Vulnerability and Adaptation to Climate Extremes in the Americas : The VACEA project

Dave Sauchyn, Prairie Adaptation Research Collaborative, U of R

Swift Current Creek Watershed Stewards AGM, 23 January 2013

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

www.parc.ca/vacea/

International Research Initiative on Adaptation to Climate Change (IRIACC)

- support activities in Canada and low and middle income countries
- $12.5 million for five research projects
- IDRC funding (50%) will be directed to the low and middle income team members.
- the Tri-Council funding (50%) enabling the participation of Canadian team members

IDRC CRDI

NSERC CRSNG

Social Sciences and Humanities Research Council of Canada

Conseil de recherches en sciences humaines du Canada

Canada

VACEA - Objective

The overall objective is to improve the understanding of the vulnerability of rural agricultural and indigenous communities to **shifts in climate variability and to the frequency and intensity of extreme climate events**, and to engage governance institutions in Canada, Argentina, Brazil, Chile and Colombia in enhancing their adaptive capacity to reduce rural community vulnerability.

VACEA

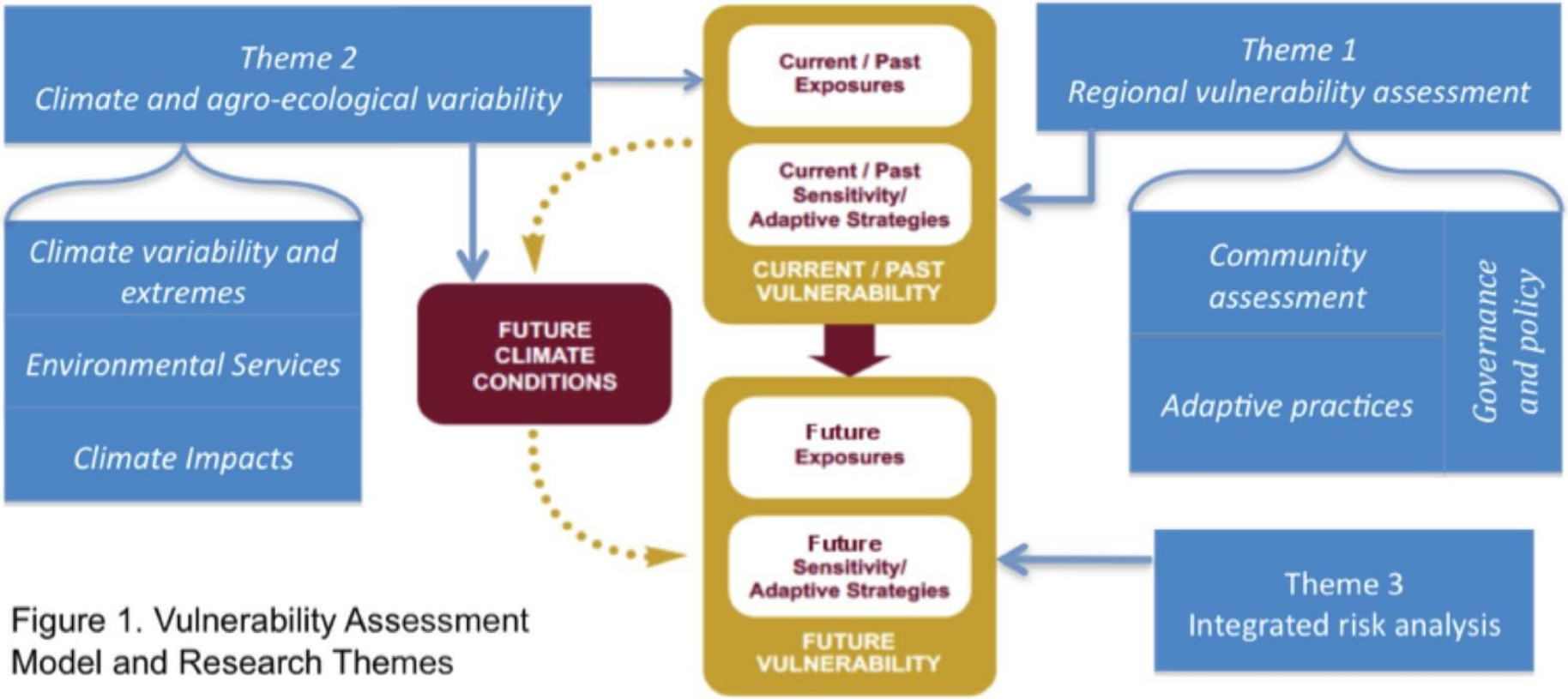


Figure 1. Vulnerability Assessment Model and Research Themes

VACEA

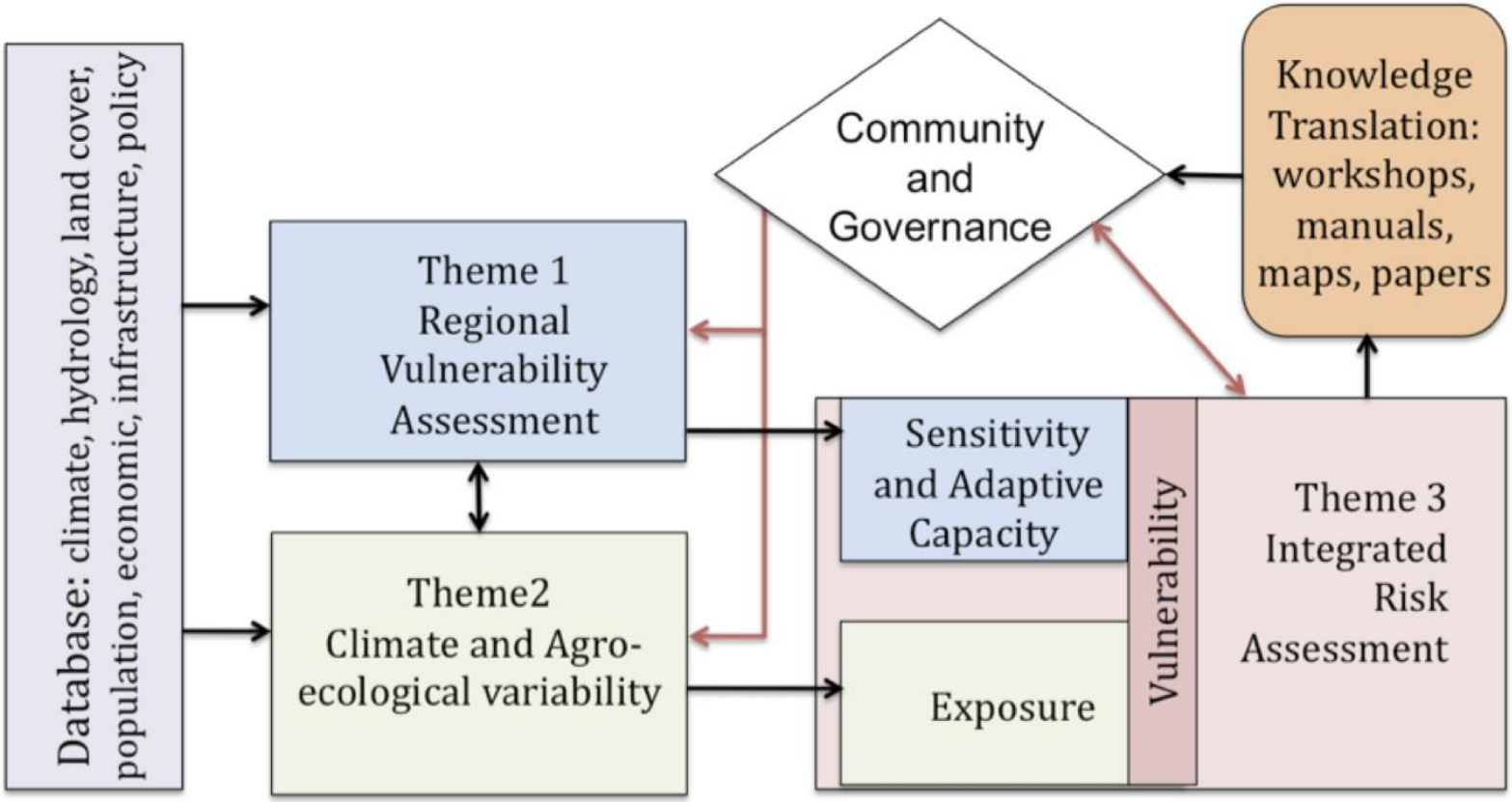


