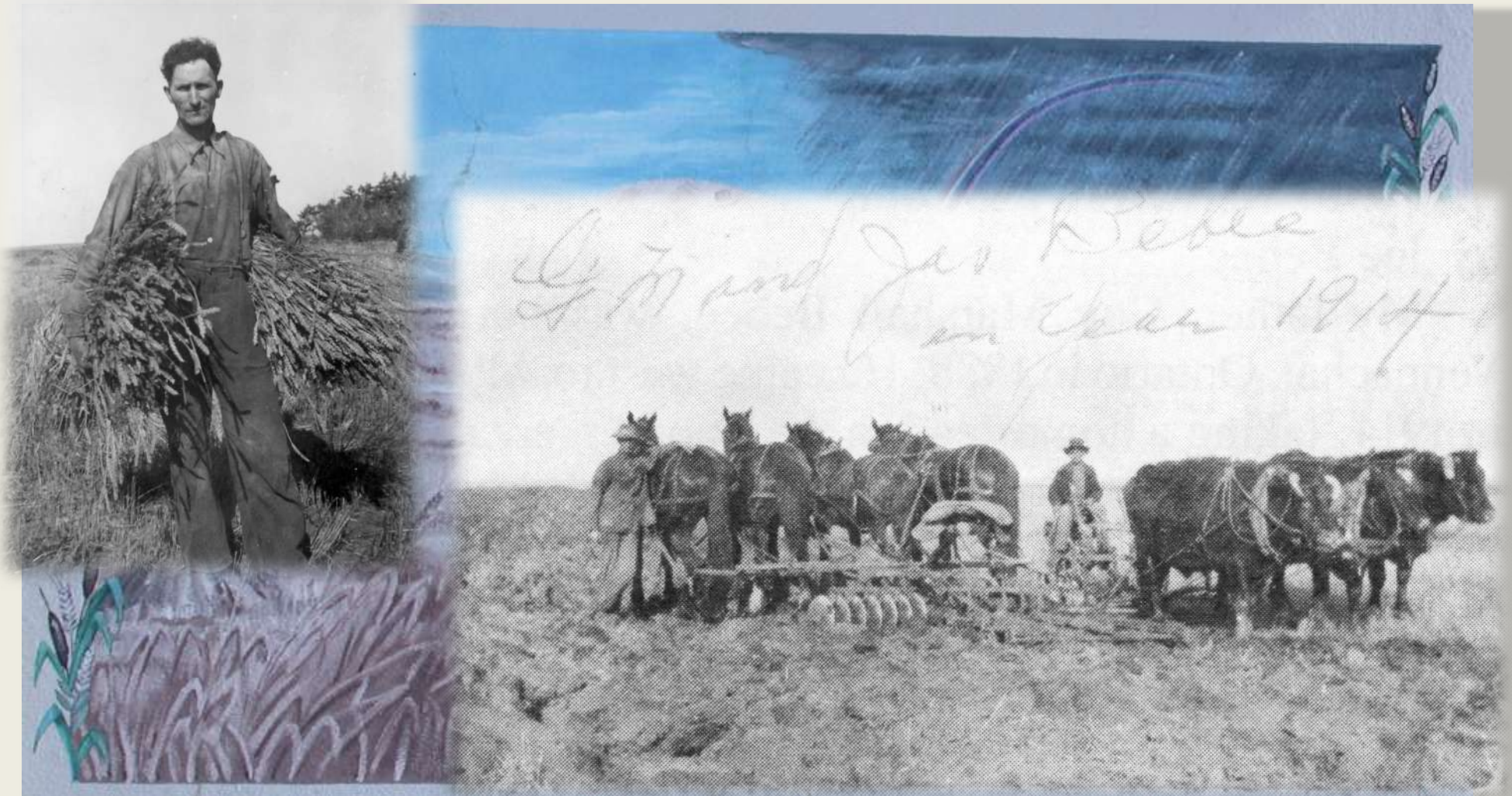


Sustainable Agriculture as Adaptation to Climate Change

Dave Sauchyn, PhD, PGeo

Prairie Adaptation Research Collaborative, University of Regina



Bentley Lecture, University of Alberta, 24 February 2016





University
of Regina

- In 1998, the federal government proposed the **Canadian Climate Impacts and Adaptation Research Network** and a physical node where the effects of climate are significant and where some adaptation research capacity and coordination already exists.
- In the Prairies, the agricultural community has a history of adapting to climate variability.
- The level of agricultural adaptation effort already resident in the **Prairie Farm Rehabilitation Administration (PFRA)** in Regina, and the supporting activities of Agriculture and Agri-food Canada, made Regina the logical base for pursuing climate impacts and adaptation research.
- On March 24, 2000, in Regina, Minister Ralph Goodale (Natural Resources Canada) announced the establishment of the **Prairie Adaptation Research Collaborative (PARC)**.



