Do We Have the Tools to Change?

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PARC

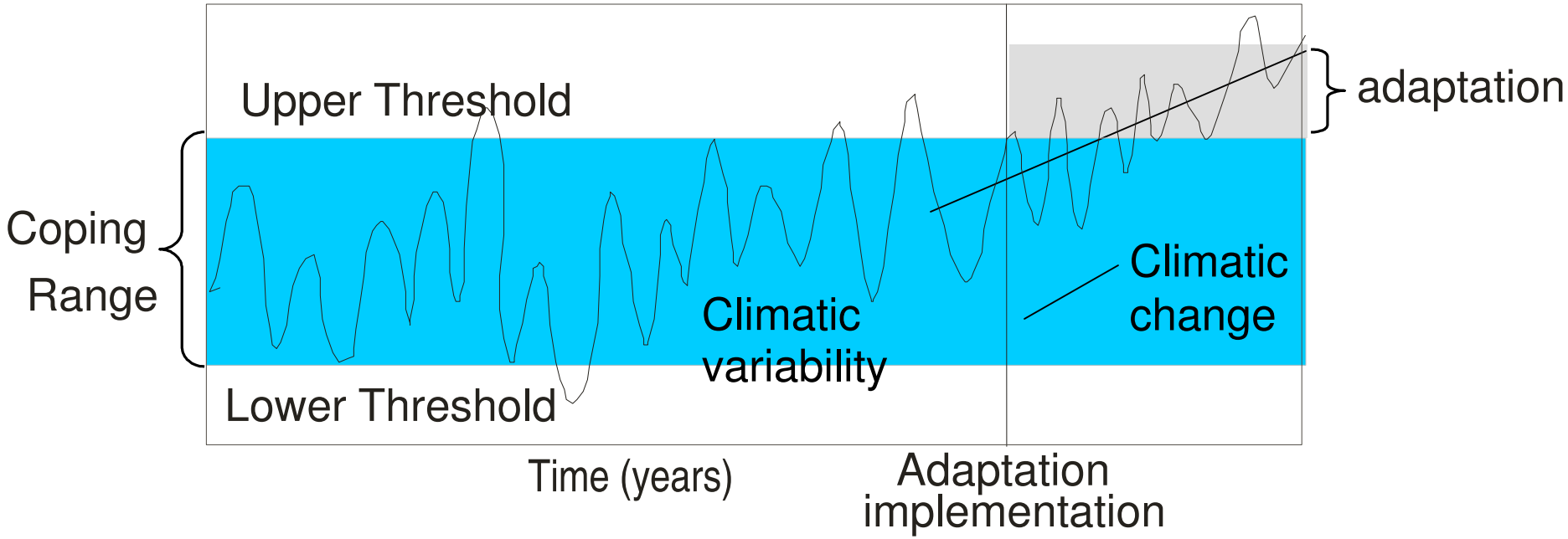
CONFRONTING WATER SCARCITY: Challenges and Choices

July 13-16, 2004, Lethbridge, Alberta

Climate and Human History

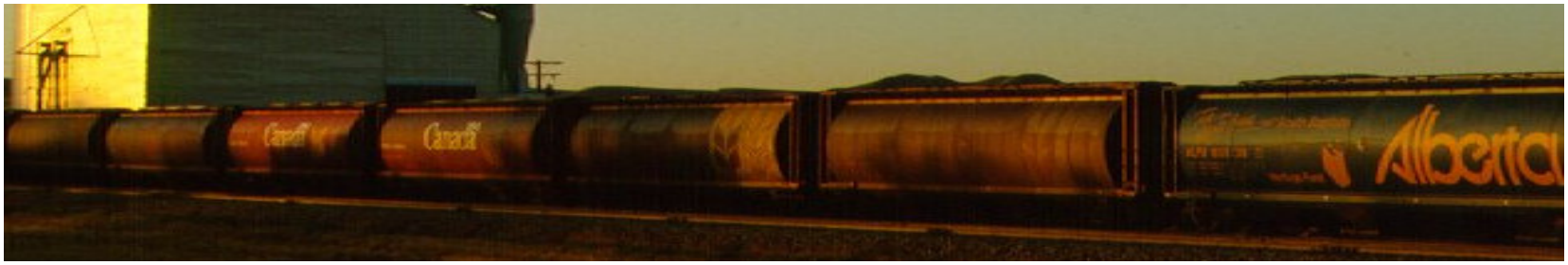
… it is likely that region-specific changes in the hydrologic cycle produced the greatest societal and economic challenges. … When record keeping became routine, those cultures with some level of awareness of at least the natural variability in rainfall and perhaps even an understanding of the characteristic timescales of drought/flood cycles would be at some advantage in managing their agricultural and commercial resources. Few examples of such awareness and coping strategies exist (even for the present day)

Dunbar (2000: 78) In The Way the Wind Blows: Climate Change, History, and Human Action