Figure 2. Methodological Framework

External Partners

Organization	*Contact*
Agriculture and Agri-Food Canada	Darrell Corkal
AARD– Irrigation and Farm Water Division	Brent Paterson
Alberta Environment	Bob Manteaw
Blood Tribe	Elliot Fox
Oldman Watershed Council	Shannon Frank
Prairie Provinces Water Board	Mike Renouf
Saskatchewan Association of Watersheds	Nancy Kapell
Saskatchewan Environment	Geoff Waters
Saskatchewan Watershed Authority	Wayne Dybvig
Swift Current Creek Watershed Stewards	Arlene Unvoas

Specific Objectives:

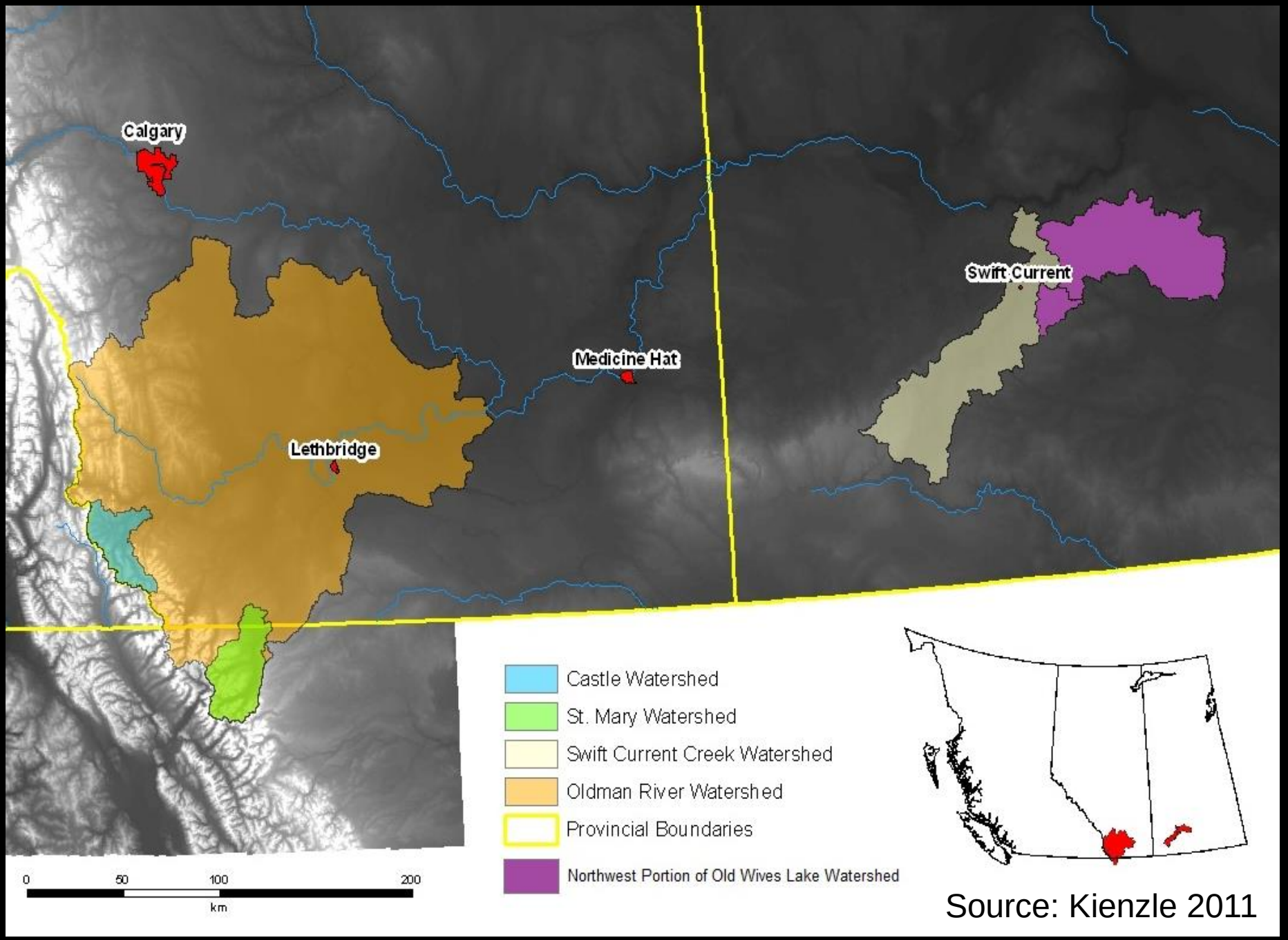
1.advance our understanding of **regional hydroclimatic variability and extreme events**, in terms of the natural characteristics and drivers, and shifts in the frequency and intensity of inter-annual variability and extremes as a consequence of global climate change;
2.advance our understanding of the **past, current and future vulnerabilities** of **rural agricultural and indigenous populations** to climate hazards and related stressors;
3.determine the **impacts** of climate variability and **extremes on agricultural productivity and environmental services** that support the studied communities;
4.evaluate and **communicate adaptive management practices and governance policies** that improve adaptive capacity and reduce climate-related risk;