PARC Graduate Scholarships

Renewable Resources: Carmela Arevalo, Sophan Chhin, Meg Krawchuk, Juha Metsaranta

Rural Sociology: Kendra Isaac, Santiago Olmos

Biological Sciences: Shannon White

PARC – U of A Collaborations



Political Climate Modeling

Dr. Debra Davidson

(Resource Economics & Environmental Sociology)

Alberta Climate Impact Assessment

Dr. Debra Davidson, Dr. Marian Weber (Adjunct, Rural Economy)

From Impacts to Adaptation – Prairies Chapter

Dr. Debra Davidson, Dr. Justine Klaver-Kibria (Public Health)

Alberta Climate Dialogue

Dr. David Kahane (Political Science)

Predicting Alberta's Water Future (PAWF)

Dr. Greg Goss (Biological Sciences)

Dr. Monireh Faramarzi (Water Initiative)



Public Talks on Climate Change

- Upper Souris **Watershed** Association, 16 November, 2015, Oungre, SK
- Partners for the Saskatchewan **River Basin**, 2-4 November 2015, Winnipeg, MB
- **Lumsden Valley** Community Association Public Meeting, 29 October 2015
- Sturgeon River **Watershed** Forum, 17 September 2015, St. Albert, AB
- Swift Current Creek **Watershed** Stewards, 21 April, 2015, Swift Current, SK
- Saskatchewan Association of **Watersheds** AGM, 15 April, 2015, Melfort, SK
- **Special Areas** Advisory Council, 03 December 2014, Hanna, Alberta.
- Assiniboine **River Basin** Initiative Conference, 14 November 2014, Regina, SK
- **Organic Connections** Conference, 07 November 2014, Regina, SK.
- Long Term Threats to the Saskatchewan **River Basin**, 20 October 2014, Saskatoon, SK
- **United Church** of Canada, Banff Men's Conference, 18 October 2014
- Battle River **Watershed** Alliance AGM, 19 June 2014, Stettler, AB.
- Citizen panel - Oldman River **Watershed**, Lethbridge, AB, 22 February 2014
- **Agricultural Producers** Association of Saskatchewan AGM, Regina, 05 December, 2013
- Canadian **Bison Association** Convention, Regina, 9 November 2013
- Strengthening Economic Security of **Irrigated Agriculture**, Lethbridge, 06 November 2013
- Oldman – South Saskatchewan **River Basin** Working Group, Lethbridge, 25 Sept 2013
- North American **Mushroom Conference**. Vancouver. 23 June 2013



Flagstaff County Agricultural Symposium
Sedgewick, Alberta, July 28, 2012



FARMING

\$7.95

FOR TOMORROW

Alberta/BC edition

Fall 2015

The earth is round, but
is the climate warming?



Vision: create a healthy landscape that sustains agriculture, wildlife and natural spaces

Mission: ALUS is a community developed, farmer delivered program that gives Canadians the opportunity to play an active role in building a healthier environment by providing support to farmers and ranchers to **enhance and maintain ecosystem services.**

Principles



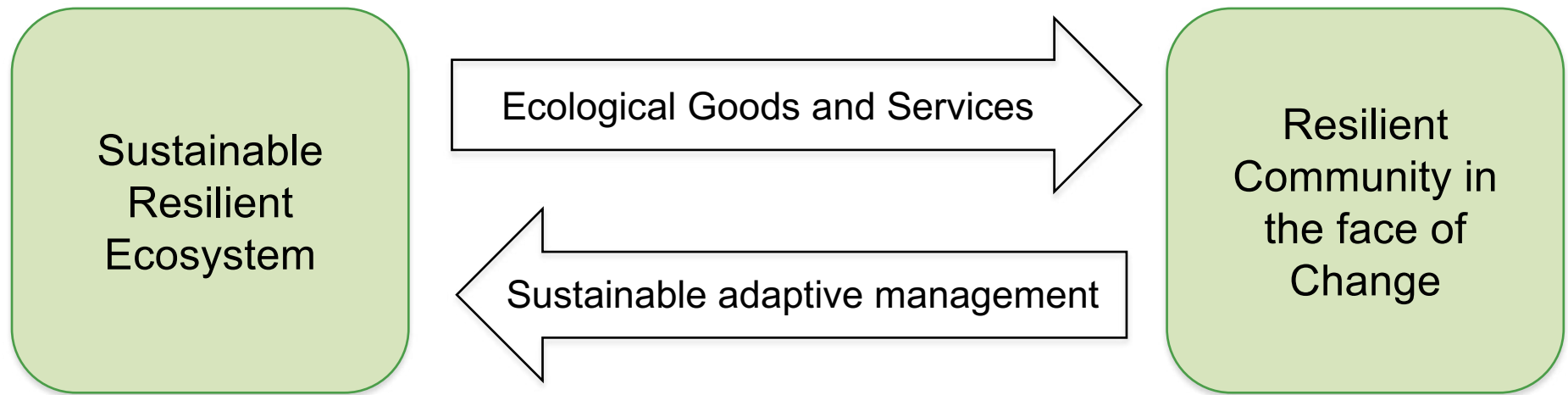
- Community-developed
- Farmer-delivered
- Targeted: marginal or ecologically sensitive parcels of land are managed in a different manner
- Market Driven - benefits from nature have economic value
- Voluntary
- Integrated: complement existing conservation programs including federal and provincial government policy frameworks
- Accountable
- Science-based

Planned Adaptation to Climate Change

Key Principles:

- **Sustainable:** enhance the capacity of natural systems to boost resilience by buffering climate risks
- **Partnerships:** engage the local community and ensure they are well informed - *Community Developed*
- **Evidence-based:** decision-making is well-supported and informed - *Science Based*
- **Balanced :** a holistic approach that includes managing both, climate and non-climate risks – *Integrated*
- **Prioritized and tailored:** target relevant scale and sectors most affected, long-term implications, high values - *Targeted*
- **Transparent** - communicate decisions – *Accountable*
- **Monitoring** and review decisions - *Accountable*

