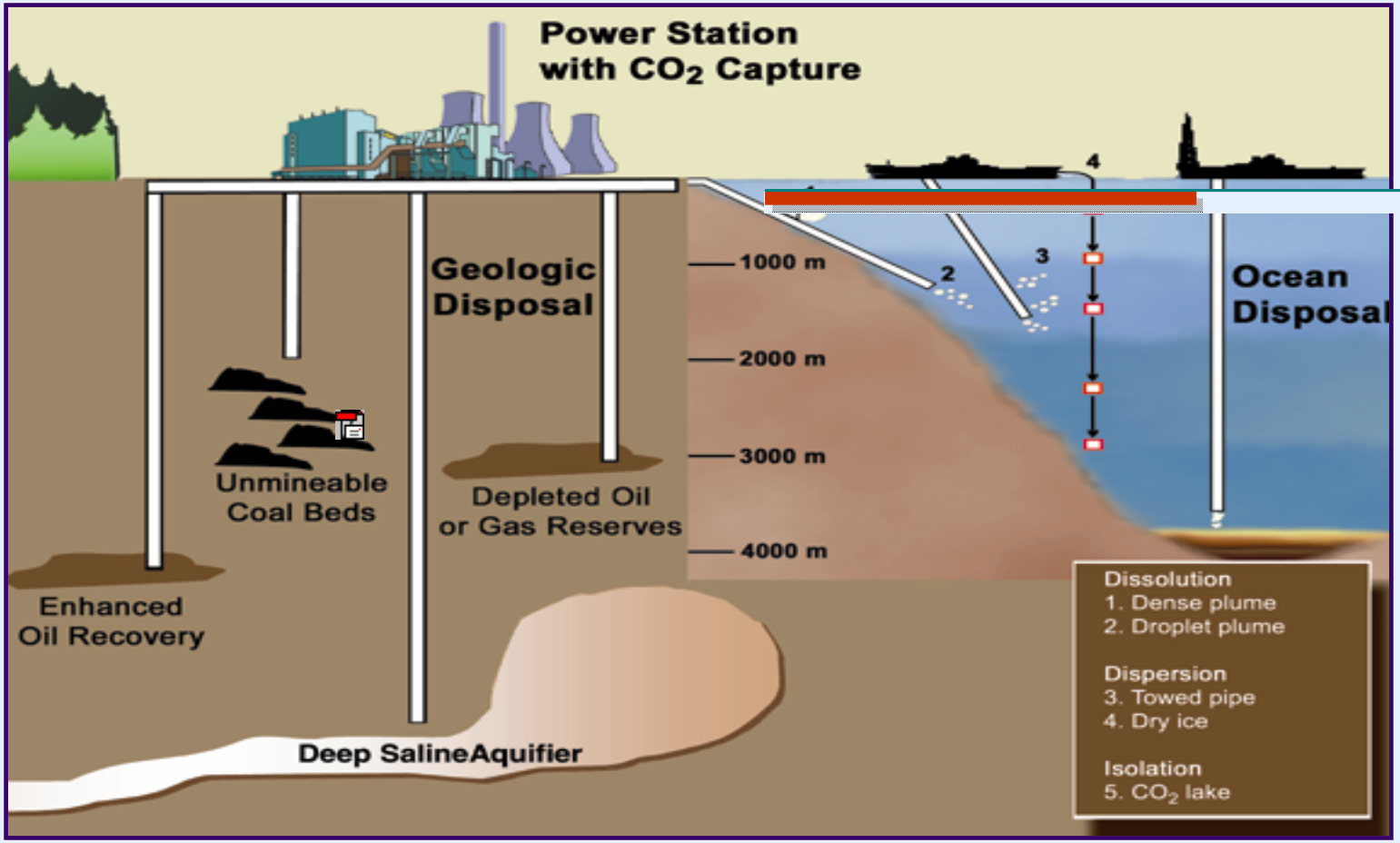
**International Test Centre for CO2 Capture (ITC)**
**Petroleum Technology Research Centre (PTRC)**