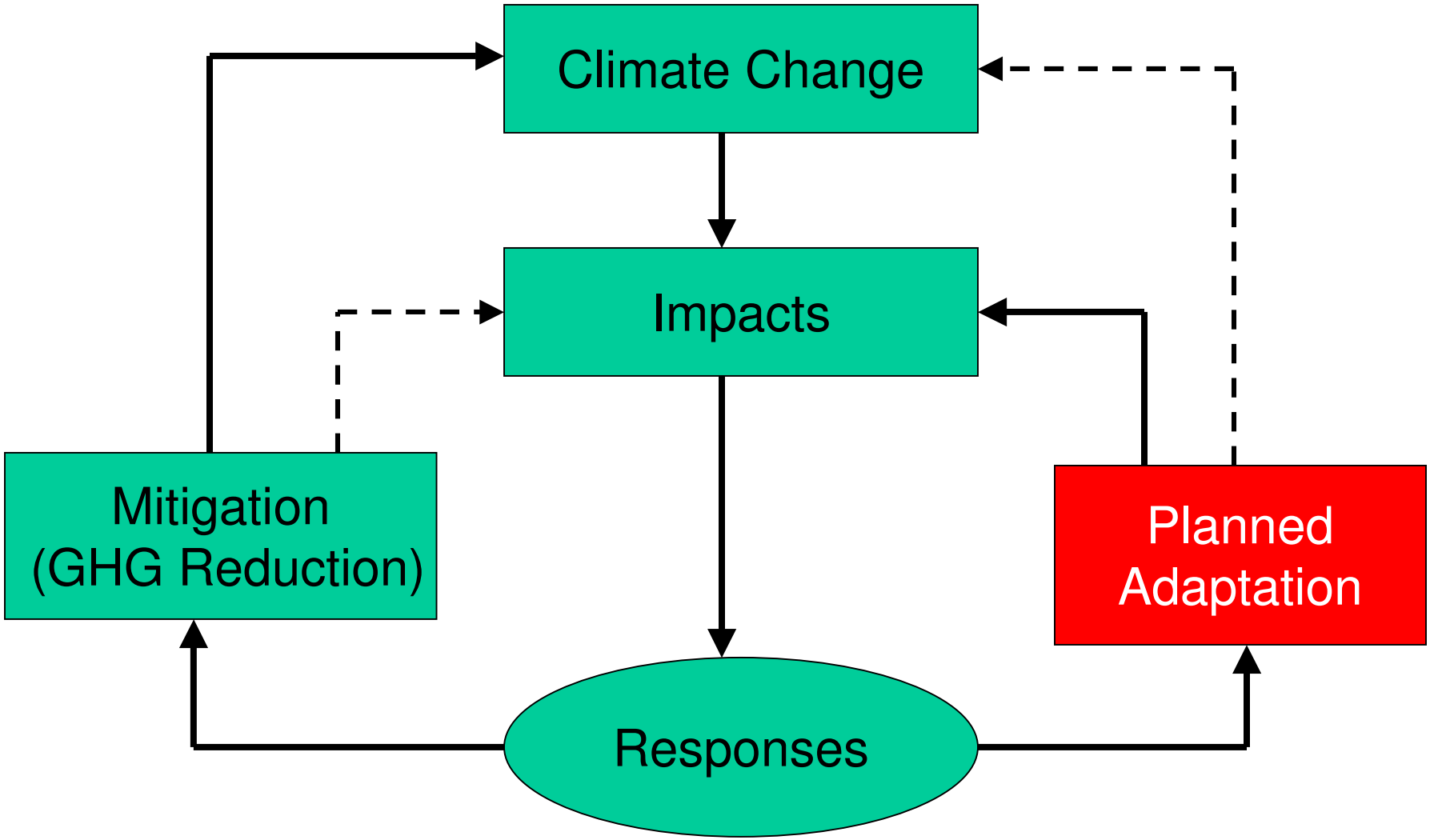

Upper Threshold
Coping
Range
Climatic
variability
Climatic
change
adaptation
Lower Threshold
Time (years)
Adaptation
implementation

ADAPTATION

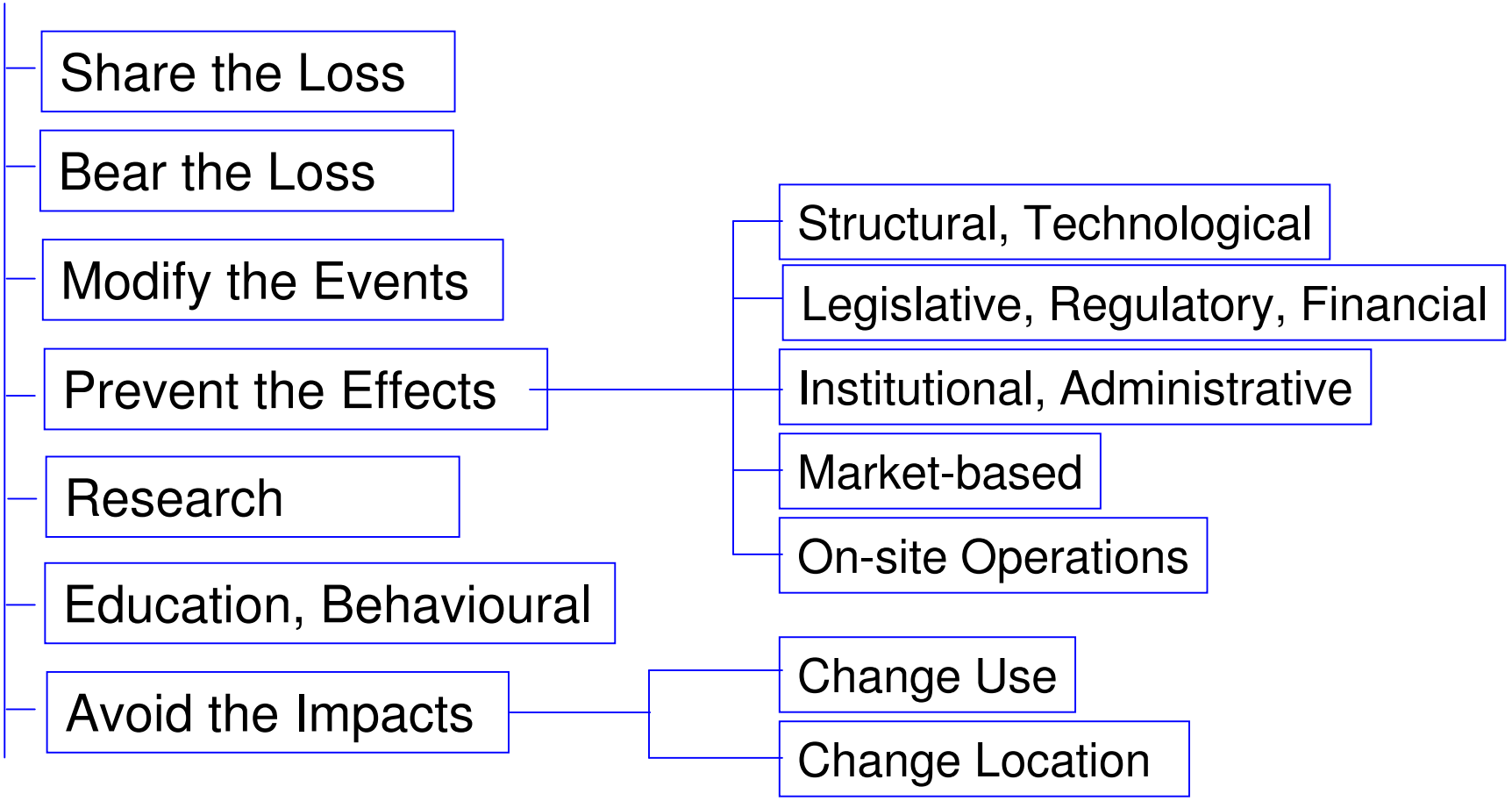
Degree to which adjustments are possible in practices, processes, or structures of systems to projected or actual changes of climate (IPCC, 2001).