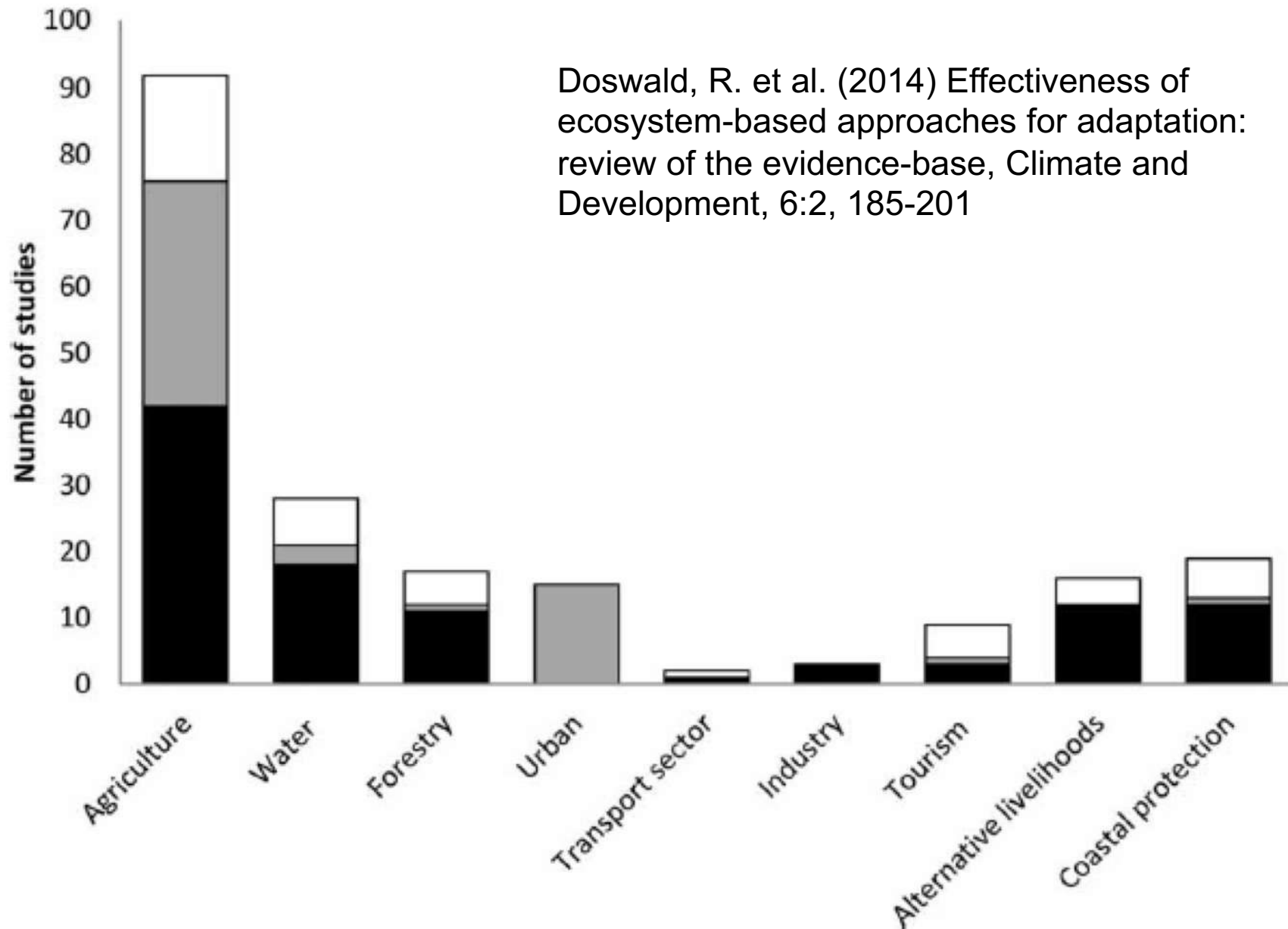
Ecosystem-Based Adaptation (EBA)



the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change

Convention on Biological Diversity (2009)

EBA-related Interventions by Sector



Examples of EBS-related Interventions

Intervention	Impact/hazard addressed
Sustainable forest management	Soil quality/productivity loss
Reforestation	Flooding and water quality/erosion
Tree shelterbelts	Water scarcity
Agroforestry/silvopastoralism	Water scarcity/productivity loss
Livelihood diversification/alternative strategies	Water scarcity
Integrated watershed management	Water scarcity
Wetlands restoration	Water scarcity/flooding and water quality
Floodplain management	Flooding and water quality
Rangeland management	Water scarcity/biomass cover
Conservation agriculture	Productivity loss
Soil conservation	Productivity loss

Doswald, R. et al. (2014)

Climate Change Adaptation in Light of Sustainable Agriculture

Wall and Smit 2005

- Sustainable agriculture and adaptive capacity depend on the viability of a *farm's natural resources*
- Both have social, environmental and economic dimensions
- A sustainable system must have the *capacity to adapt*

The Potential of Sustainable Agriculture for Climate Change Adaptation

Mulli and Niggli 2013

Sustainable agriculture is a system well suited to adaption:

- Traditionally it uses locally adapted varieties and cropping practices, and thus can better adjust to *local climate variability*
- It can respond to water stress by managing soil organic matter
- Biodiversity and crop rotations mitigate weed and pest outbreaks
- Sustainable and management practices reduce vulnerability to extreme events (reduced sensitivity) and they increase the *resilience of agro-ecosystems*