… Specific Objectives:

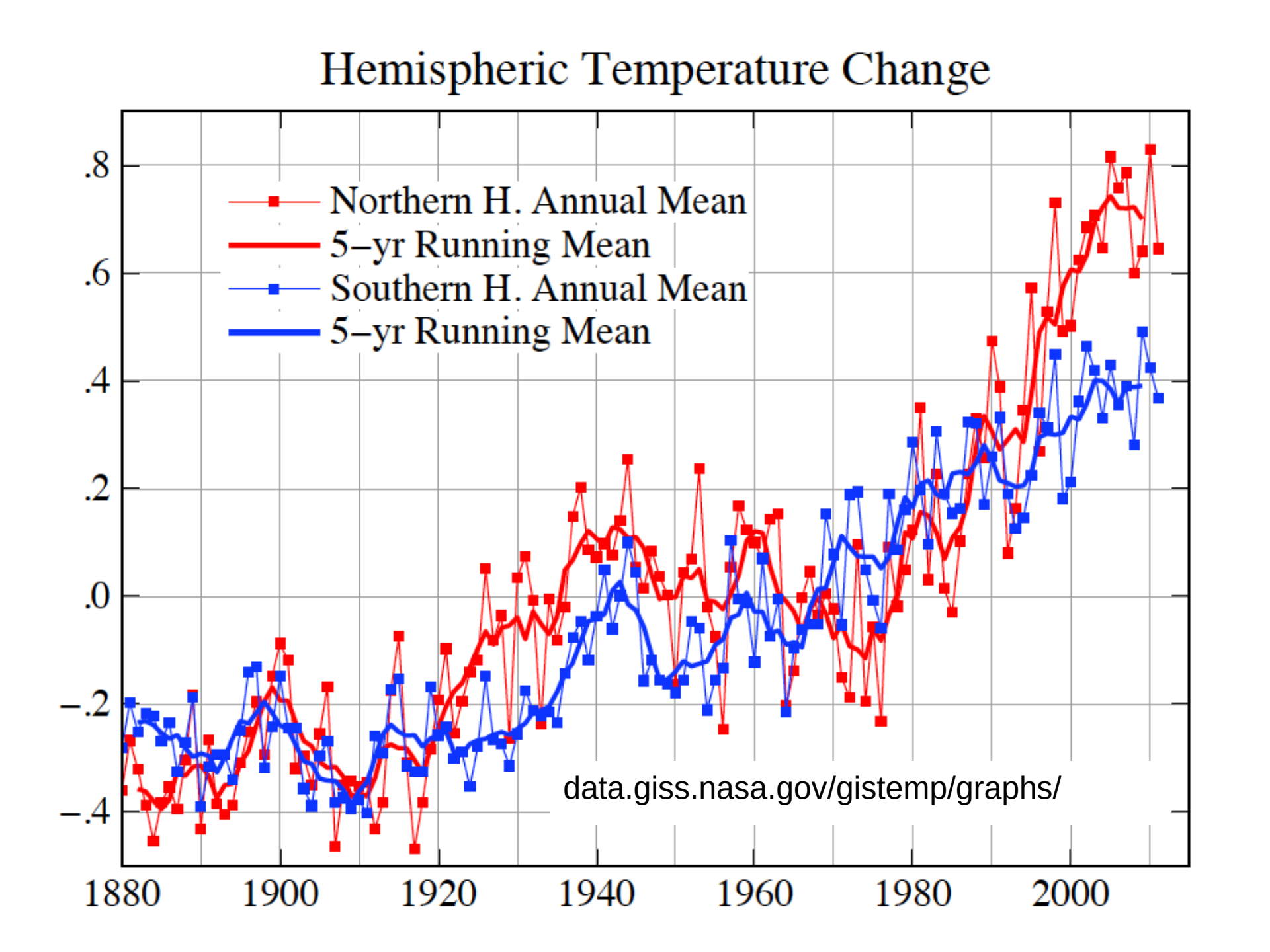
5. develop and implement **a unified methodology**, based on biophysical and socioeconomic indicators of vulnerability, to evaluate adaptation options for reducing vulnerability;
6. promote **sharing of knowledge, resources and expertise** among research and governance institutions in order to inform policies and programs for reduced vulnerability and enhanced adaptive capacity;
7. **increase** the **capacity** of research organizations and researchers in the five countries to undertake comparative and collaborative interdisciplinary research on climate change impacts and adaptation; and
8. enhance **young researchers**' expertise and skills in the interdisciplinary study of global environmental change.