Addressing Climate Change: Mitigation and Adaptation

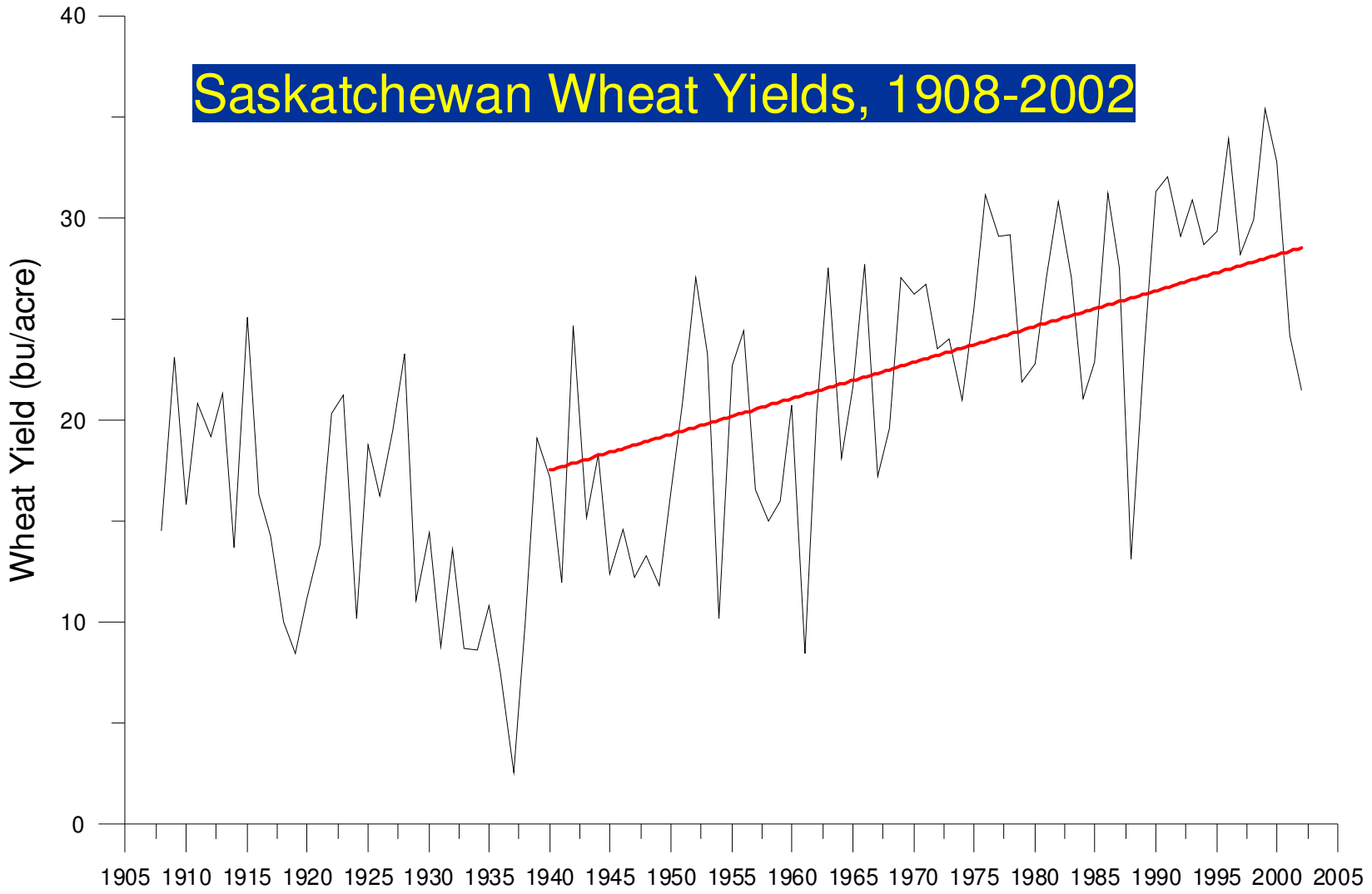


Adaptation Options

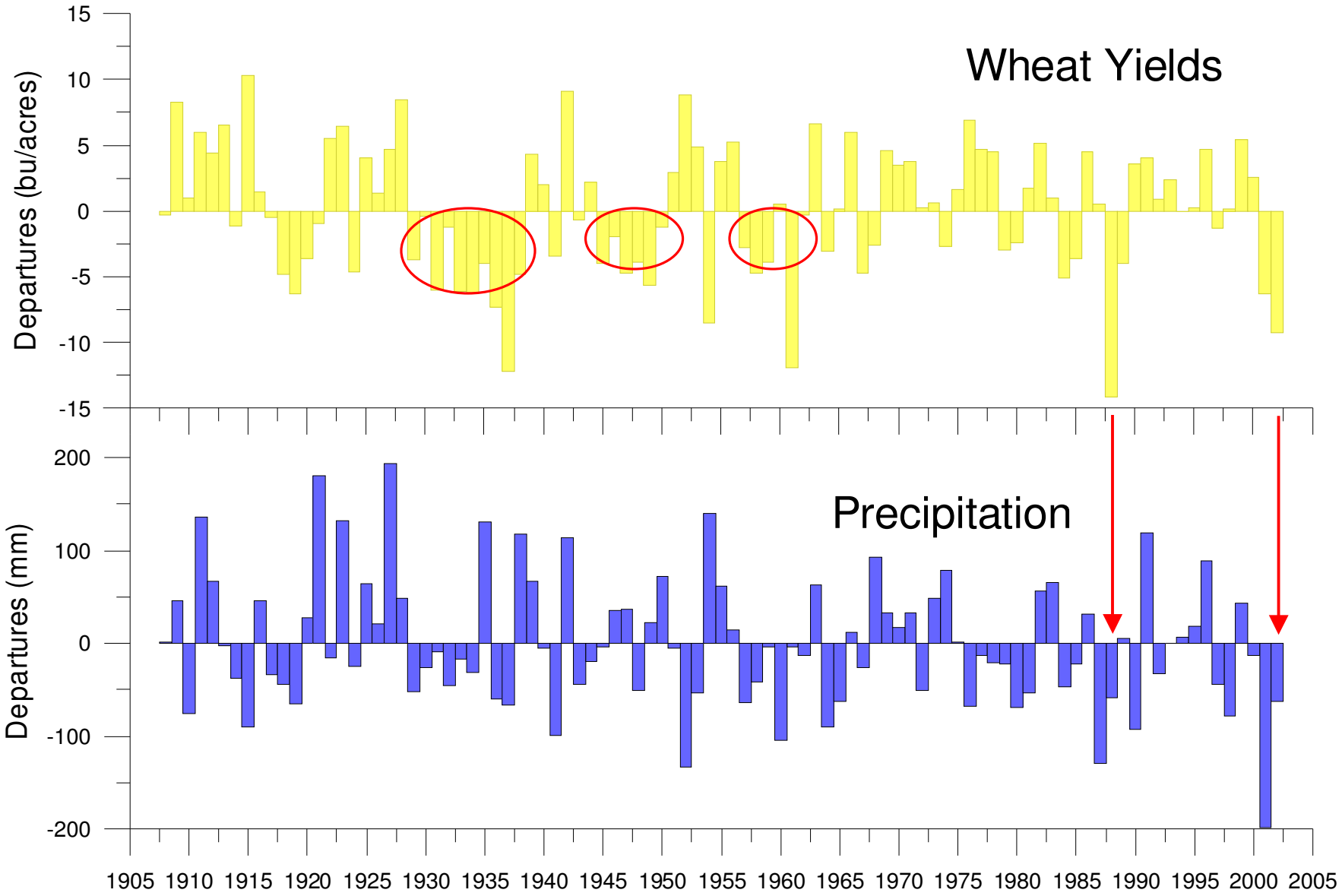


Adaptive Capacity

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



source: Statistics Canada

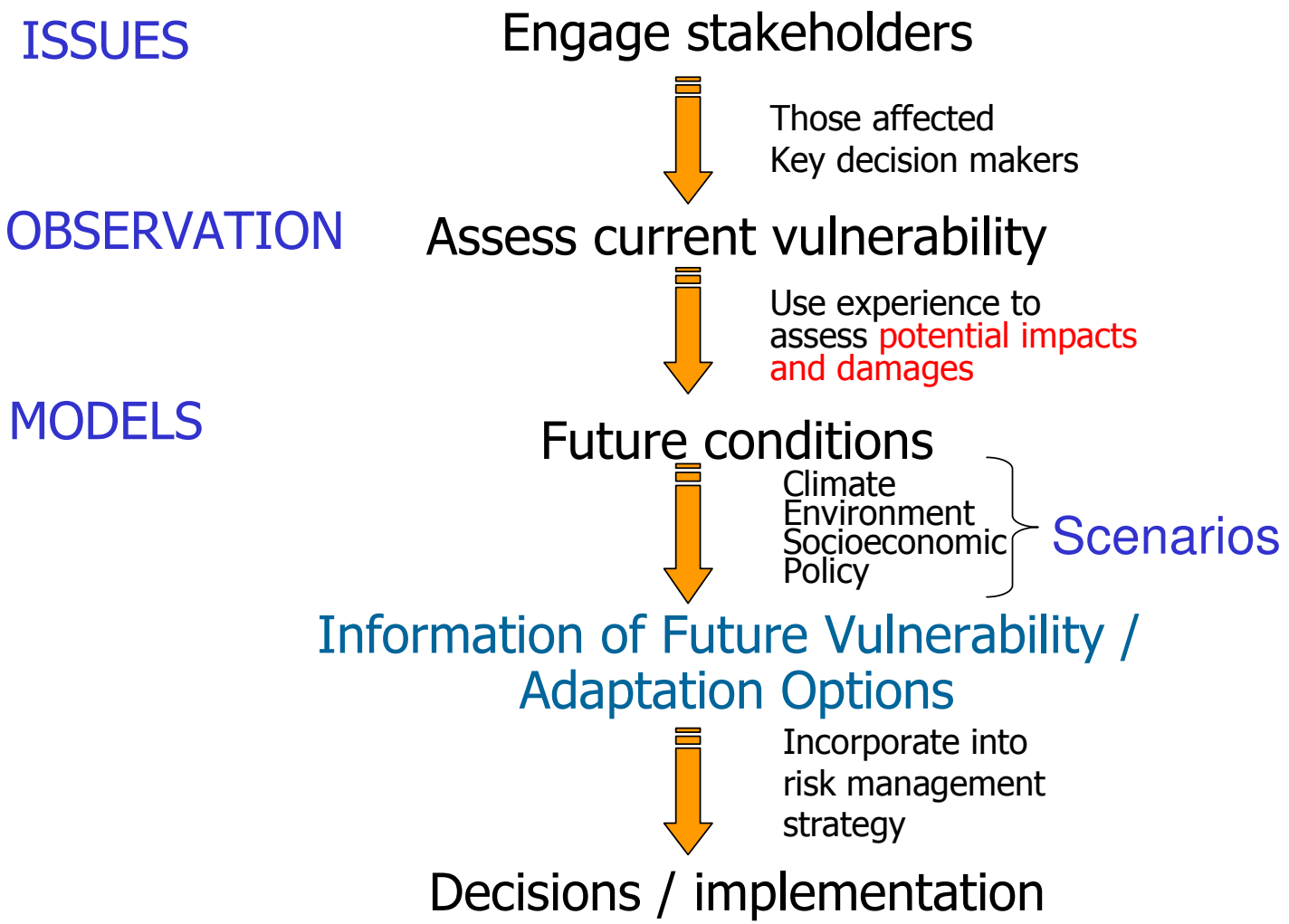

Wheat Yields
Departures (bu/acres)
15
10
5
0
-5
-10
-15
Precipitation
Departures (mm)
200
100
0
-100
-200
1905 1910 1915 1920 1925 1930 1935 1940 1945 1950 1955 1960 1965 1970 1975 1980 1985 1990 1995 2000 2005