# Structured packing testing unit

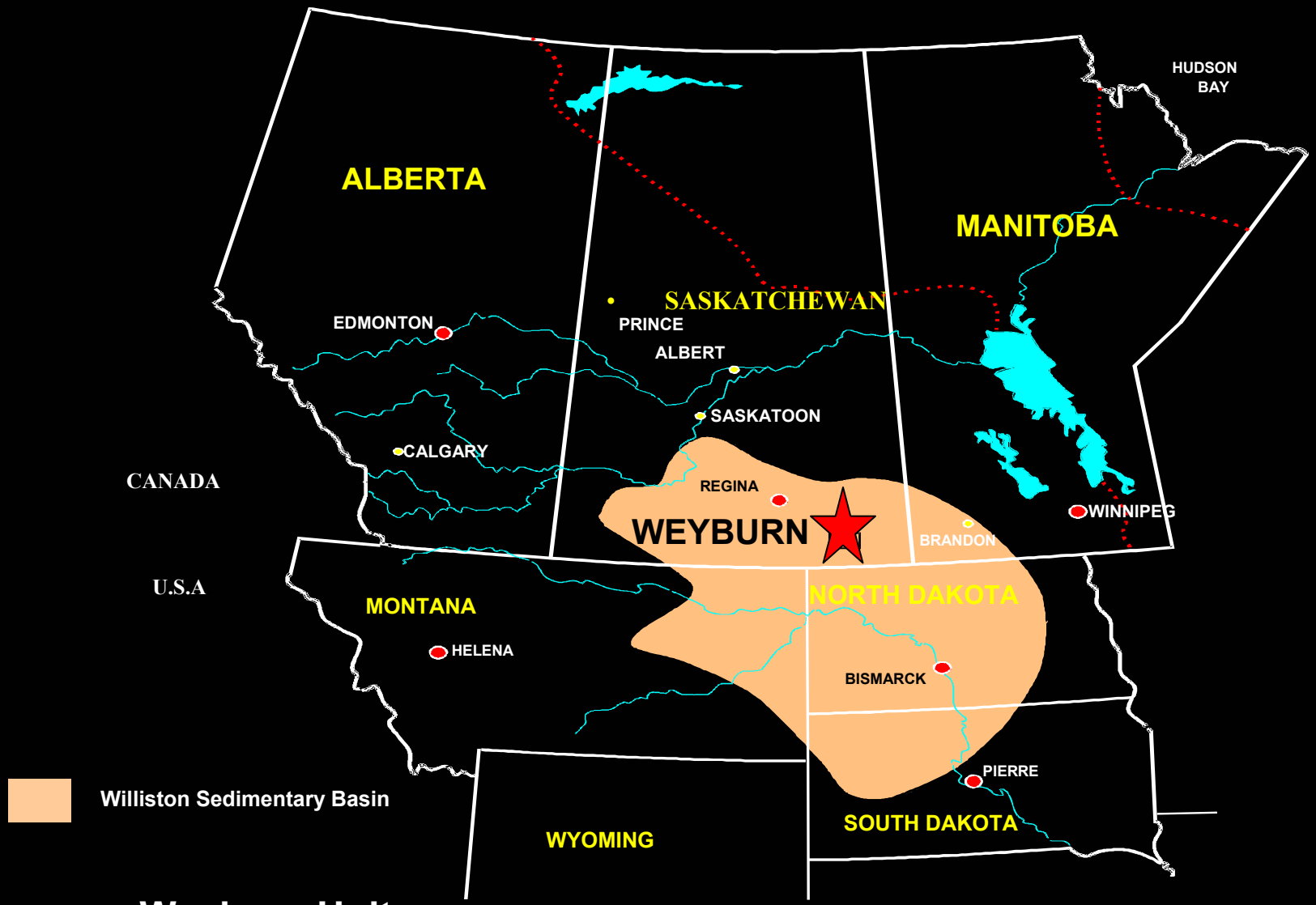




PUTTING CARBON
BACK INTO THE GROUND
Oil Reservoirs
Deep Saline
Aquifer
Coal Beds
IEA GREENHOUSE GAS R&D PROGRAMME

# Carbon ($CO_2$) Storage Model




"Sequestration"

