Adaptation as resilience building:

A policy study of climate change vulnerability and adaptation on the Canadian prairies

Henry David Venema
Director, Sustainable Natural Resources Management, IISD
Fikret Berkes,
Natural Resources Institute, NRI
Harvey Hill,
Prairies Farm Rehabilitiation Administration, AAFC

iisd International Institute for Sustainable Development / Institut international du développement durable

Agriculture and Agri-Food Canada / Agriculture et Agroalimentaire Canada

university of manitoba Natural Resources Institute

iisd International Institute for Sustainable Development / Institut international du développement durable

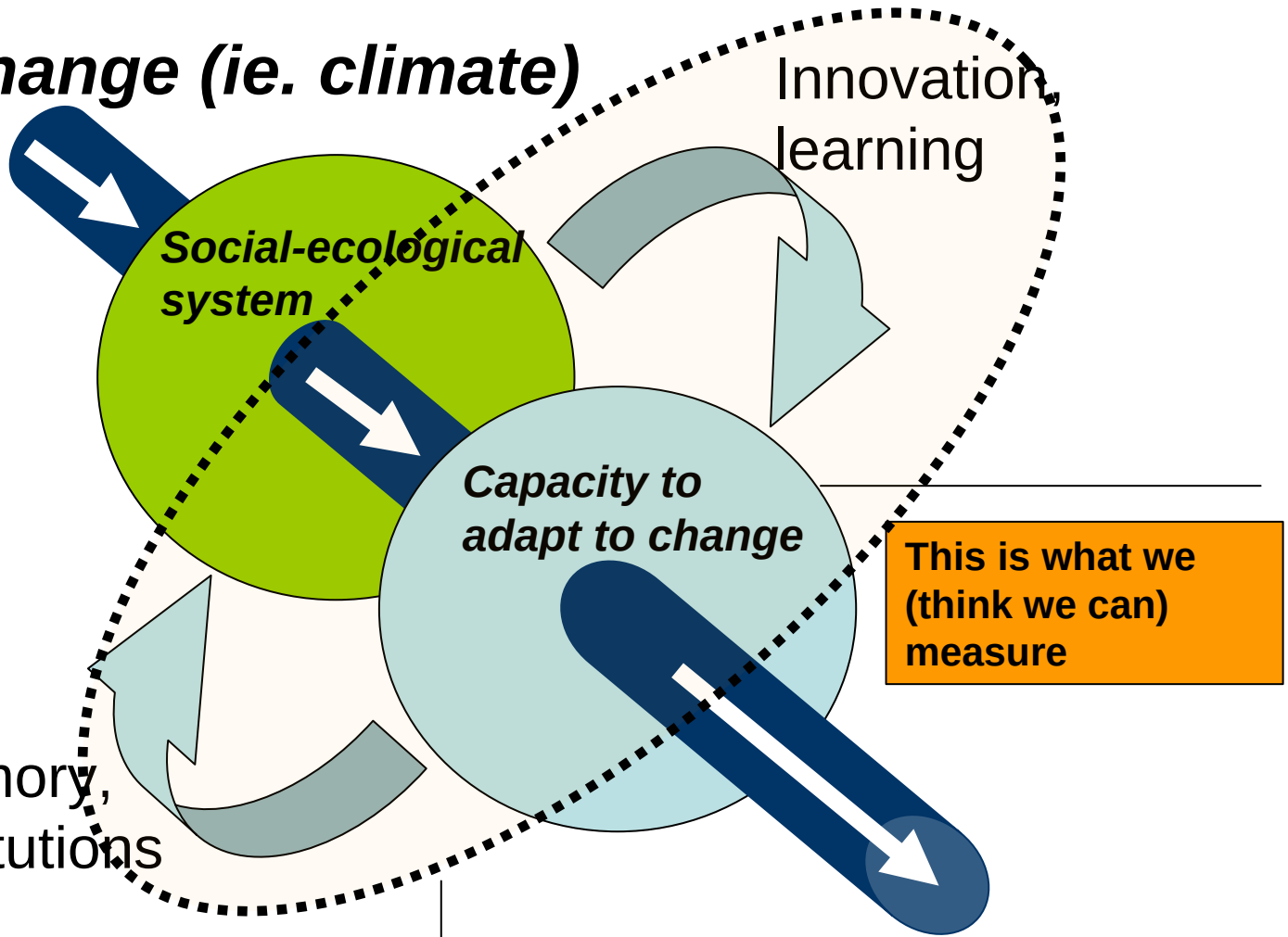
"Drought as a Natural Hazard": A prairie perspective

- "the prairie ecozone is the the only major reason where drought is a landscape hazard….management of prairie ecosystems and soil landscapes requires an understanding of past and future trends and variability" [Sauchyn et al, 2002, p.247].