Research Sites (Watersheds)

	River basin	Location	Size (km^2)	Extreme climate events	Agricultural production
Brazil	Ararangua	southern Brazil	3,020	hurricanes, hail and tornadoes, heat stress	rice, fruits, vegetables, cattle
Colombia	Chinchiná	central Andes	1,135	droughts, floods, storms, avalanches	coffee, sorghum, maize, rice, cattle
Argentina	Mendoza	eastern Andes	17,821	droughts, hailstorms, heat stress	fruits, horticulture, goats
Chile	Choapa	northern Chile	8,124	droughts, floods, mudslides, frost, heat	fruits, horticulture, flowers, goats
Canada	Oldman	southern Alberta	26,700	droughts , floods,	grains, pulses, forage, vegetables, cattle
	Swift Current	southern Saskatchewan	5,592	droughts , floods	grains, pulses, forage, , cattle



Source: Kienzle 2011


Hemispheric Temperature Change
Northern H. Annual Mean
5–yr Running Mean
Southern H. Annual Mean
5–yr Running Mean
.8
.6
.4
.2
.0
–.2
–.4
1880
1900
1920
1940
1960
1980
2000
data.giss.nasa.gov/gistemp/graphs/

THE GLOBE AND MAIL

Warming trend could prove boon to Canadian farming

MARTIN MITTELSTAEDT

Last updated Thursday, May. 12, 2011 6:20PM EDT

Lucky North Americans

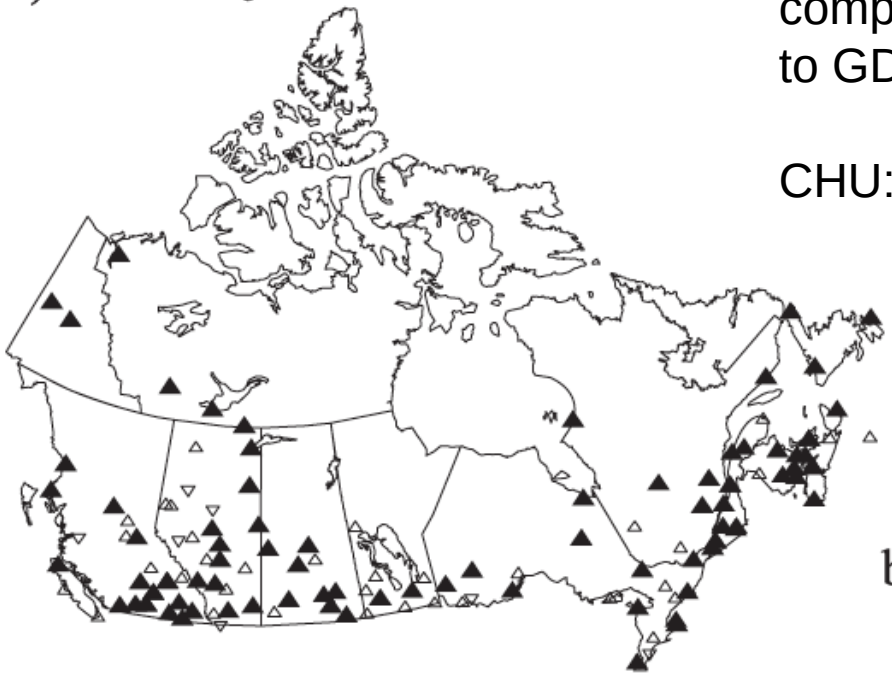
There was upside for Canadian farmers. In their number crunching, the researchers noted no effect on yields in **Canada and the U.S.**, because **temperatures haven't risen in those countries** as they have elsewhere around the globe.

This is "one of the reasons why when we looked around the world at agricultural investing, we just thought Canada is where you have got to be, and we're seeing more and more people reach that conclusion," said Tom Eisenhauer, president of Bonnefield Financial, a firm that invests in farmland. Mr. Eisenhauer says **most warming is likely to occur at latitudes to the south of Canada's prime agricultural lands**.

Observed Long-Term Trends for Agroclimatic Conditions in Canada
Qian *et al*. 2010

Crop Type	Cool Season Crops				Warm Season Crops		
Crop Name	Wheat	Oat	Barley	Canola	Corn	Bean	Soybean
GDD Range	1538 to 1680	1483 to 1750	1269 to 1540	1152 to 1445	1173 to 1779	1100 to 1300	1186 to 1719
Criteria	On an average, cool-season crop: 1485				On an average, warm-season crop: 1375		
Time frame	April 1 - August 31				May 1 - September 30		

a) $EGDD_0$ GSS-GSE



EGDD: effective growing degree-days computed by applying a day-length factor to GDD

CHU: crop/corn heat units

b) CHU_w GSS-GSE

GSS: growing season start

GSE: growing season end

Qian *et al*. 2010

Percentage of stations showing a significant positive trend (++) or a significant negative trend (--)

	1885-2007				
INDICES	#	++	+	-	--
$EGDD_C$	124	**53.2**	44.4	2.4	0.0
$EGDD_O$	124	**64.5**	29.8	5.6	0.0
EGDDw	124	**62.9**	29.8	7.3	0.0
$CHU1_w$	124	**58.9**	34.7	6.5	0.0

EGDD: effective growing degree-days computed by applying a day-length factor to GDD