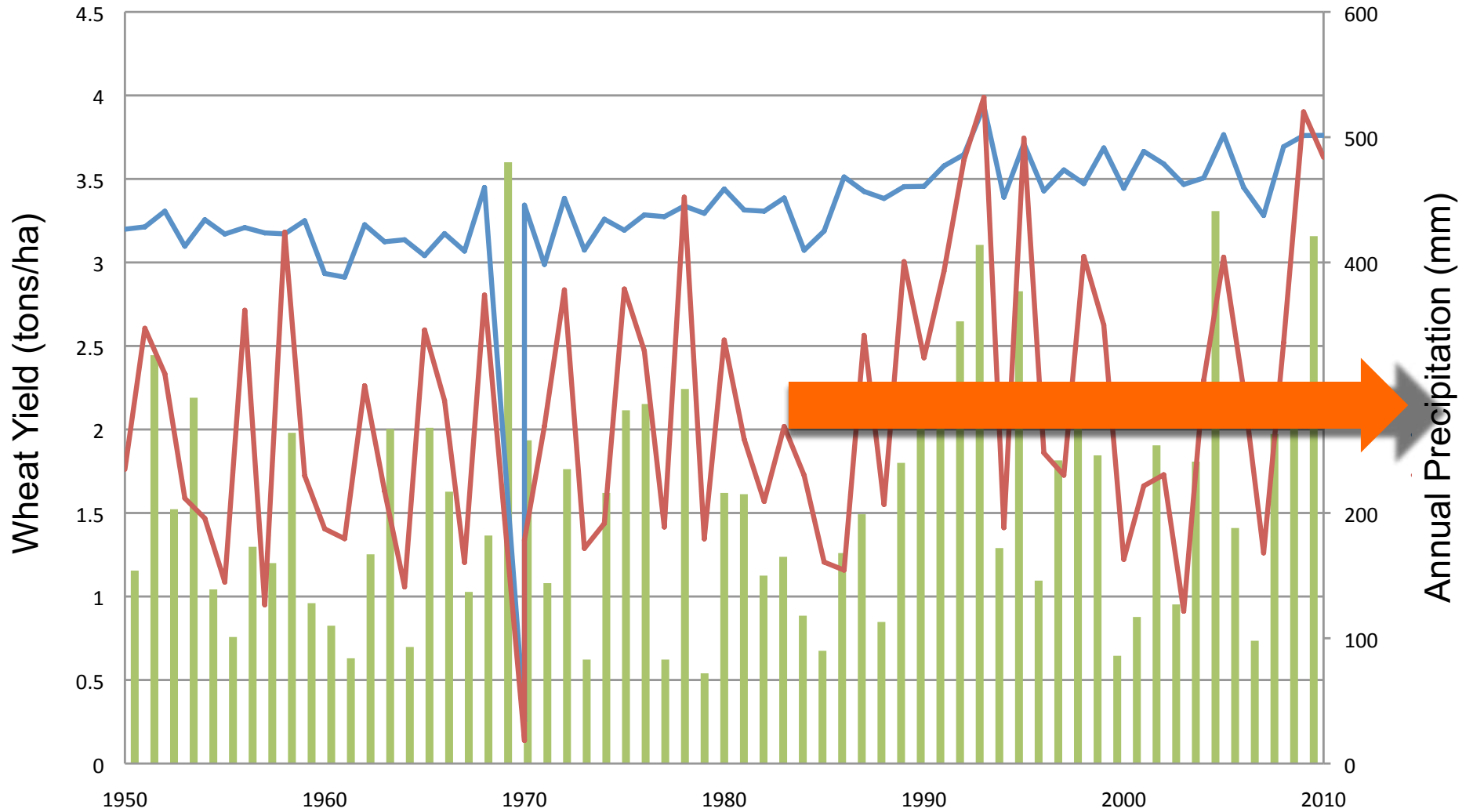
Southern Alberta (Near Enchant)



Wheat Yield (tons/ha), Southwestern