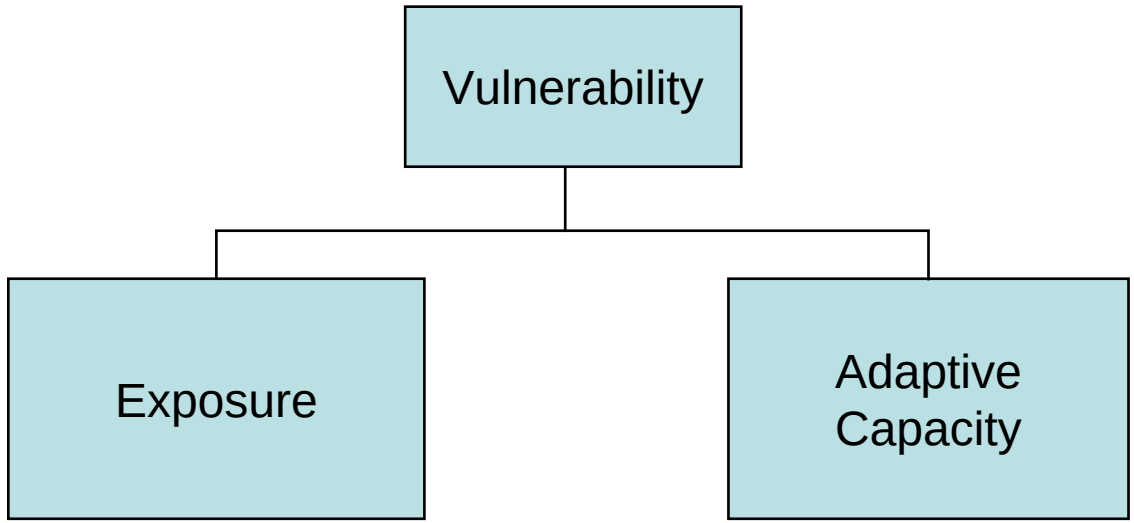
- "The sustainability of Prairie agriculture depends on adaptation to the amplitudes of climate change and variability" [Sauchyn and Beaudoin, 1998, p337]

- "A policy framework to minimize the adverse impacts of drought and increasing aridity must support adaptation of soil and water management practices to climatic variability" [Sauchyn et al, 2003, p.11].

Sustainability as a Process of Continuous Adaptation [Berkes et al, 2003]



Vulnerability = f(Exposure, Adaptive Capacity)



Historic climate stress
Future climate stress

Adaptation occurs continuously; (successfully and unsuccessfully)
Ongoing successful adaptation is *resilience*
Objective: identify, learn and replicate The policy environment that creates these successes.

"Experience gained coping with current climate variability is the basis for future adaptation to climate change"

[International Strategy for Disaster Reduction, 2003]

Project Schematic

Key inputs

Historical Climate data

Socio-economic data

Stakeholder narratives

Future Climate Models

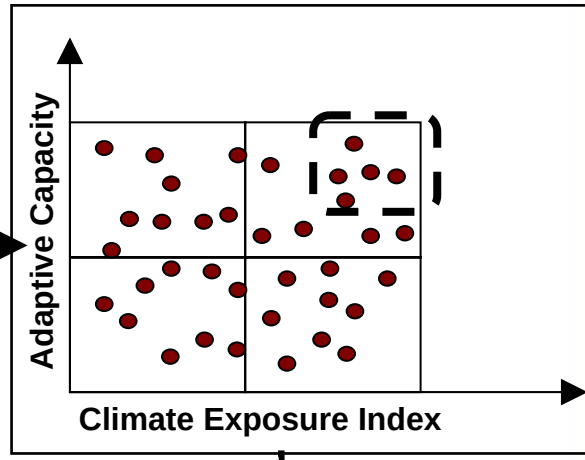
Vulnerability Analysis
Where are the key lessons to be found?

Resilience Analysis
What is working, what isn't

Adaptation Priority Analysis
Where and how?