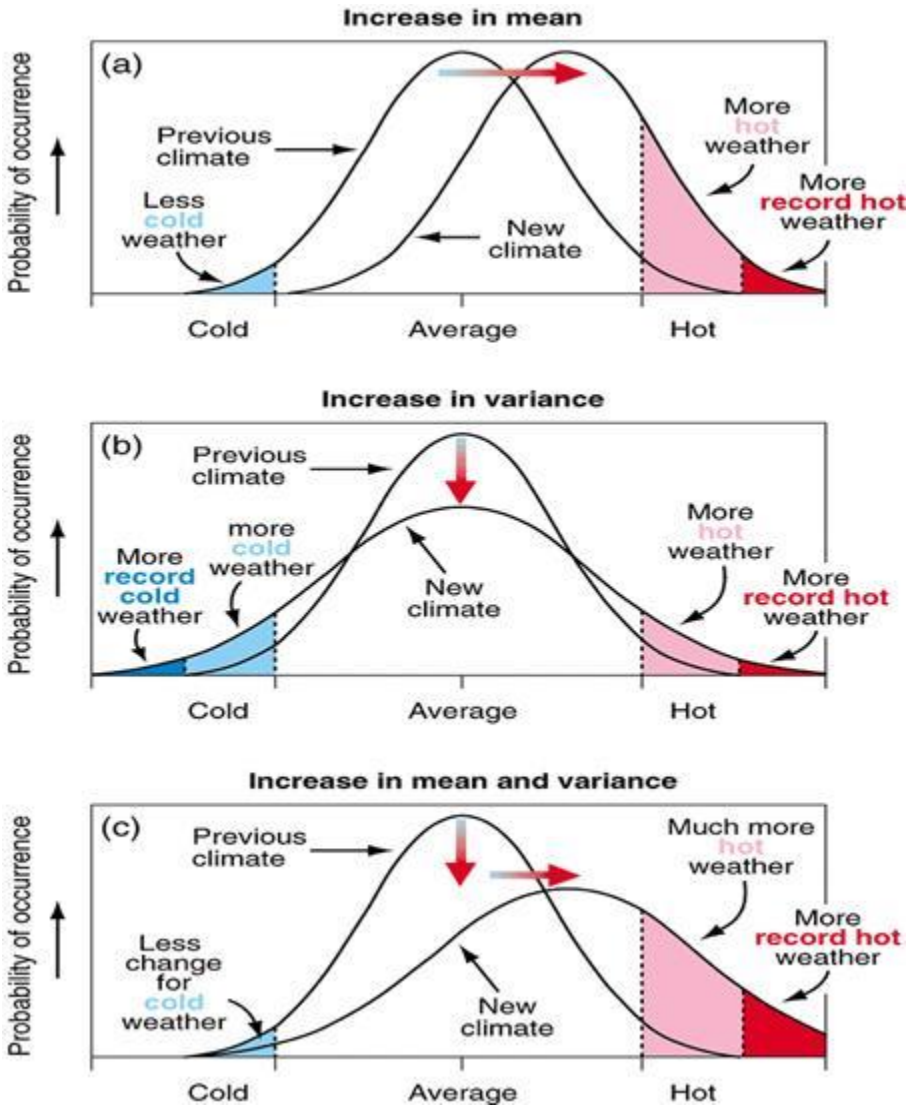
CHU: crop/corn heat units

Observed Long-Term Trends for Agroclimatic Conditions in Canada

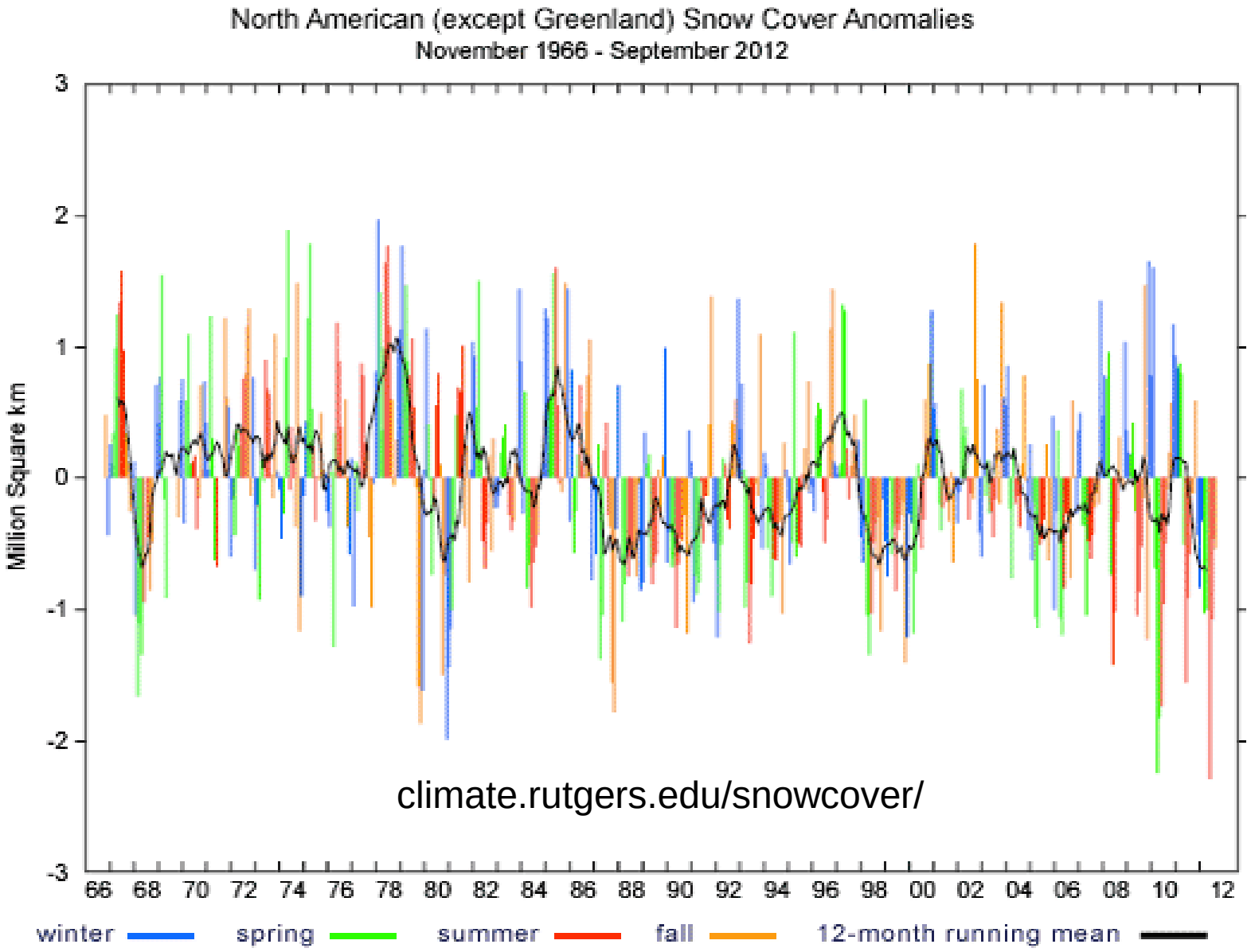
We find a significant **increasing** trend in the **length of the growing season** and in the associated available **heat**. The winter temperature is less damaging and the **frost-free periods are longer**. We also find trends in precipitation-related indices that indicate **more availability of water**, though the trend in the main agriculture region is less significant.