Climate and Human History

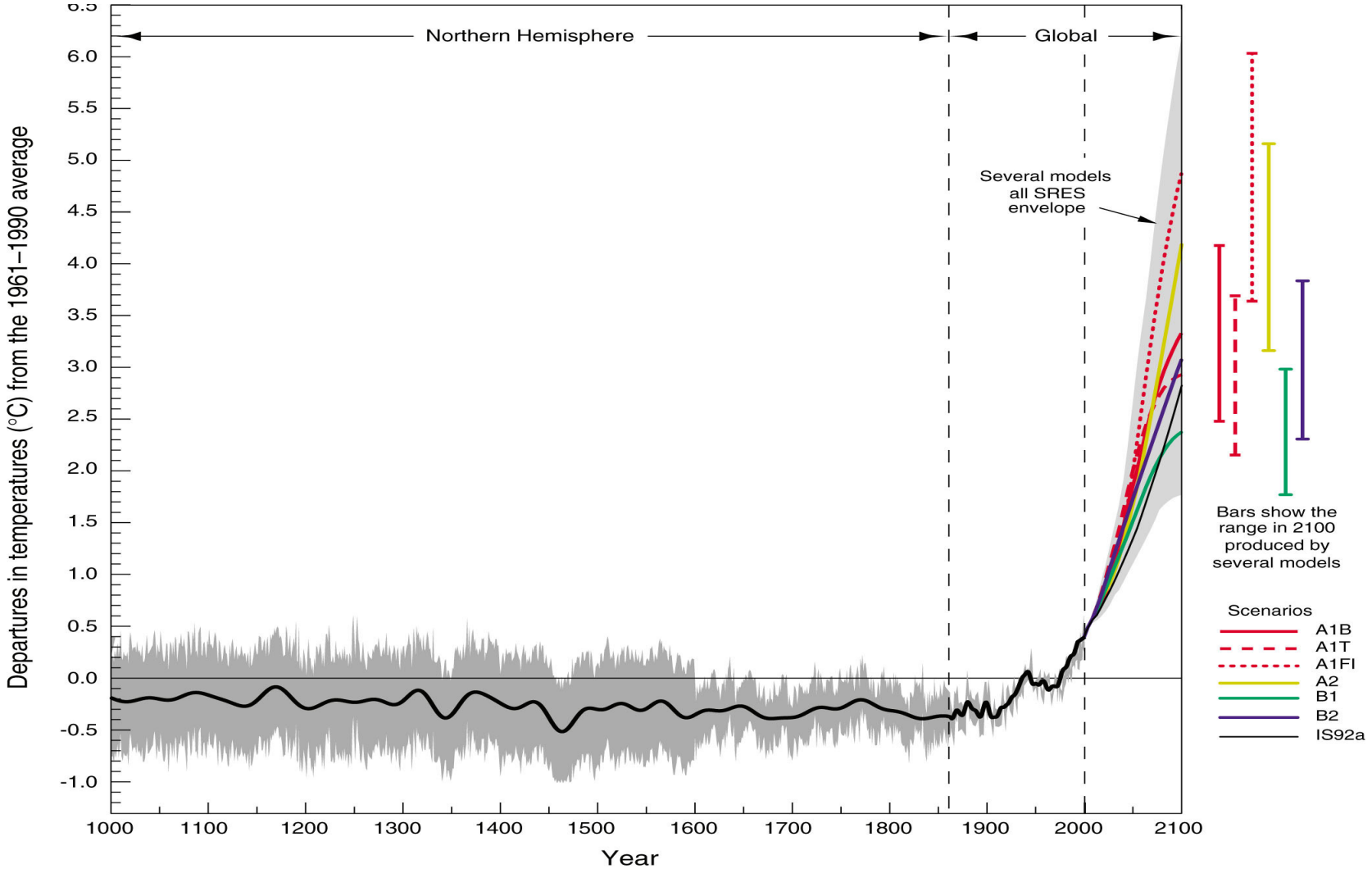
The interaction of climate and history is not a matter of a single pivotal event, but an intricate dance of challenge and response involving changing ecosystems, technologies, and evolving political, cultural and social systems. For all the changes, the long-term pattern is consistent: the entire history of civilization has been a continual process of trading up -- of accepting vulnerability to large climate stresses in exchange for resistance to smaller ones.