Policy Recommendations: *influence the APF*

Key outputs

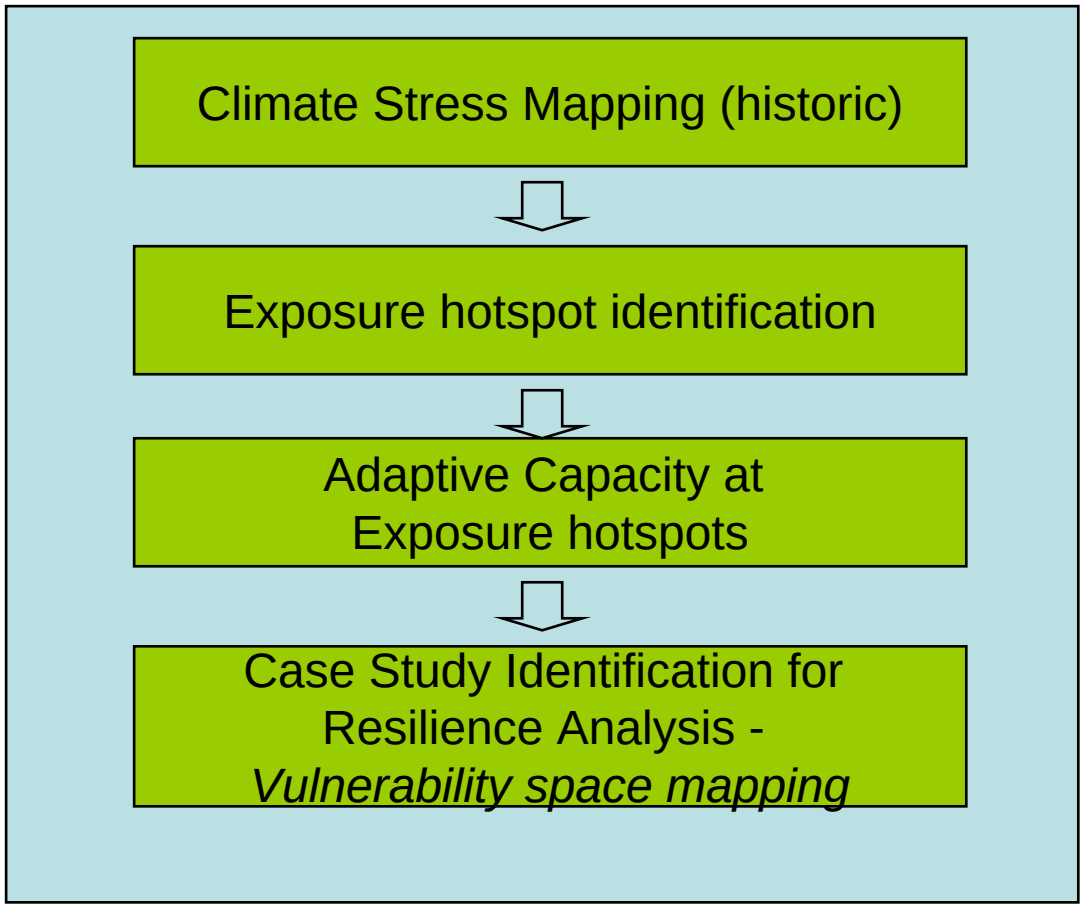


Case study identification

Current Policy Synthesis

Vulnerability Analysis

Hypothesis:
rural agro-ecosystems with high exposure to historic climatic stress differ in their vulnerability and resilience



Mapping Historic Climate Stress:

The Palmer Drought Sensitivity Index [Shabbar and Skinner, 2004]