QIAN *et al*. 2010

Climate Change



North American Snow Cover, 1966-2012

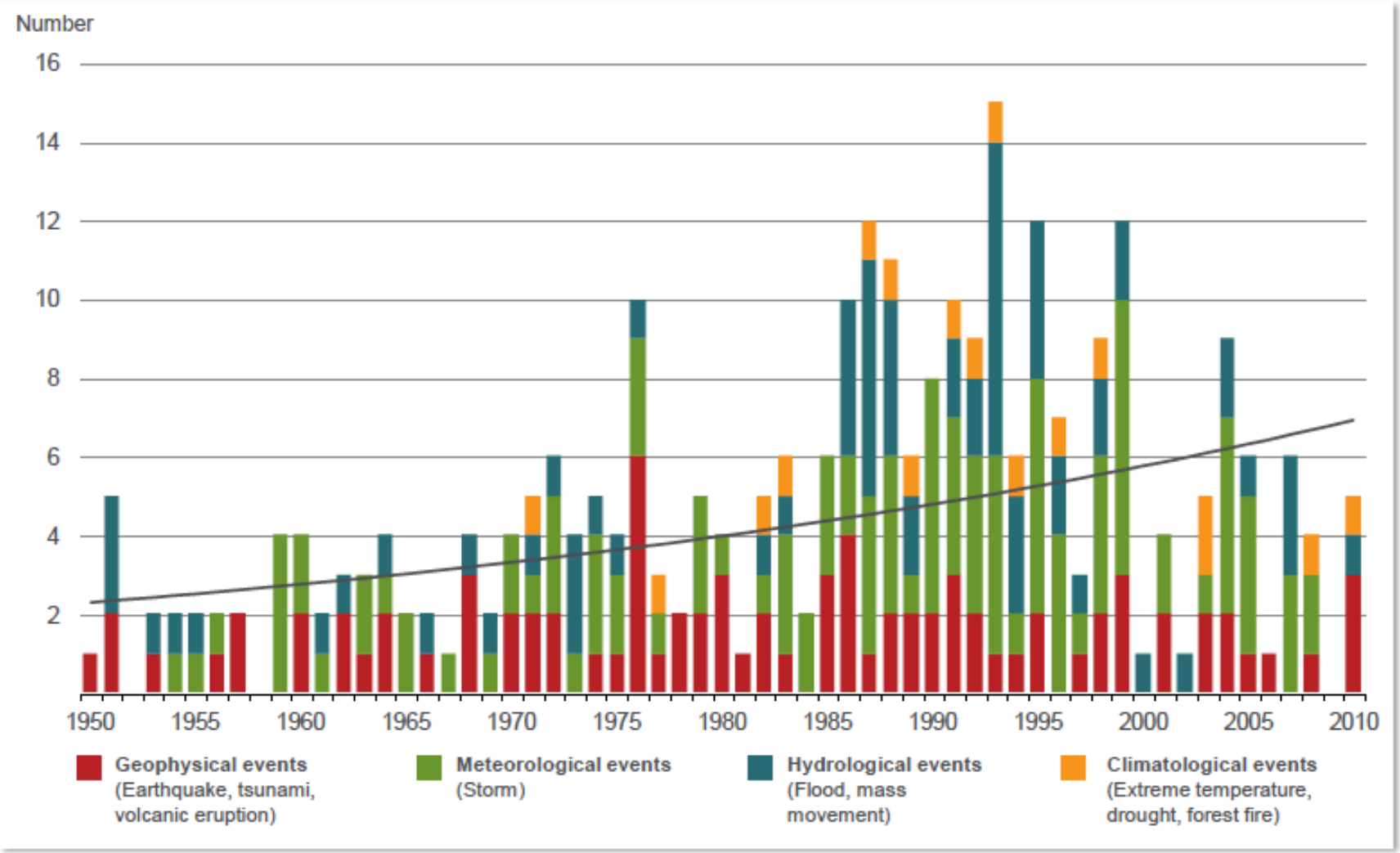


NatCatSERVICE

Great natural catastrophes worldwide 1950 – 2010