Fagan, Brian (2004) The Long Summer: How Climate Changed Civilization.

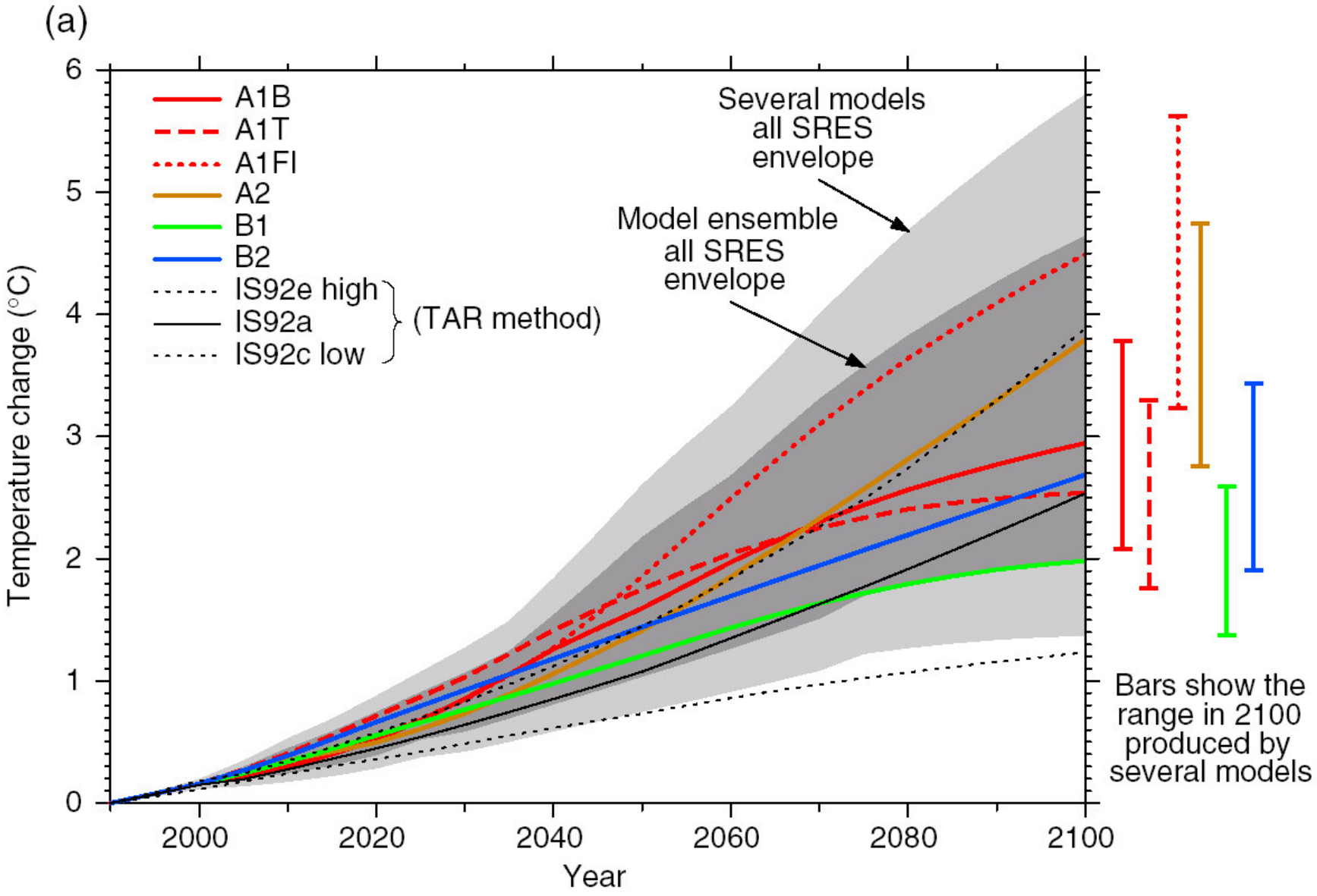
Vulnerability = f(climate risk + adaptive capacity)