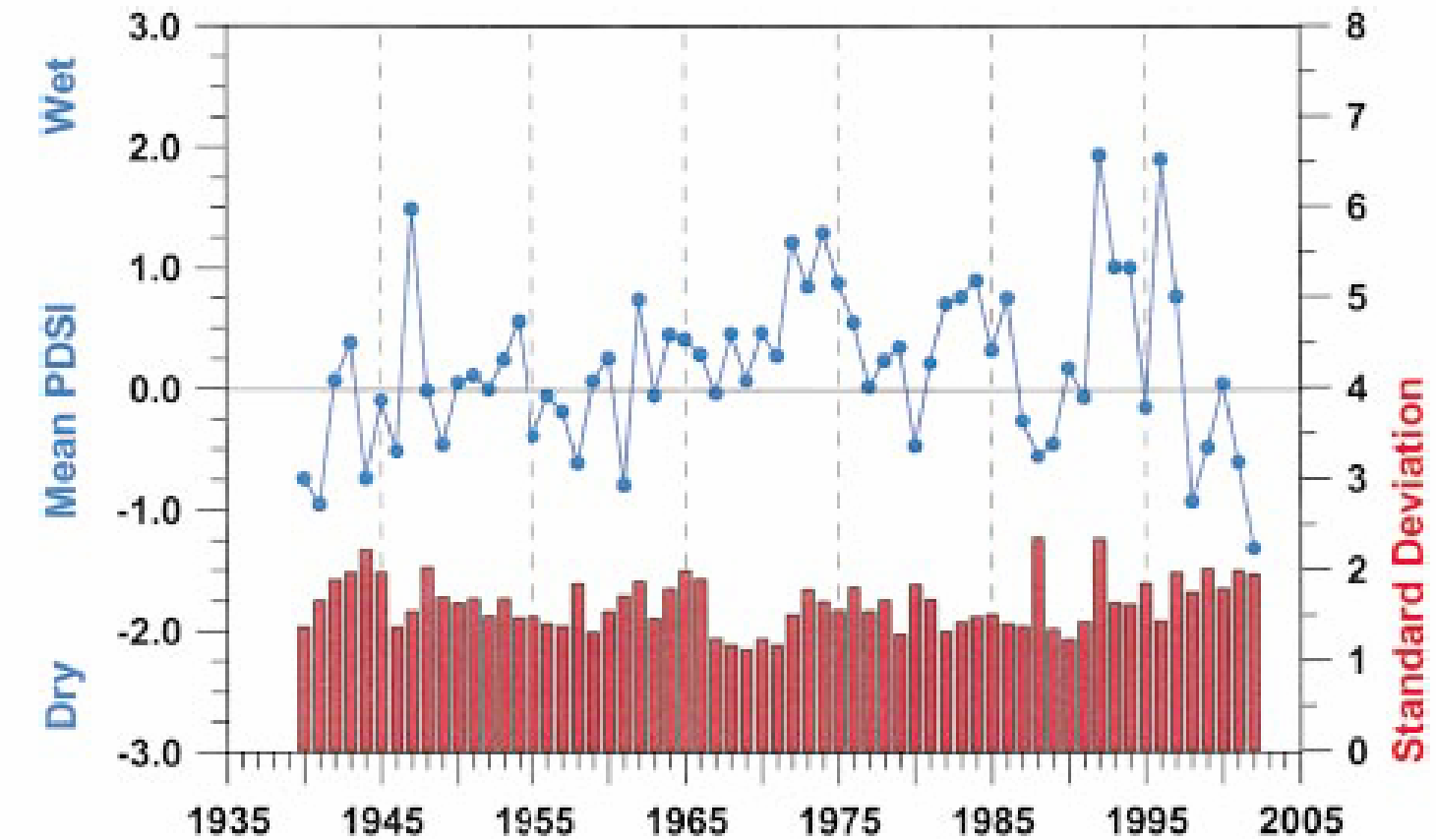


FIG. 2. National summary of Canadian summer (JJA) PDSI, 1940–2002. The line indicates the Canada-wide mean PDSI and the bars represent the spatial variability (standard deviation).

Towards a High Resolution PDSI (Shen et al, 2001)

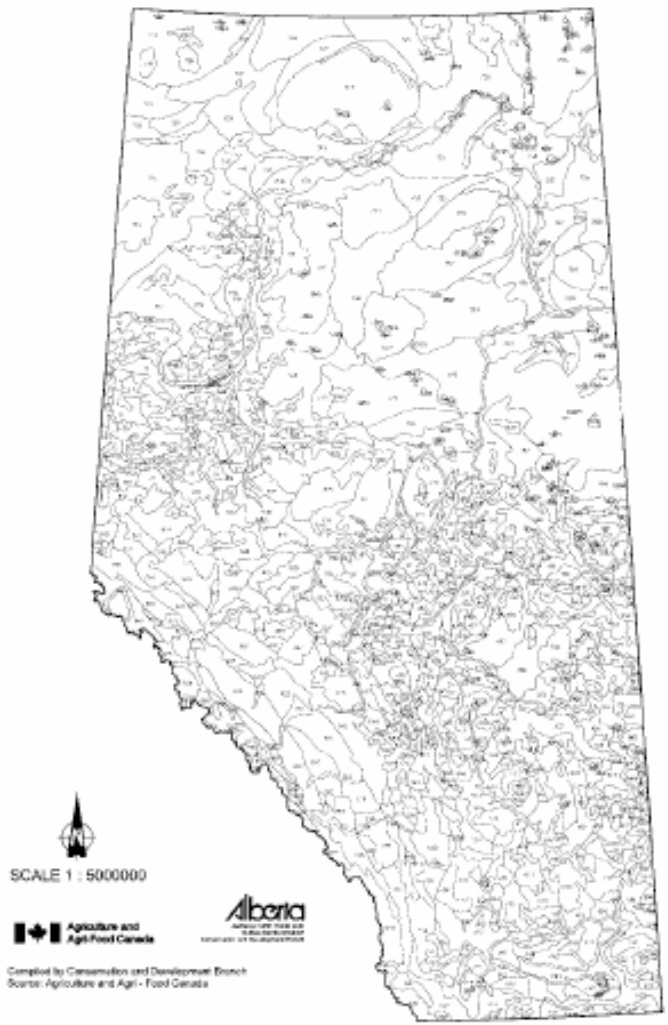


FIG. 2. The 894 SLC polygons in Alberta.