Number of events with trend

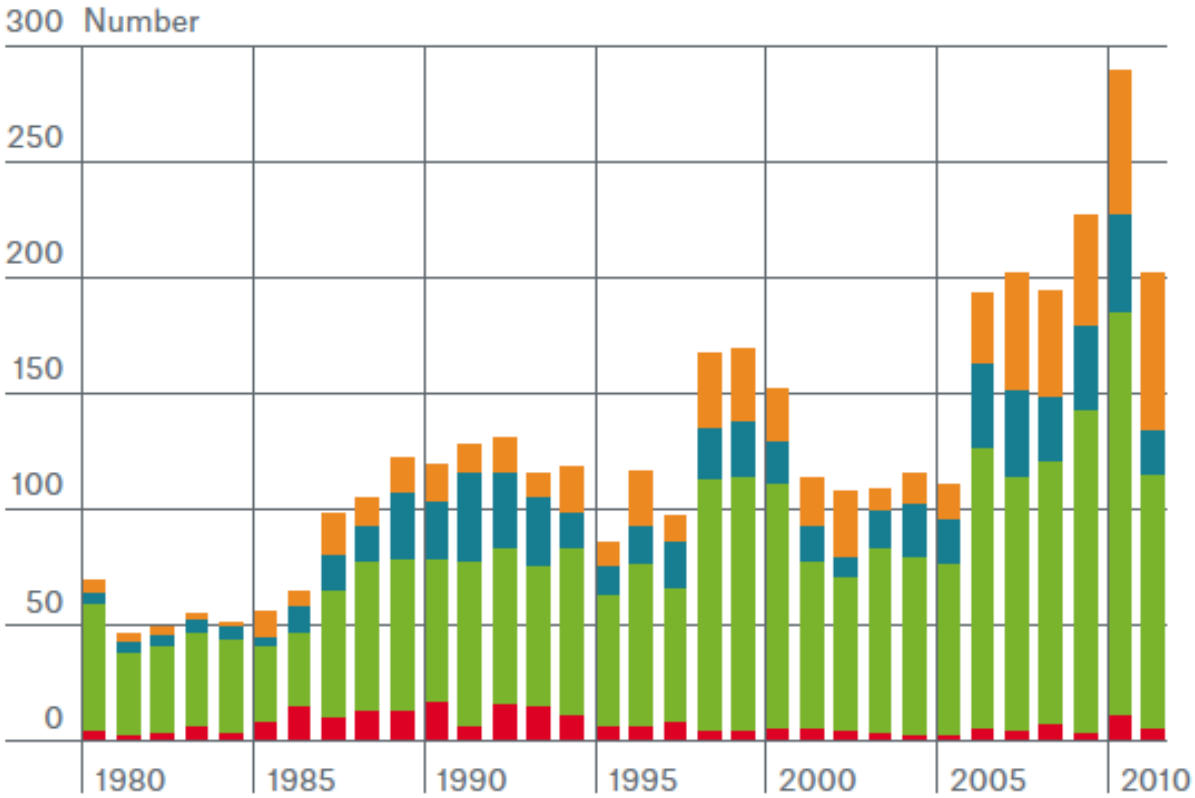
Munich RE



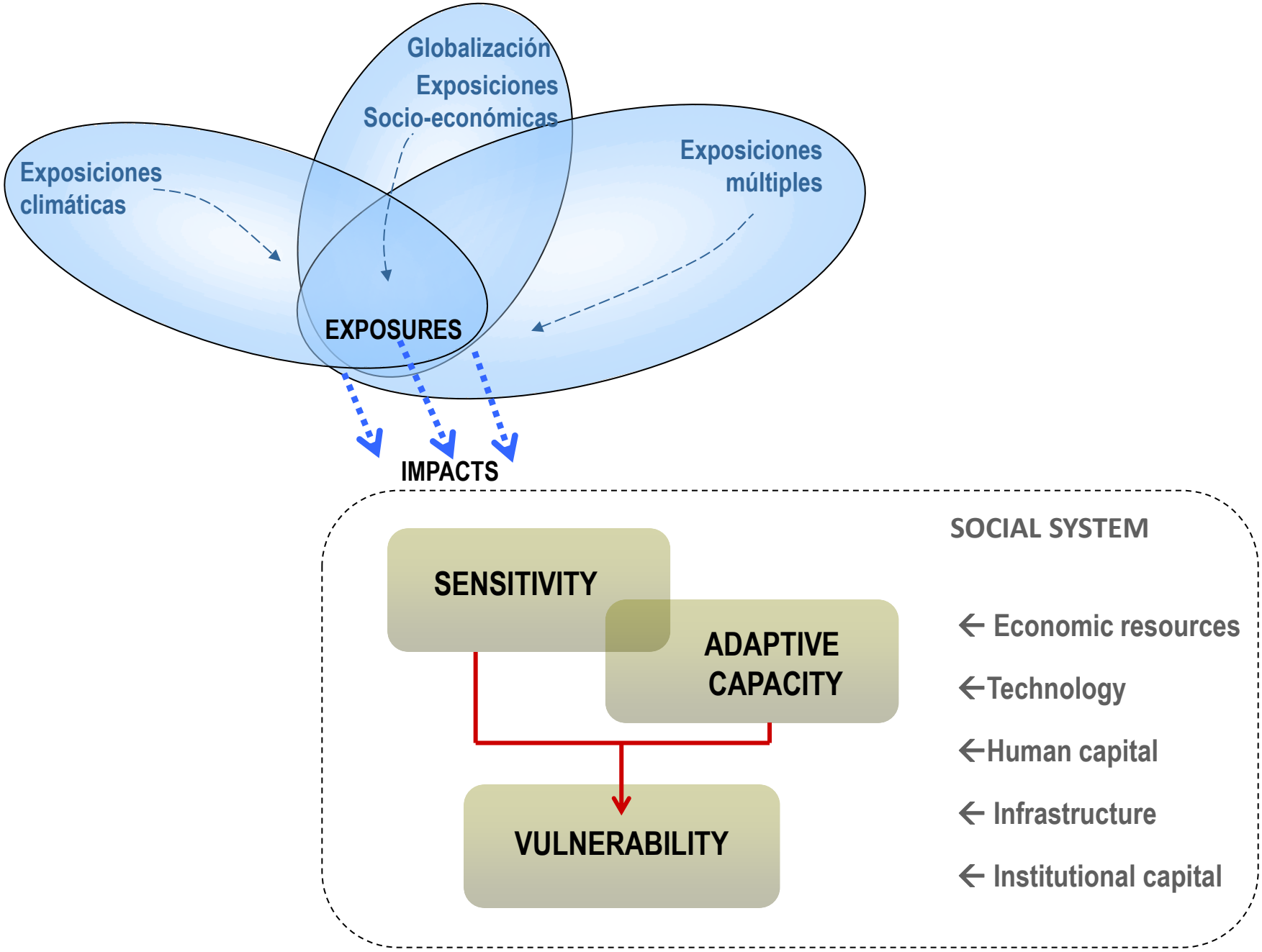
Natural catastrophes in North America 1980–2011: Number of events