Alberta, 1950-2010

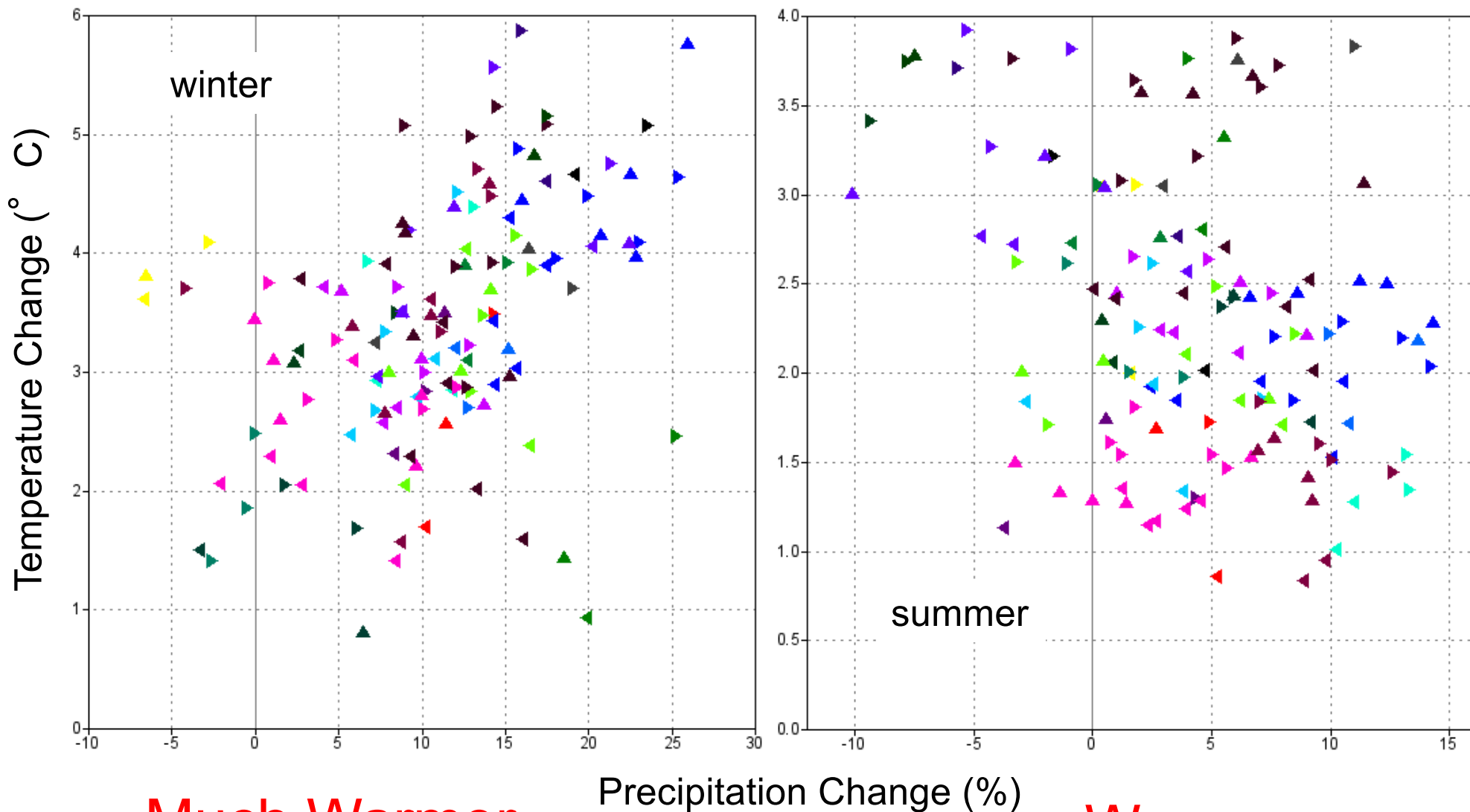
- precipitation
- irrigated
- non-irrigated