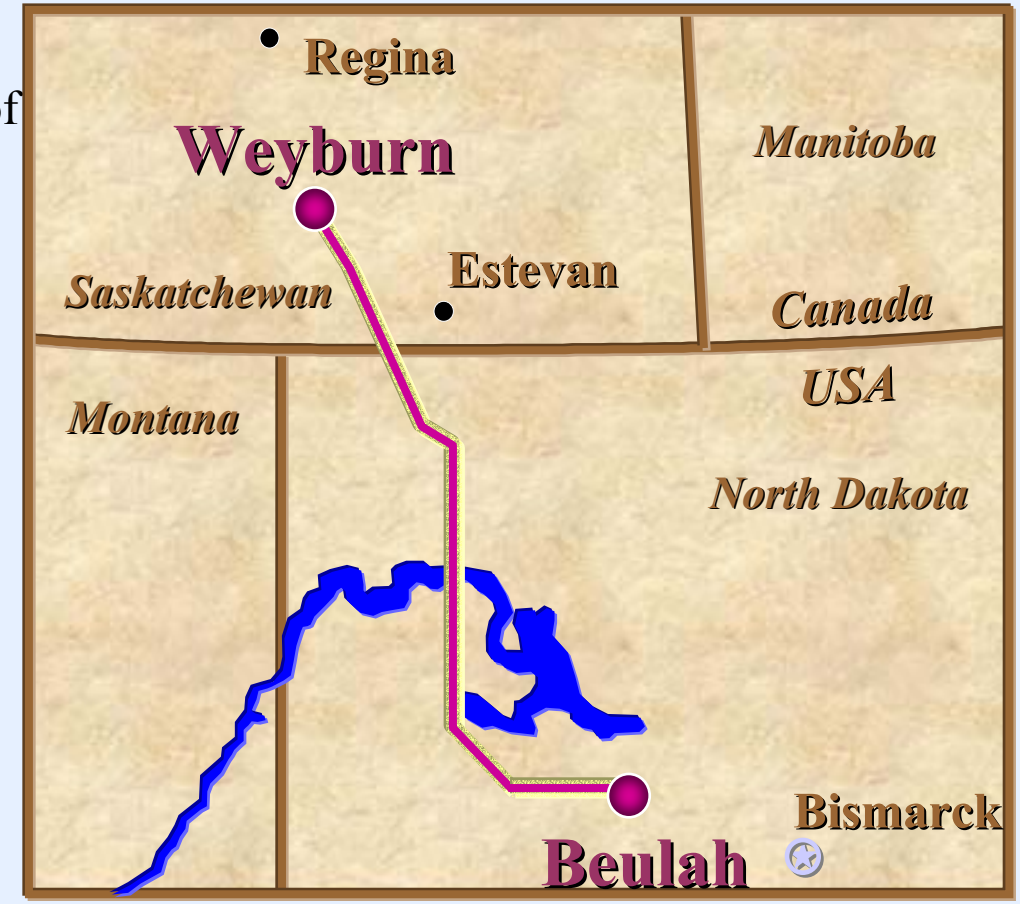



## Weyburn Unit:

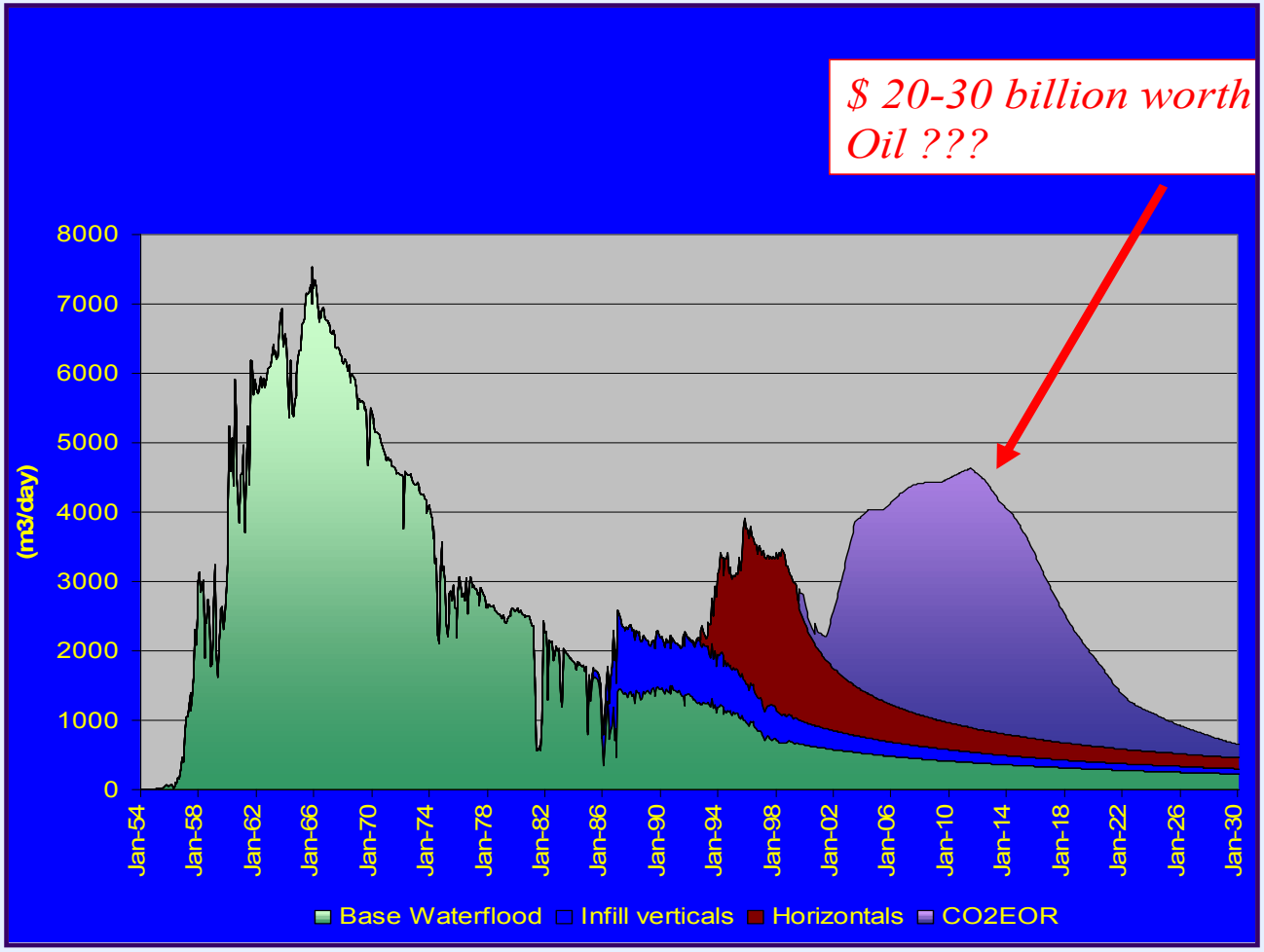
**Field Size:** 70 sq. miles
**Oil Recovered:** 370 million bbls
**OOIP:** 