- Geophysical events
- Meteorological events
- Hydrological events
- Climatological events

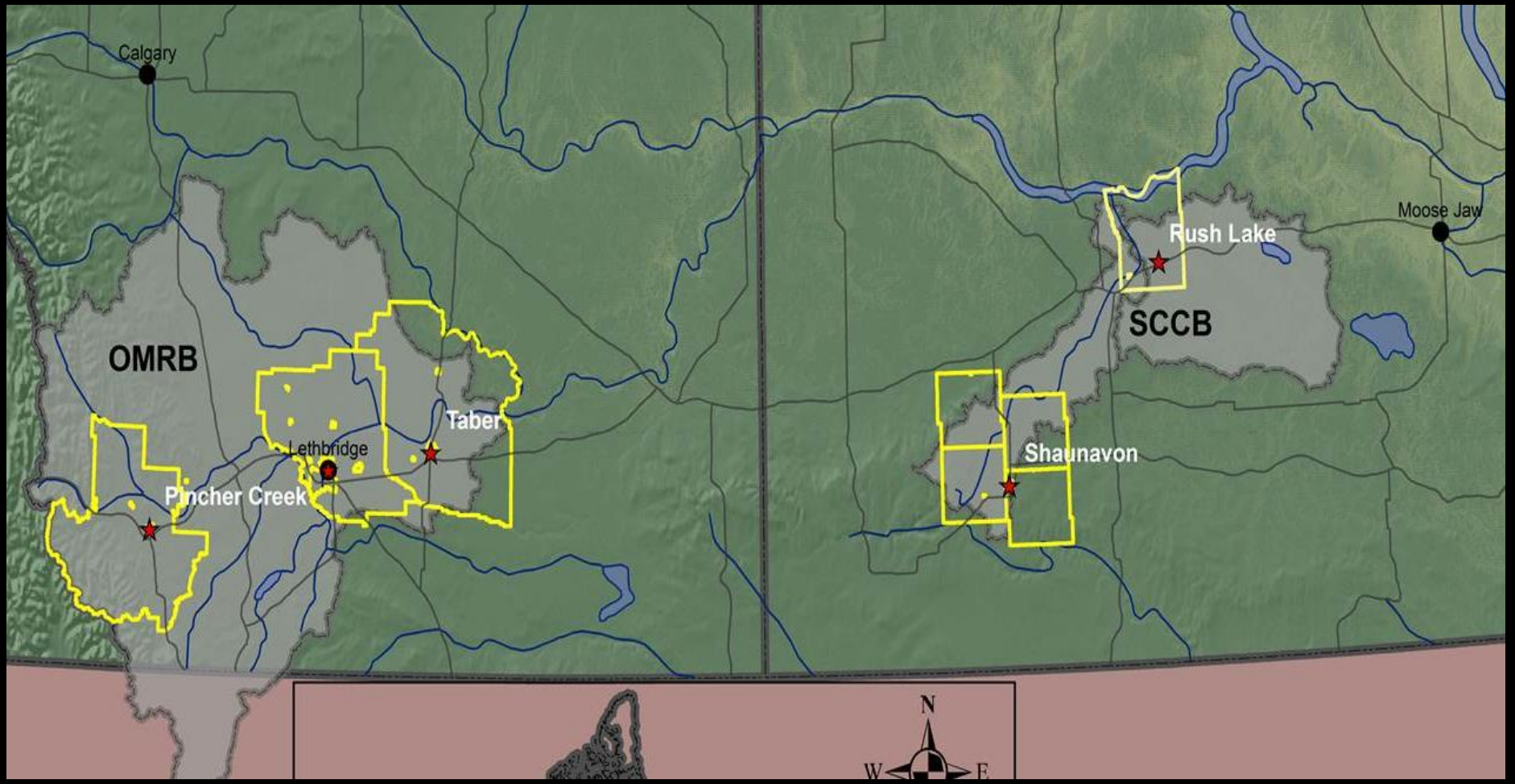
Source: Munich Re, NatCatSERVICE



Munich Reinsurance (2012) Severe weather in North America


Globalización
Exposiciones
Socio-económicas
Exposiciones
climáticas
Exposiciones
múltiples
EXPOSURES
IMPACTS
SOCIAL SYSTEM
SENSITIVITY
ADAPTIVE
CAPACITY
VULNERABILITY
← Economic resources
←Technology
←Human capital
← Infrastructure
← Institutional capital

Study "Communities"



The objective of the **Community Vulnerability Assessment** is to develop a systematic understanding of the present and past vulnerabilities of rural people to extreme climate events.

- February – March 2012: Rush Lake, Saskatchewan
- May – June 2012: Pincher Creek, Alberta
- June – July 2012: Shaunavon, Saskatchewan
- July 2012: Taber, Alberta

170 Interviews

Adaptation: adjustments in practices, processes, or structures of systems to projected or actual changes of climate

Integrated Risk Assessment

Risk = Probability X Consequences

Press Conference, Manizales, Colombia, November 1, 2011

Community and Stakeholder Engagement

Stakeholders meetings

Newsletters: fall 2011, winter 2012, fall 2012

Website: www.parc.ca/vacea