Source: Stefan Kienzle, U of L



Projected Climate Changes, Western Prairies 2040-69 versus 1971-2000

Source: PCIC



**Much Warmer
and Wetter**

**Warmer,
Possibly Drier**

Communication of the role of natural variability_in future North American climate

Deser et al. 2012

Natural climate variability poses inherent limits to climate predictability ... contributes substantial uncertainty to temperature and precipitation trends over North America, especially in winter at mid and high latitudes... [It] is unlikely to be reduced as models improve

Robustness and uncertainties in the new CMIP5 climate model projections

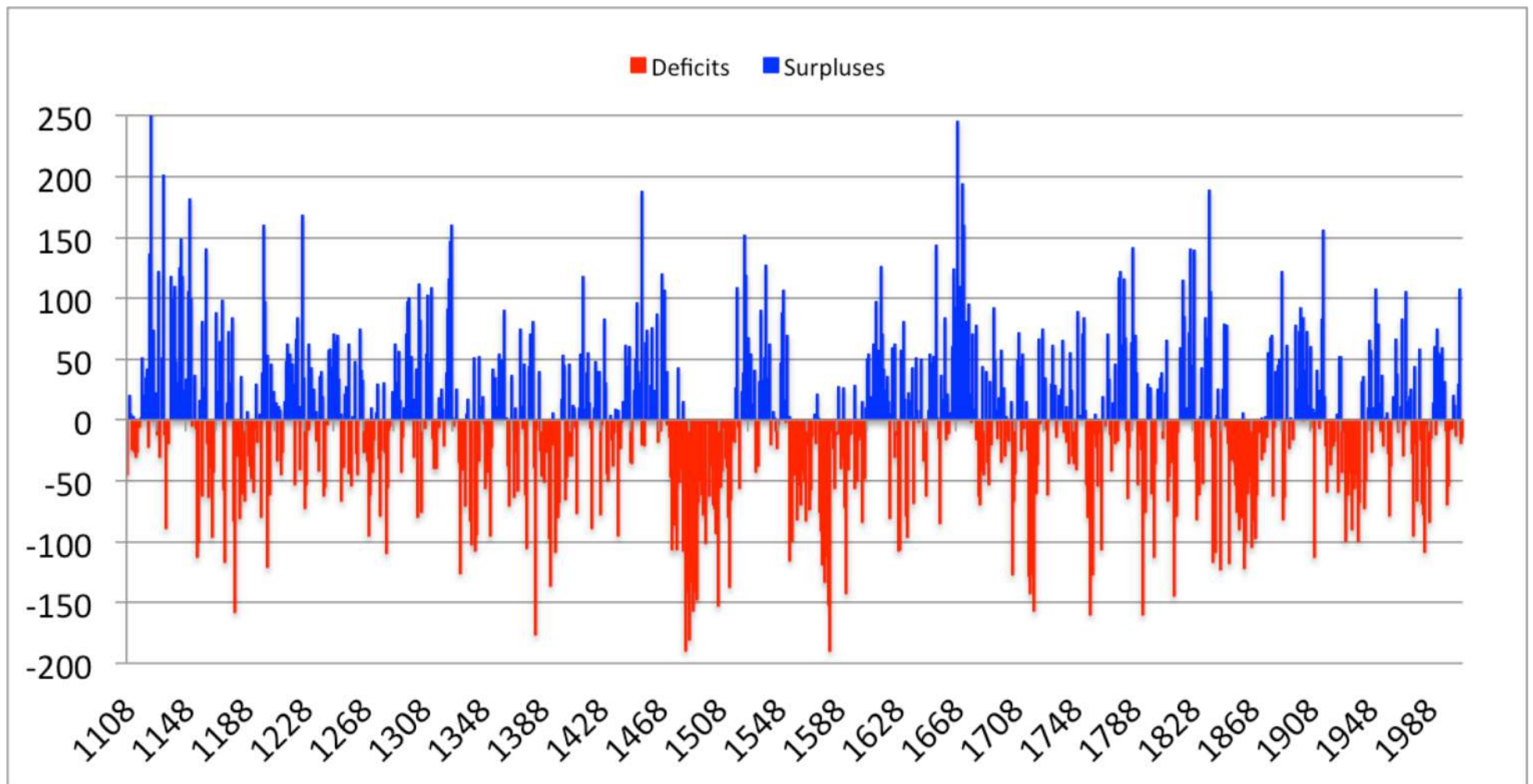
Knutti and Sedláček 2012

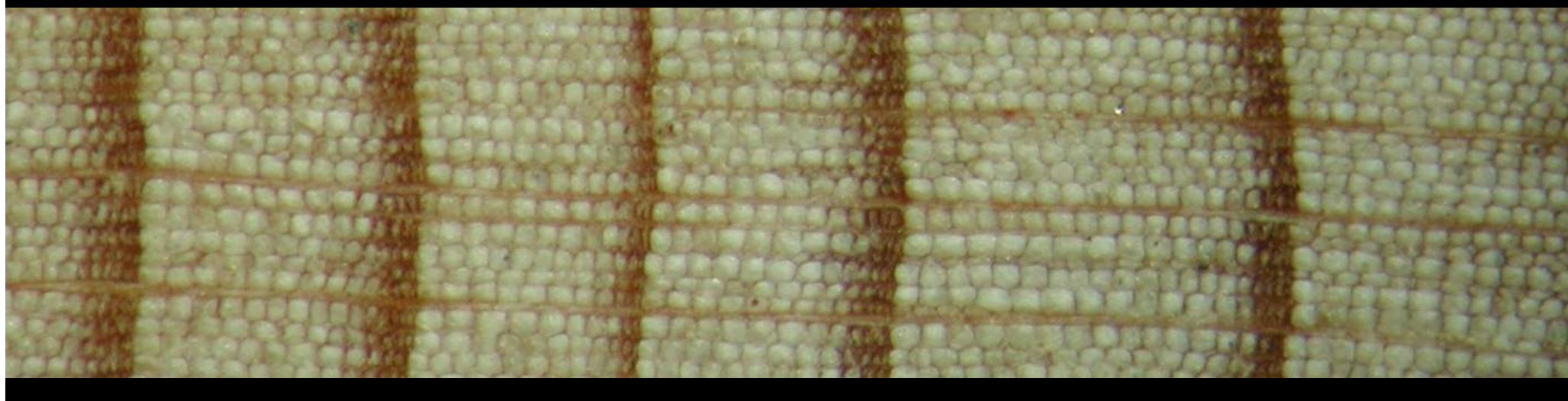
The local model spread has not changed much despite substantial model development and a massive increase in computational capacity. ...[it] is irreducible owing to internal variability in the climate