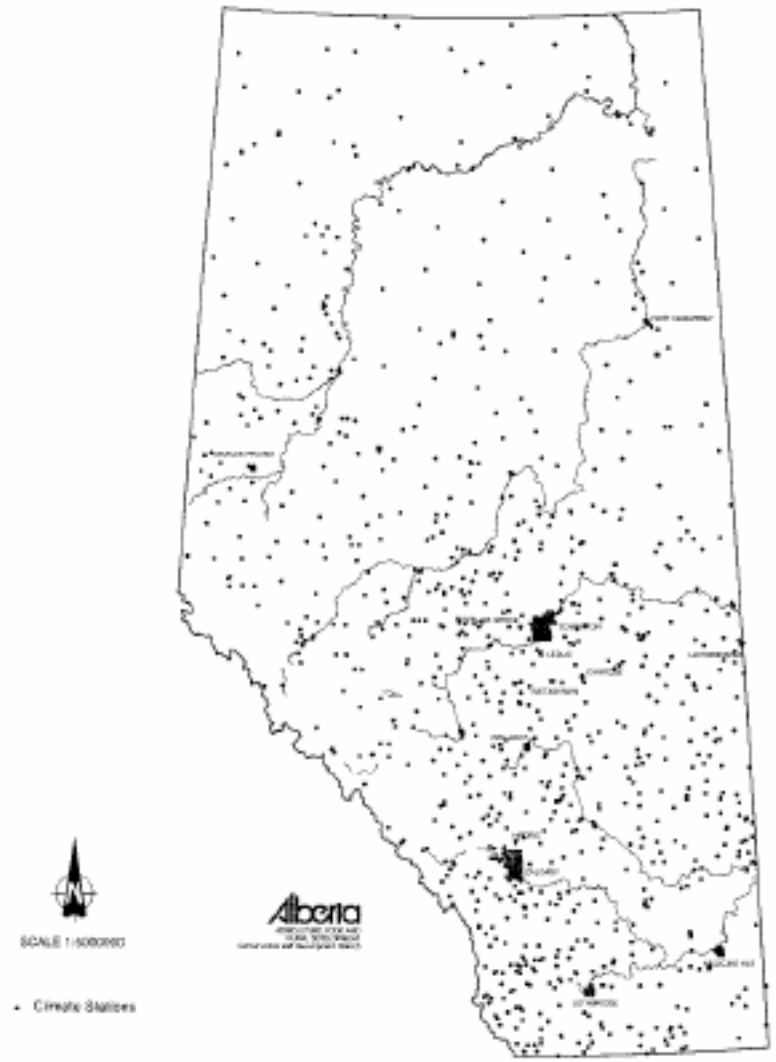
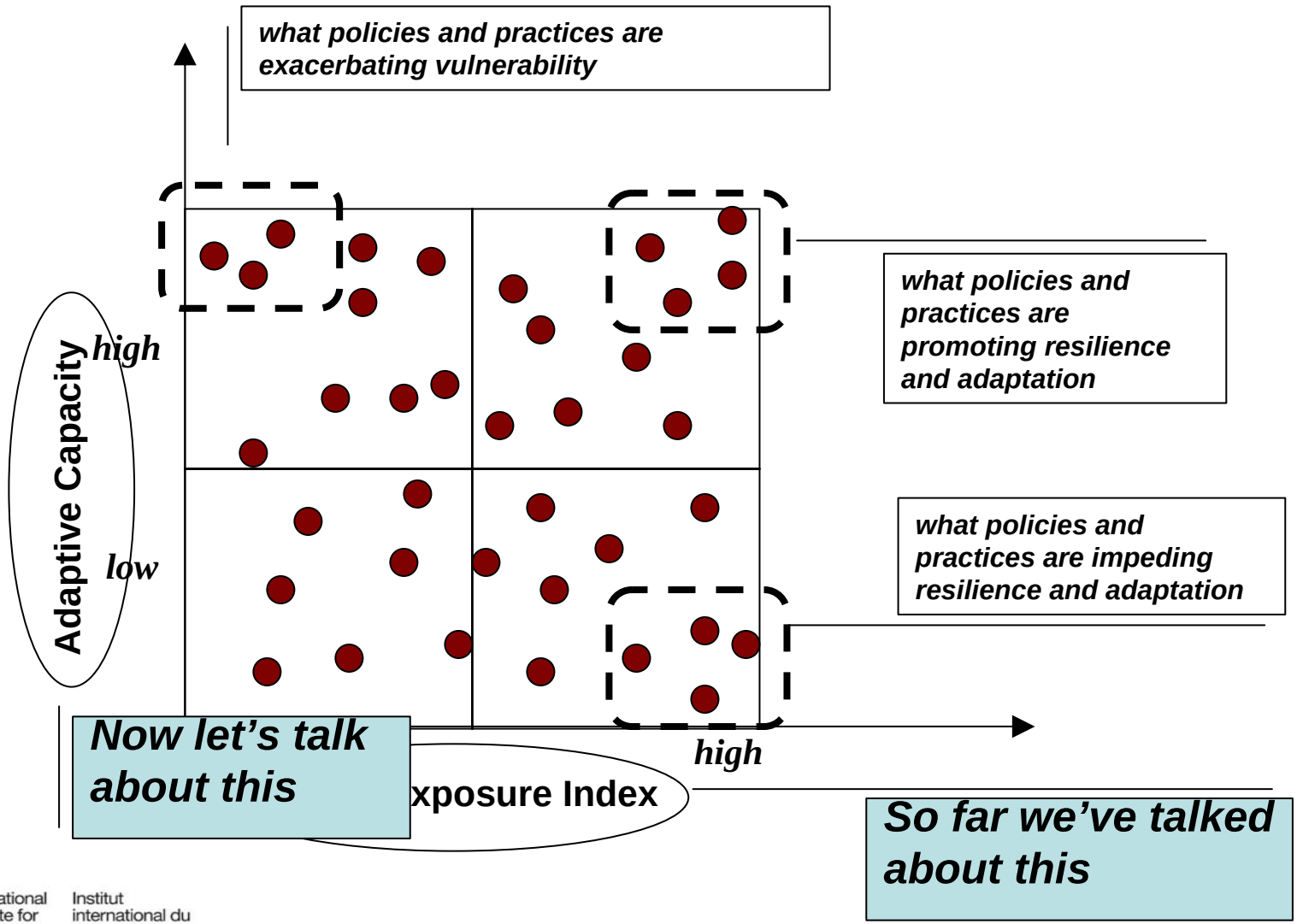


FIG. 3. Locations of the 927 temperature and precipitation stations (1961–90) in Alberta.

Case Study Identification with Vulnerability Space Mapping



Determinants of adaptive capacity (from Smit et al., 2001).

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 Policies and regulations have constrain or enhance adaptive capacity
Equity	Equitable distribution of resources increases adaptive capacity Both availability of, and entitlement to, resources is important

Smit, B., Pilifosova, O., Burton I., Challenger B., Huq S., Klein R.J.T. and Yohe, G. (2001): Adaptation to climate change in the context of sustainable development and equity; in Climate Change 2001: Impacts, Adaptation and Vulnerability, (ed.) J.J. McCarthy, O.F. Canziani, N.A.