1.4 billion bbls
**CO2 IR:** 130 million bbls

# Weyburn Field CO2 Source

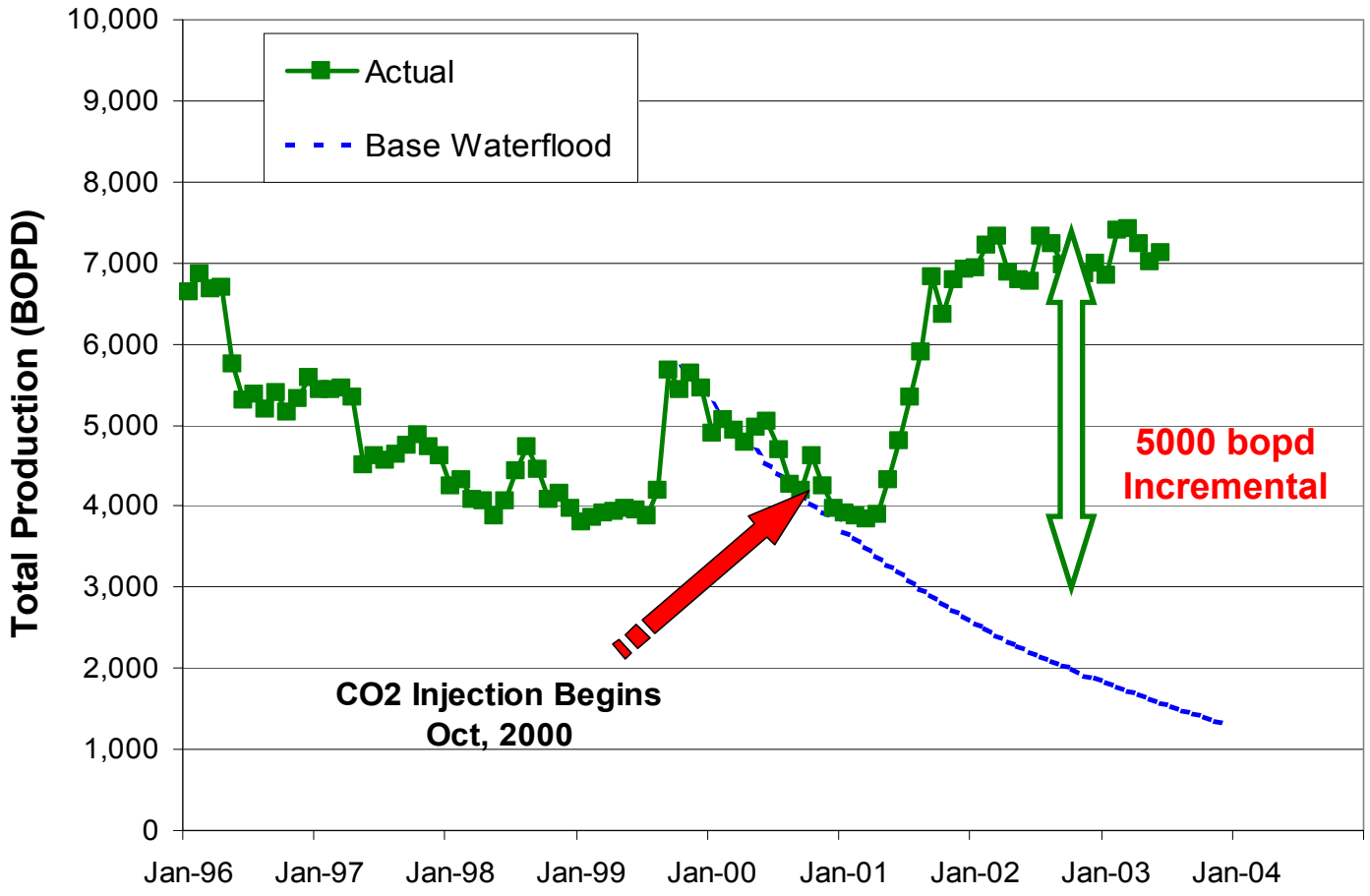
- Dakota Gasification Company
- 250 mmscfd $CO_2$ by-product of coal (lignite) gasification
- 95 mmscfd (5000 tonnes/day) contracted and injected at Weyburn
- $CO_2$ purity 95%
- EnCana currently injects 120 mmscfd (i.e. 21% recycle)