**“The farther back you can look, the further forward
you are likely to see.”**

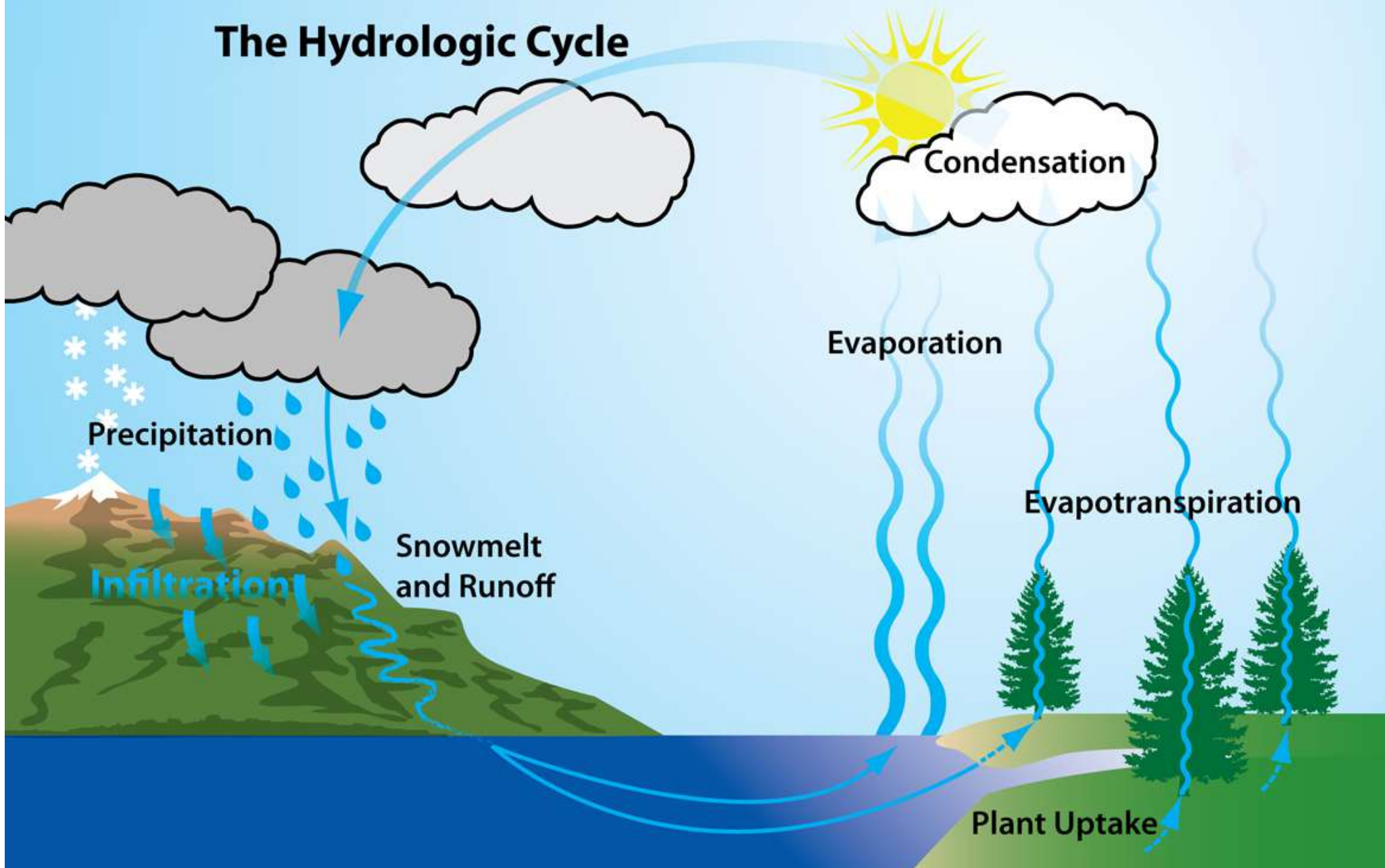
- Sir Winston Churchill

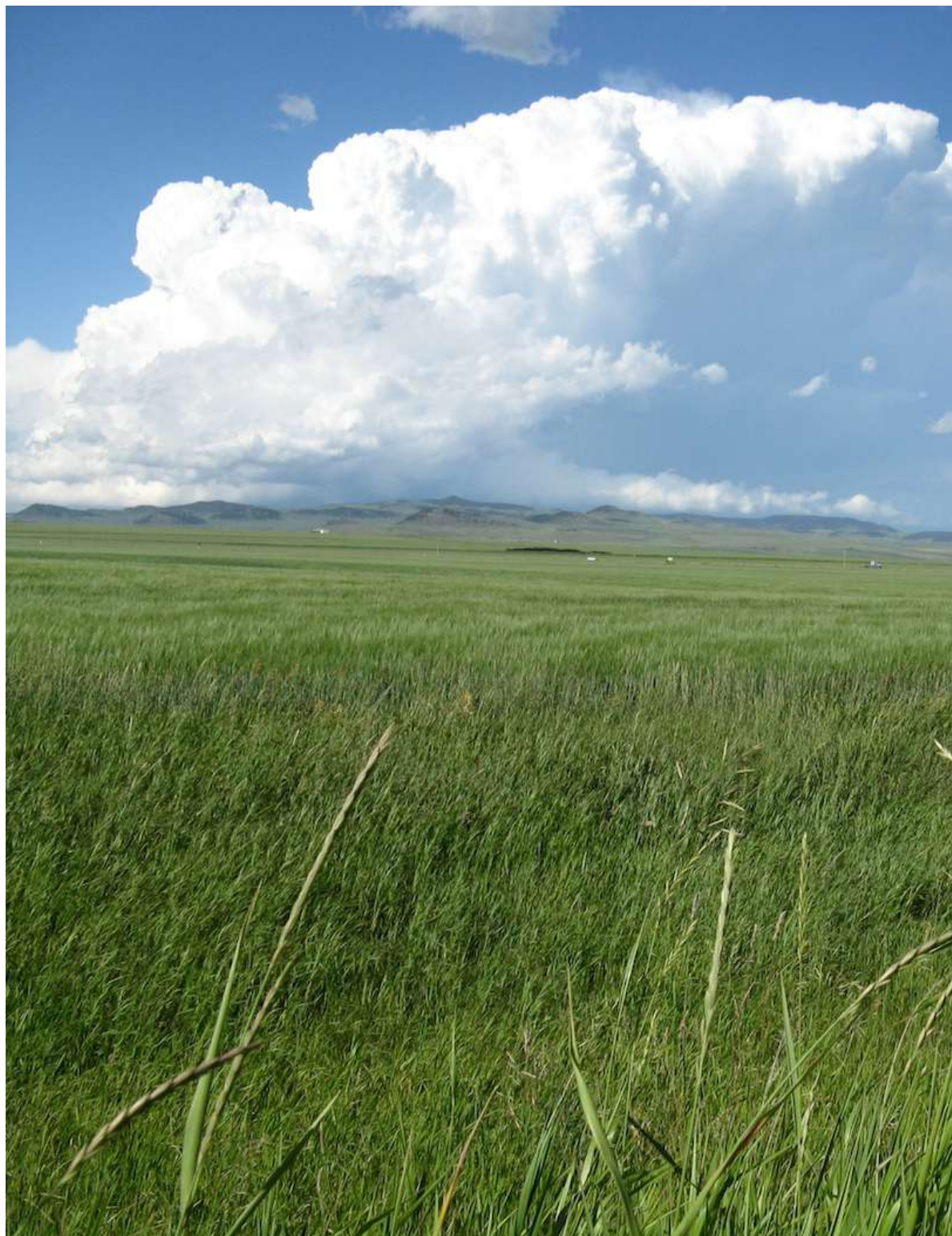
South Saskatchewan River Flow (m³/s), 1108-2010