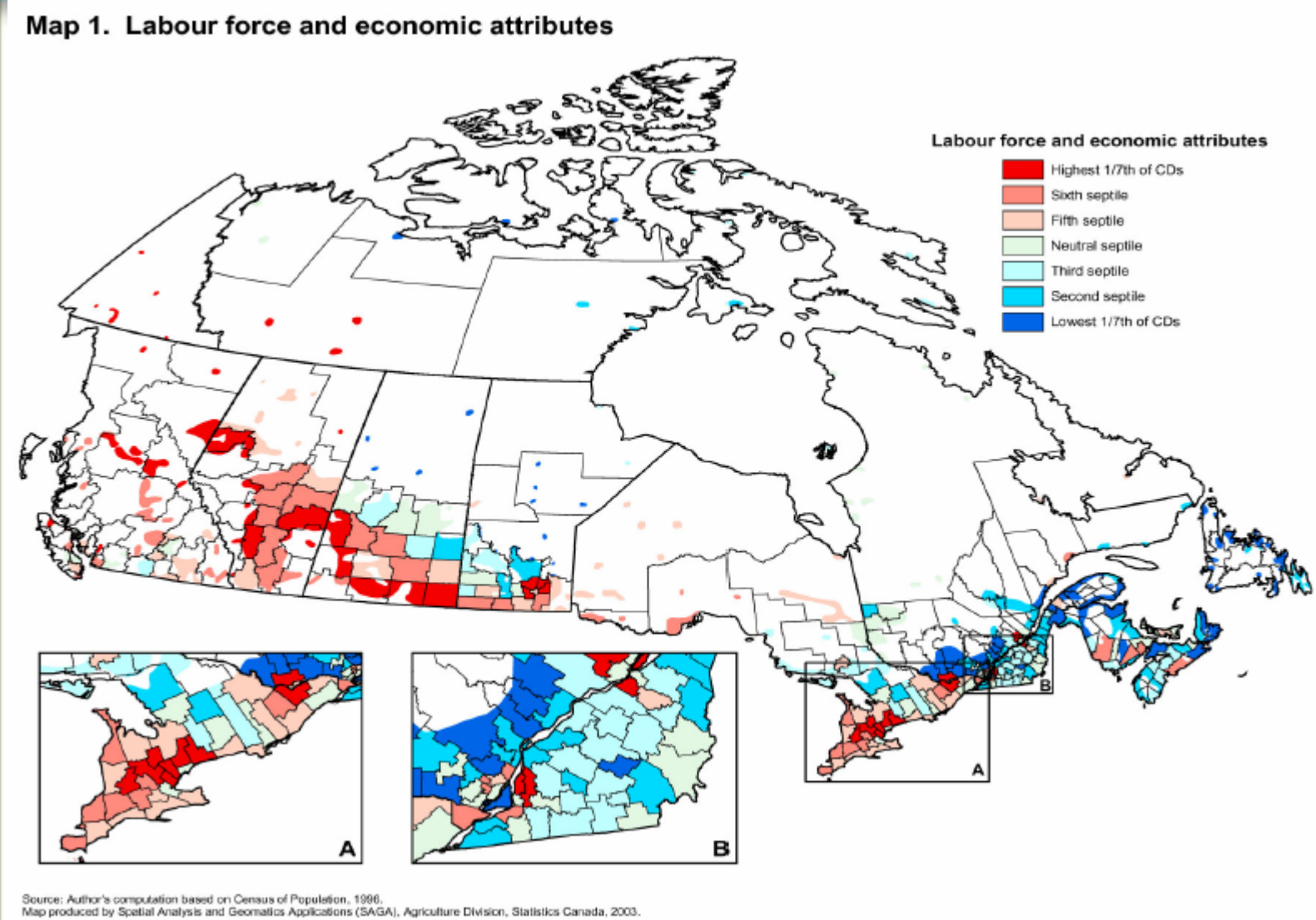
Possible Indicators for Adaptive Capacity to use in Study Site Selection (under development)

(using Smit et al. framework)