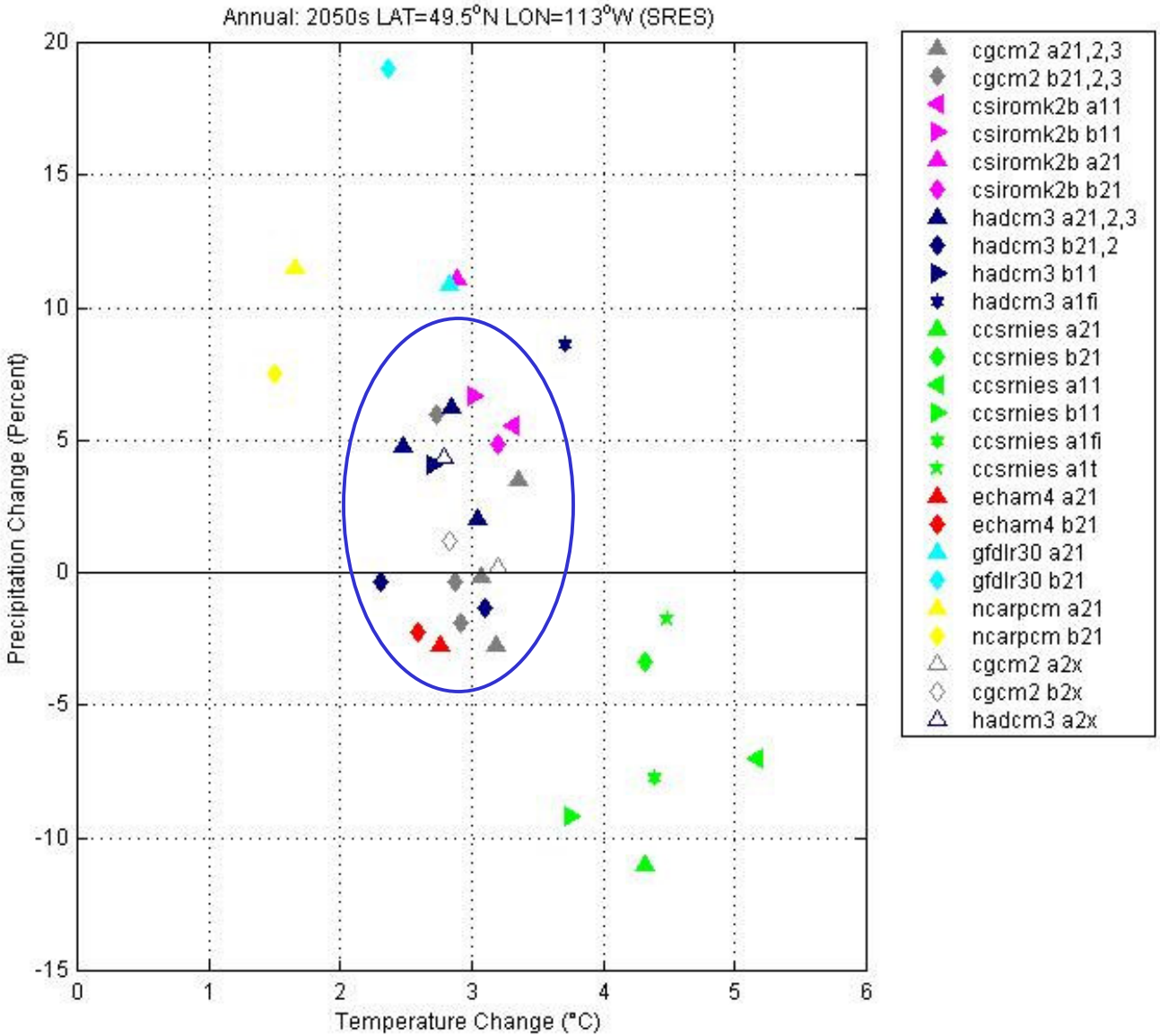


Past and Future Temperatures



Temperature Projections for the 21st Century

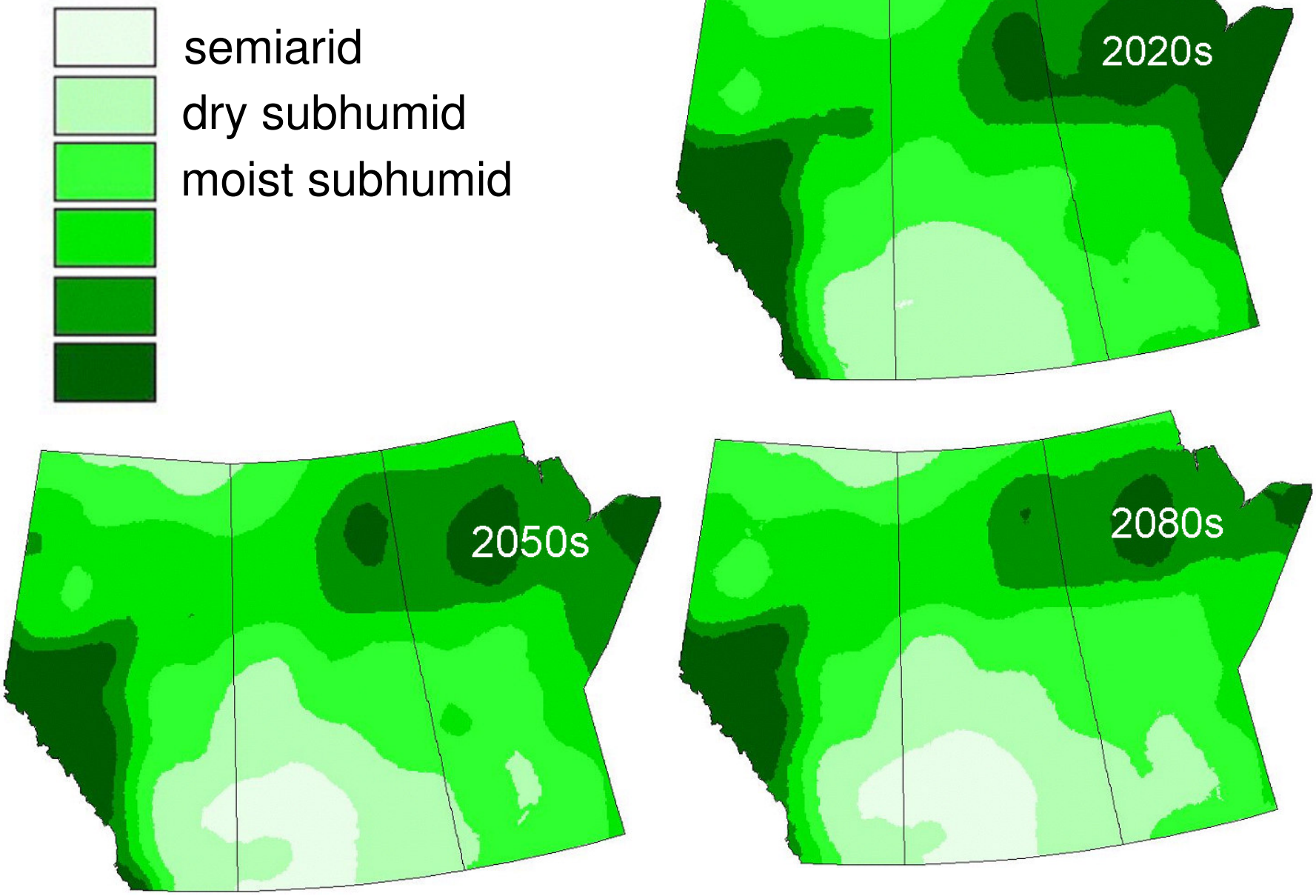


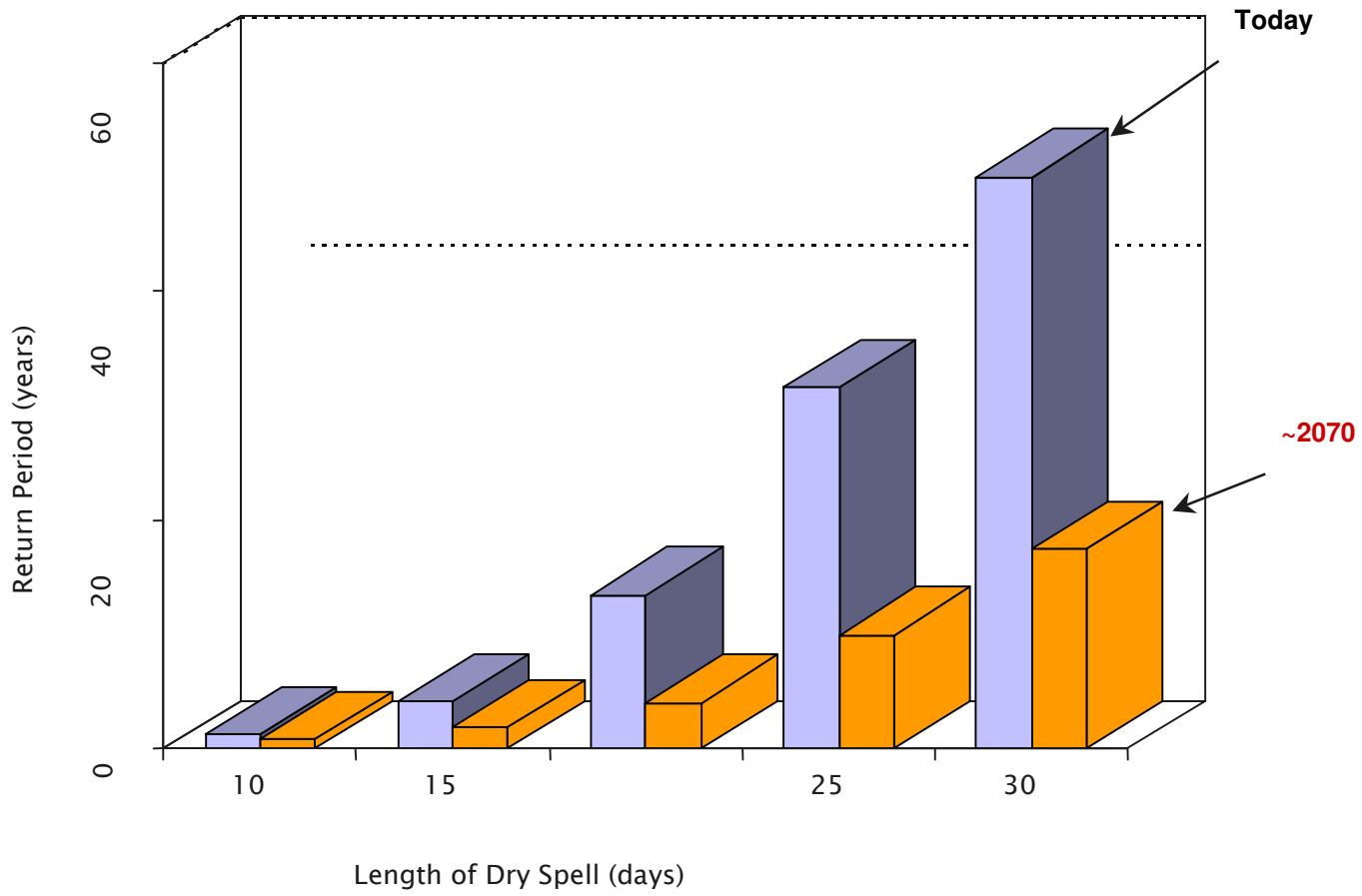

Annual: 2050s LAT=49.5°N LON=113°W (SRES)
Precipitation Change (Percent)
Temperature Change (°C)
20
15
10
5
0
-5
-10
-15
0
1
2
3
4
5
6
cgcm2 a21,2,3
cgcm2 b21,2,3
csiromk2b a11
csiromk2b b11
csiromk2b a21
csiromk2b b21
hadcm3 a21,2,3
hadcm3 b21,2
hadcm3 b11
hadcm3 a1fi
ccsrnies a21
ccsrnies b21
ccsrnies a11
ccsrnies b11
ccsrnies a1fi
ccsrnies a1t
echam4 a21
echam4 b21
gfdlr30 a21
gfdlr30 b21
ncarpcm a21
ncarpcm b21
cgcm2 a2x
cgcm2 b2x
hadcm3 a2x

Projections for the future climate of the Prairie Provinces

Temperature	increasing, greater in winter than summer, greater at night than during day