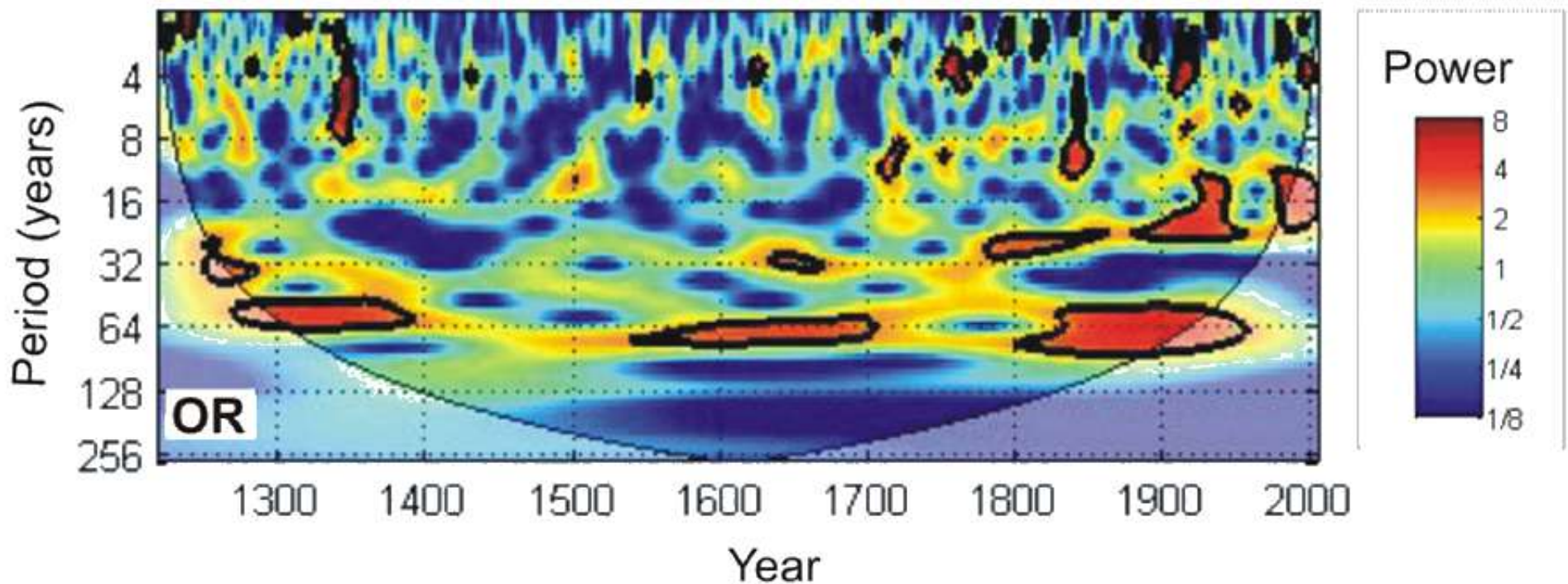
The Hydrologic Cycle





“I found looking at the **tree-ring growth**, that there’s an **approximate 60-year weather cycle** in this country, but 60 years isn’t definite, it could be 70 years and it could be even less, with weather **there’s nothing written in stone.**”

- Reno Welsch, Upper Tennessee Creek, Alberta, 04/09/2012



Cooking Lake, September 2008





Sustained Historical and Pre-Settlement Droughts, SSRB

Sustained Historical Drought		Sustained Proxy Drought	
Year	% dep ¹	Year	% dep
1935	-5%	1717	-30%
1936	-24%	1718	-46%
1937	-12%	1719	-20%
1938	2%	1720	-41%
1939	-15%	1721	-34%
1940	-29%	1722	-1%
1941	-1%	1723	3%
1942	23%	1724	20%

¹ departure from a 1961-90 baseline



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

Central Valley, Chile



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



Social Sciences and Humanities
Research Council of Canada

www.parc.ca/vacea/





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Swift Current, Saskatchewan



Interviews

Community Vulnerability **100**

Governance **70**

Exposure	Impacts	Sensitivities	Adaptation
DROUGHT			
<p>Shaunavon and the surrounding area have historically experienced drought as an ongoing stressor.</p>	<p>Ranchers are affected by reduction in hay yields and lack of water for livestock. Crop producers are affected by declining crop yields/quality.</p> <p>Surface water quality is affected by drought conditions.</p>	<p>Some older farmers reflected that the movement away from mixed farms and toward single-commodity farms may cause additional sensitivity, since crop and cattle prices tend to operate conversely.</p>	<p>The area has a history of utilizing adaptive practices to adjust and adapt to dry conditions. Historically, these include:</p> <ul style="list-style-type: none"> • Rotational grazing • Crop rotation • Contour tillage • Zero-till farming (more recently) • Crop selection

Cypress Hills, September 2015



Raising cattle requires water, grass and shelter. I can replace only one of these.
– Rancher near Shaunavon, SK



RECOMMENDATIONS

- **Regional proactive planning**, involving multiple agencies and orders of government, because individuals have limited capacity to cope with water scarcity and excess water. **Plan and be prepared** even if the risk seems remote and when time are “good”.
- **Institutional capacity** matters - it is not very practical for local stakeholders to implement their own adaptation practices without a broader information and policy plan for climate change adaptation.
- **Watershed groups** are well positioned to test and implement local adaptations, and to develop preparedness plans. They should be supported and capacity enhanced.
- With the dissolution of government and university extensions programs, **a technical knowledge gap** is a significant problem when implementing new adaptation practices.
- Need for a collaborative **coordinating network** of stakeholders, watershed groups, researchers and all orders of government.
- **A single coordinating agency** to link science to the interests and concerns of local people; delivering technical expertise on climate, water and adaptation practice to local groups and rural communities.



Thanks!