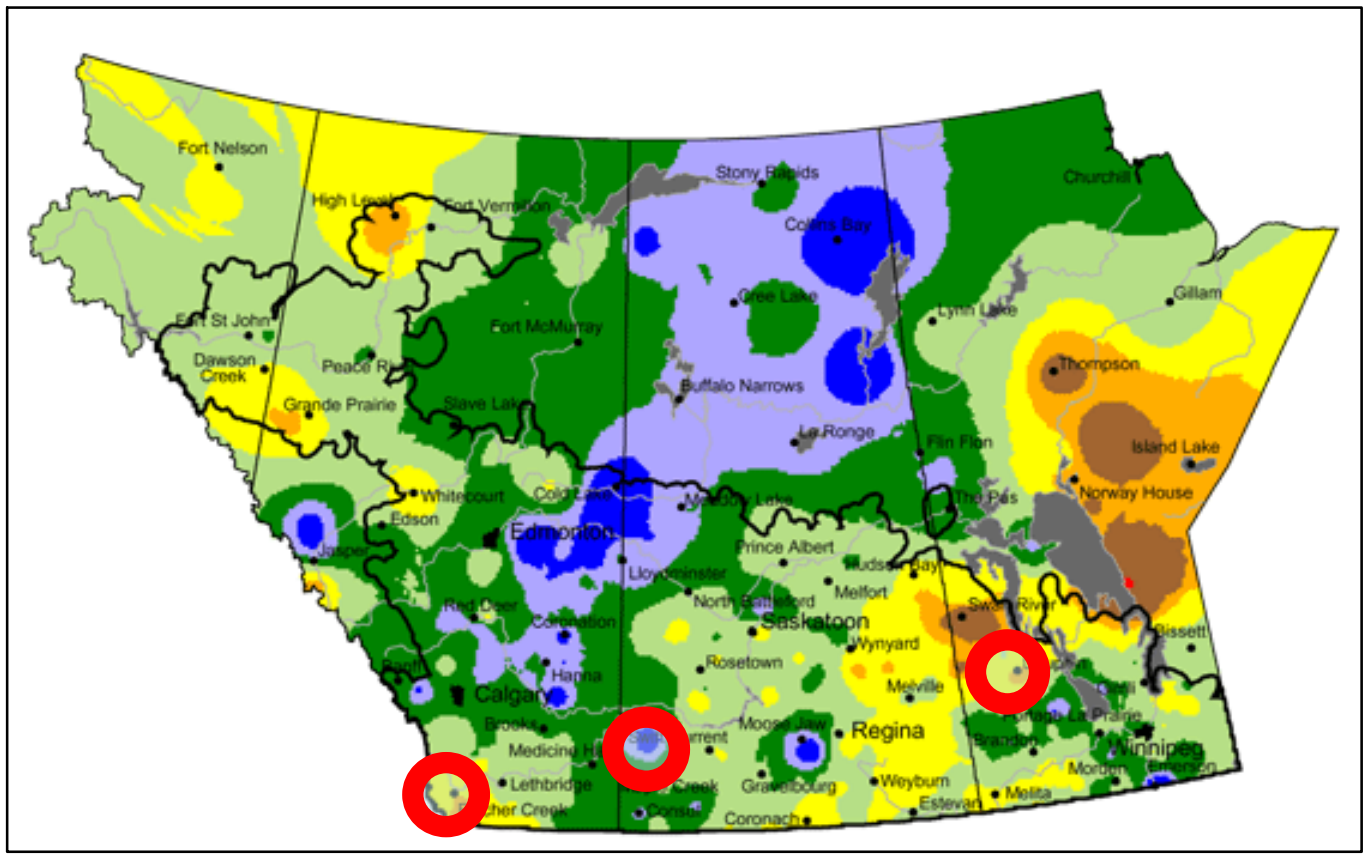
Determinant	Possible Indicators
Economic resources	Total Capital Investment, expenses, income, non-farm work,
Technology	Irrigation, machinery and equipment owned, greenhouse structures
Information, skills and ***management***	Internet use, skill, area irrigated, no-till seeding practice, organic practices, time contribution on and off farm, Area of farm, Area of summary land uses, Type and area of crops; Size of livestock inventory by type; Land Mgt. Practices; Hiring of Off-Farm Labour
Infrastructure	Soil quality, surface water resource capability?, groundwater resource capability?, land resource capability?, land owned
Institutions and ***networks***	Lacking good social capital indicator, [number of formal partnerships, informal partnerships??]
Equity	Census division Gini coefficient??

Indicators to be developed using Census of Agriculture and Canada Census data

Example of Indicator Mapping
Rural and Small Town Canada Bulletin – Mapping the Socio-Economic Diversity of Rural Canada



Site Selection for Resilience Analysis



Case Study Goal: to understand how policy influences resilience

Themes the PRA will explore	Reference
1. Learning to live with change and uncertainty *- Evoking disturbance* *- Learning from crisis (attribution of credit, even without direct causality)* *- Expecting the unexpected (surprises)* ***2. Nurturing diversity for reorganisation and renewal*** *- Promoting variation and redundancy* *- Nurturing ecological memory* *- Nurturing social memory (respecting local histories)* *- Enhancing social-ecological memory* ***3. Combining different types of knowledge for learning*** *- Combining experiential and experimental knowledge (exploitation / exploration)* *- Expanding from knowledge of structure to knowledge of function* *- Building process knowledge into institutions* *- Fostering complimentarity of different knowledge systems* ***4. Creating opportunity for self-organisation*** *- Recognising the interplay between diversity and disturbance* *- Dealing with cross-scale dynamics* *- Matching scales of ecosystems and governance* *- Accounting for external drivers* *- Building networks of reciprocal inter-action*	Berkes at al, 2003. Navigating social-ecological systems: building resilience for complexity and change. Cambridge University Press, UK.

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Clusters of factors for building resilience from the local perspective in lagoon social-ecological systems.