Precipitation	great uncertainty, annually small decrease to significant increase
Evaporation	significant increase
Soil moisture	decrease
Growing season	increased length
Water Resources	increased variability, earlier peak flows
Extreme events	increased frequency and magnitude

The Future Climate





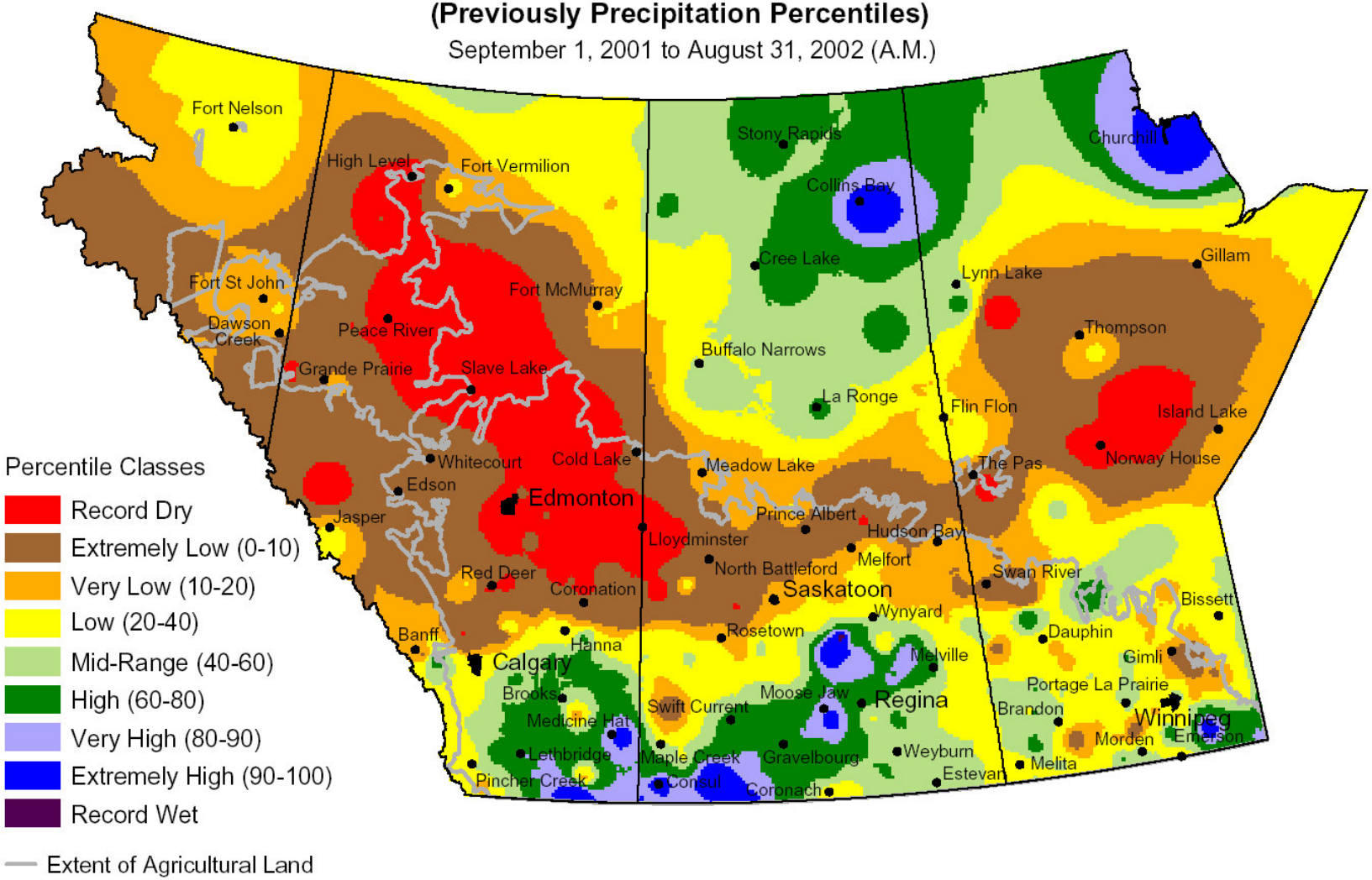
From: Kharin and Zwiers, 2000

Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

Current Precipitation Compared to Historical Distribution

(Previously Precipitation Percentiles)

September 1, 2001 to August 31, 2002 (A.M.)



Percentile Classes

- 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

Prepared by PFRA (Prairie Farm Rehabilitation Administration) using data from the Timely Climate Monitoring Network and the many federal and provincial agencies and volunteers that support it.