# $CO_2$ Application for Enhanced Oil Recovery (Weyburn Field)



# Weyburn $CO_2$ Project – Phase 1



# $CO_2$ Injection well


# Adaptation

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

# Centre for Young Farmers and Sustainable Agriculture

## Sustainable Agriculture

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

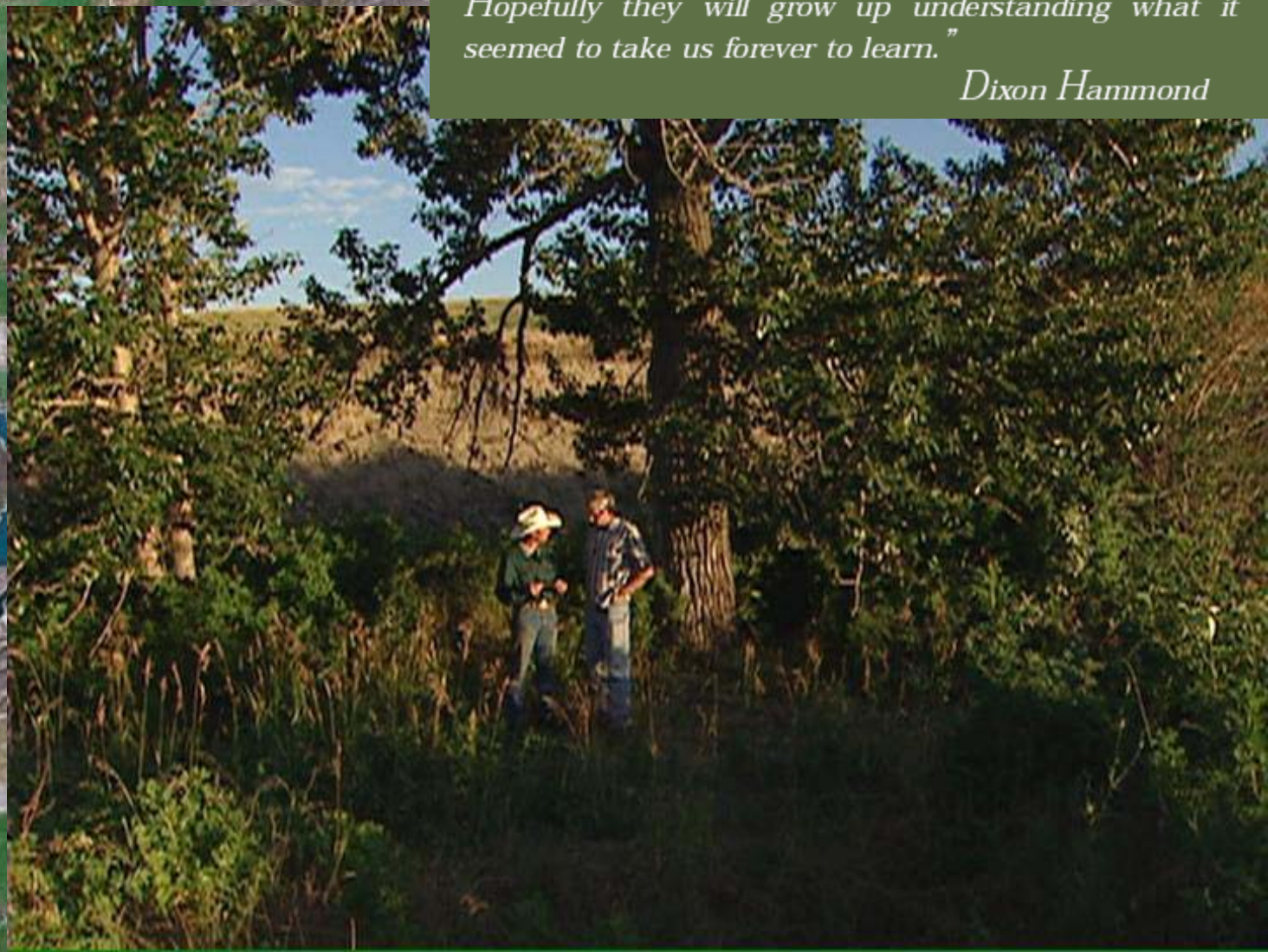
- Achieves the **integration** of natural biological cycles and controls,
- Protects and renews **soil** fertility and the natural resource base,
- Optimizes the management and use of **on-farm** resources,
- **Reduces** the use of nonrenewable resources and purchased production inputs,
- Provides an 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.

# 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*

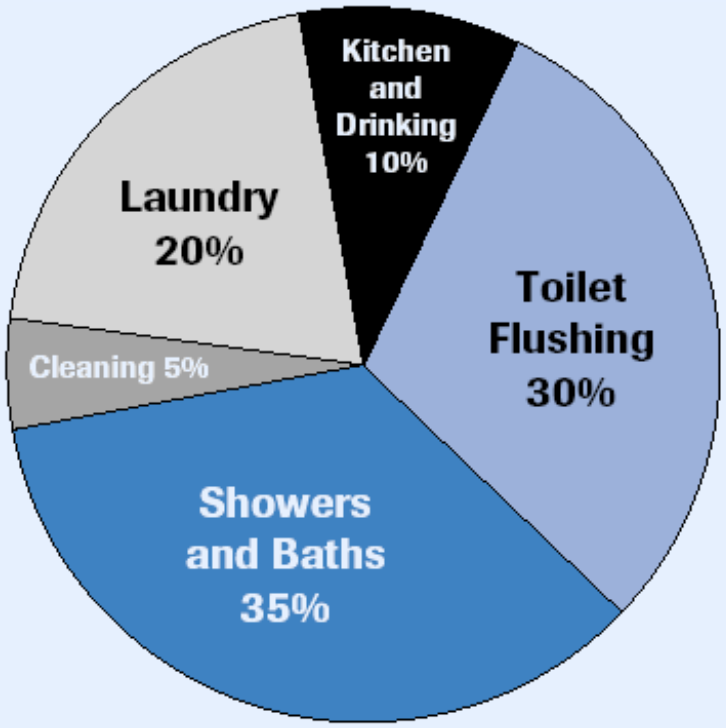


Programs & Services
Welcome to Regina
Doing Business
Parks & Recreation
City Hall

## Water Conservation

The Water Conservation Program was established in 1988 to reduce water consumption in the city and delay the need for a $40 million expansion of the water treatment plant. Each summer, when demand for water is highest, the program sponsors a public awareness campaign. During other times in the year, the City offers an informative display at the Home and Garden Show, **free xeriscape workshops** and water conservation tips on water bills.

The program has been successful. Since the late 1980's average day water consumption has been reduced by 20%, and peak day water use is down by 25%.



# 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*