Canada


Near Outlook, SK, May 2002

Saskatoon (1908-2002)

1-yr	2-yrs	3-yrs
2001	**2001-02**	**2000-02**
1952	**2000-01**	1951-53
1987	1987-88	1987-89
1960	1952-3	1999-01
1941	1964-65	1986-88

Edmonton (1883-2002)

1-yr	2-yrs	3-yrs
1889	**2001-02**	1883-85
1883	1883-84	1896-98
2002	1897-98	1887-89
1898	1886-87	1885-87
1961	1949-50	**2000-02**

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Institutional adaptations to climate change:
comparative study of dryland river basins in Canada and Chile

Social Sciences and Humanities Research Council of Canada

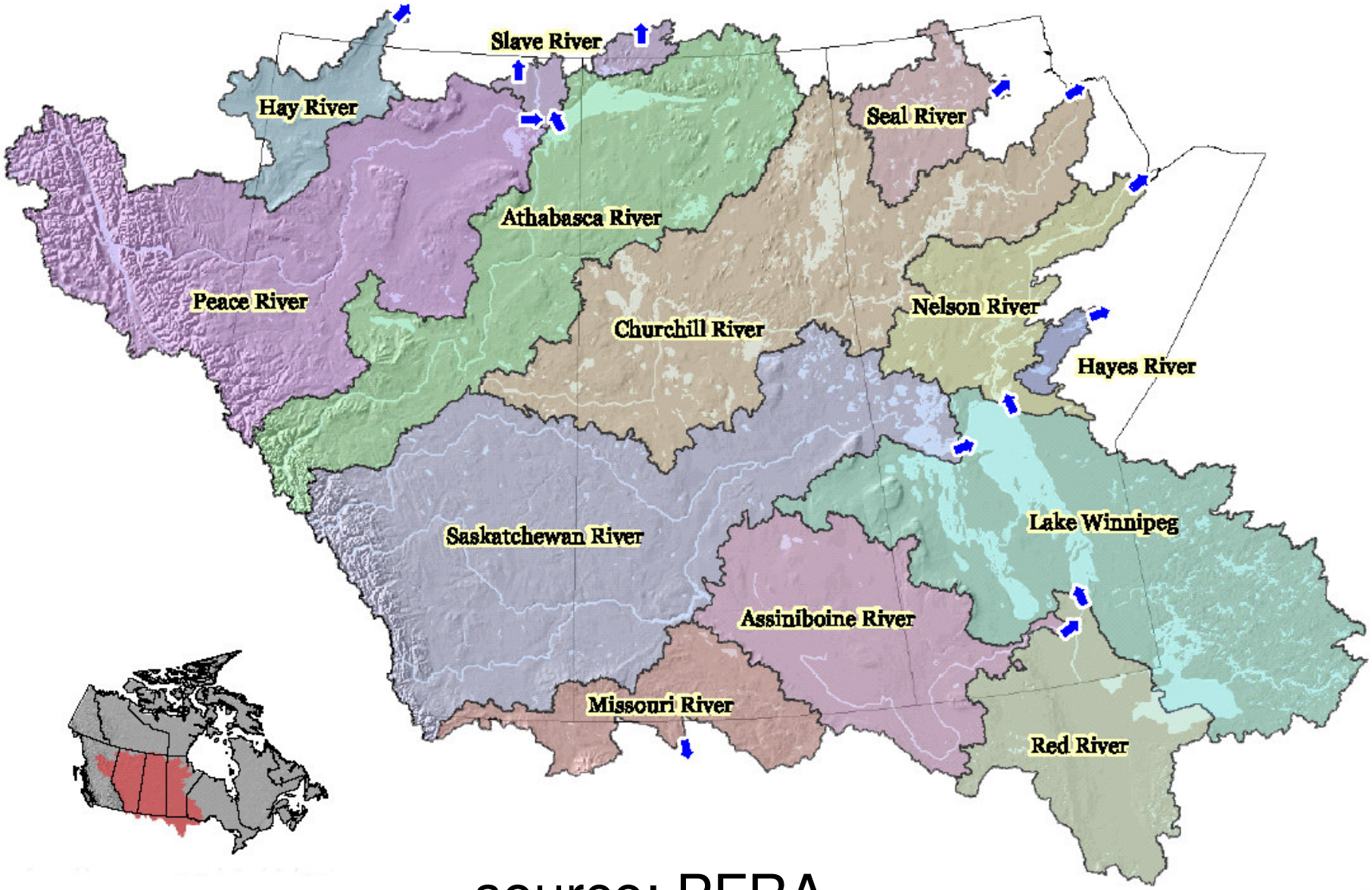
Major Collaborative Research Initiatives (MCRI) program

$2.43 M over five years

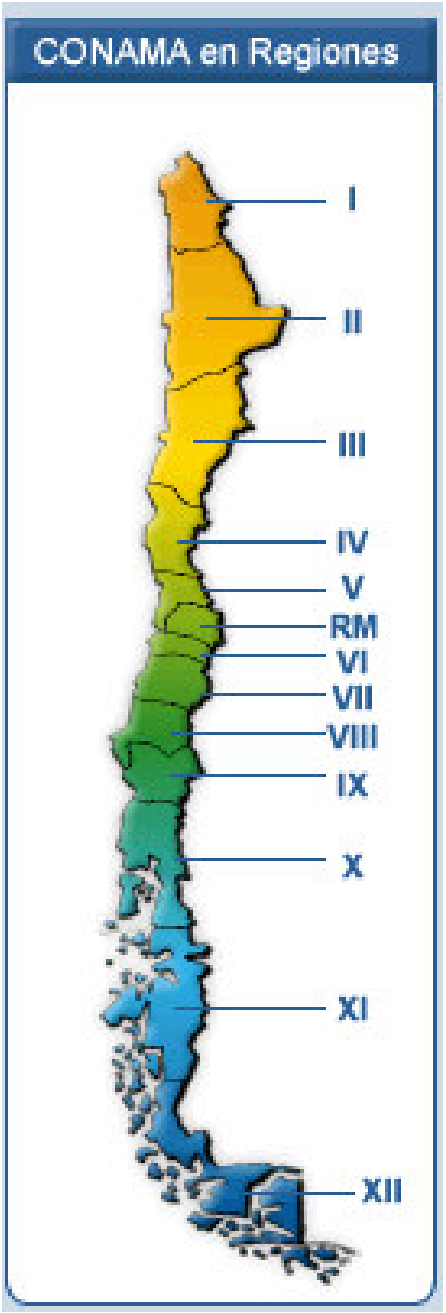
The goal of our project is to develop a systematic and comprehensive understanding of the technical and social capacities of regional institutions to formulate and implement strategies of adaptation to climate change risks and the forecasted impacts of climate change on the supply and management of water resources in dryland environments. We will address this goal through a comparative study of two large, regional, dryland water basins at different stages of social and environmental vulnerability to climate change.

Research objectives:

1. to identify the current physical and social vulnerabilities related to water resource scarcity in the two dryland regions;
2. to examine the effects of climate change risks on the identified vulnerabilities; and
3. to assess the technical and social adaptive capacities of the regional institutions to address the vulnerabilities to current water scarcity and climate change risks


Slave River
Hay River
Seal River
Athabasca River
Peace River
Churchill River
Nelson River
Hayes River
Saskatchewan River
Lake Winnipeg
Assiniboine River
Missouri River
Red River

source: PFRA



Region IV

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Instituto de Ecologia Politica	Bernardo Reyes

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