(a) Learning to live with change and uncertainty
- Learning from crises
- Building rapid feedback capacity to respond to environmental change
- Managing disturbance
- Building a portfolio of livelihood activities
- Developing coping strategies

(b) Nurturing diversity for reorganization and renewal
- Nurturing ecological memory
- Nurturing a diversity of institutions to respond to change
- Creating political space for experimentation
- Building trust among users
- Using social memory as source of innovation and novelty

(c) Combining different kinds of knowledge
- Building capacity to monitor the environment
- Building capacity for participatory management
- Building institutions that frame learning, memory and creativity
- Creating cross-scale mechanisms to share knowledge
- Combining local and scientific knowledge

(d) Creating opportunity for self-organization
- Building capacity for user self-organization
- Building conflict management mechanisms
- Self-organizing for equity in resource access and allocation
- Self-organizing in response to external drivers
- Matching scales of ecosystem and governance
- Creating multi-level governance

From Fikret Berkes and Cristiana S. Seixas (2004)

Categories based on Folke et al. (2003).

Project Flowchart and Responsibilities

Vulnerability Analysis

Data/Consulting: PFRA
GIS Analysis: PFRA/ IISD

Resilience Analysis

RRA/PRA: U of M (1 master's student)
Policy Synthesis: IISD + U of M
Peer review: PFRA

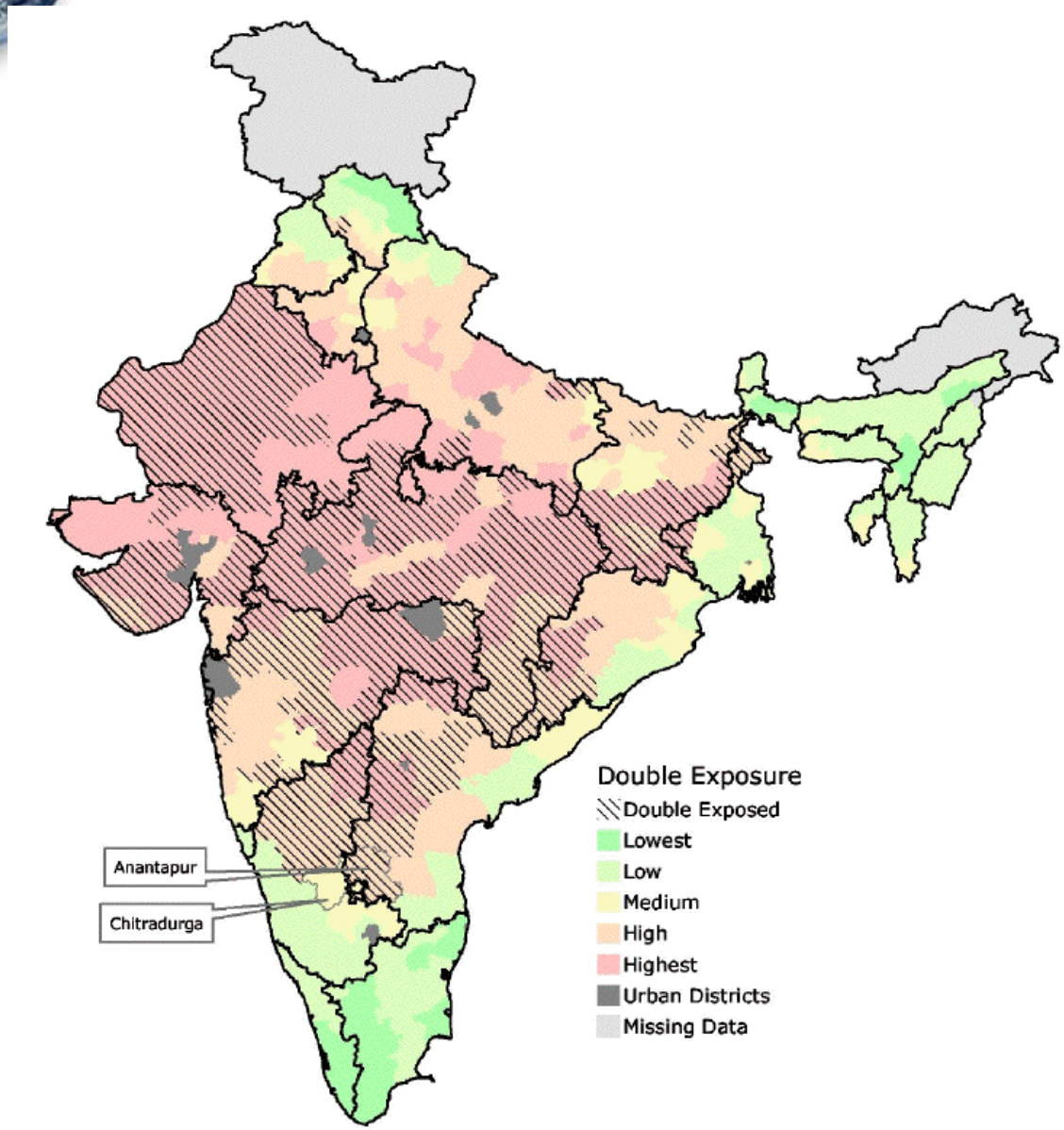
Adaptation Priority Analysis

Data/Consulting: PFRA
GIS Analysis: IISD or U of M
GIS component can be concurrent with Vulnerability analysis

Policy Recommendations: *influence the APF*

Policy Analysis and Recs: IISD
Peer review: PFRA + U of M

The Need: recent IDRC research [Moench et al, 2003]



From the Summary:

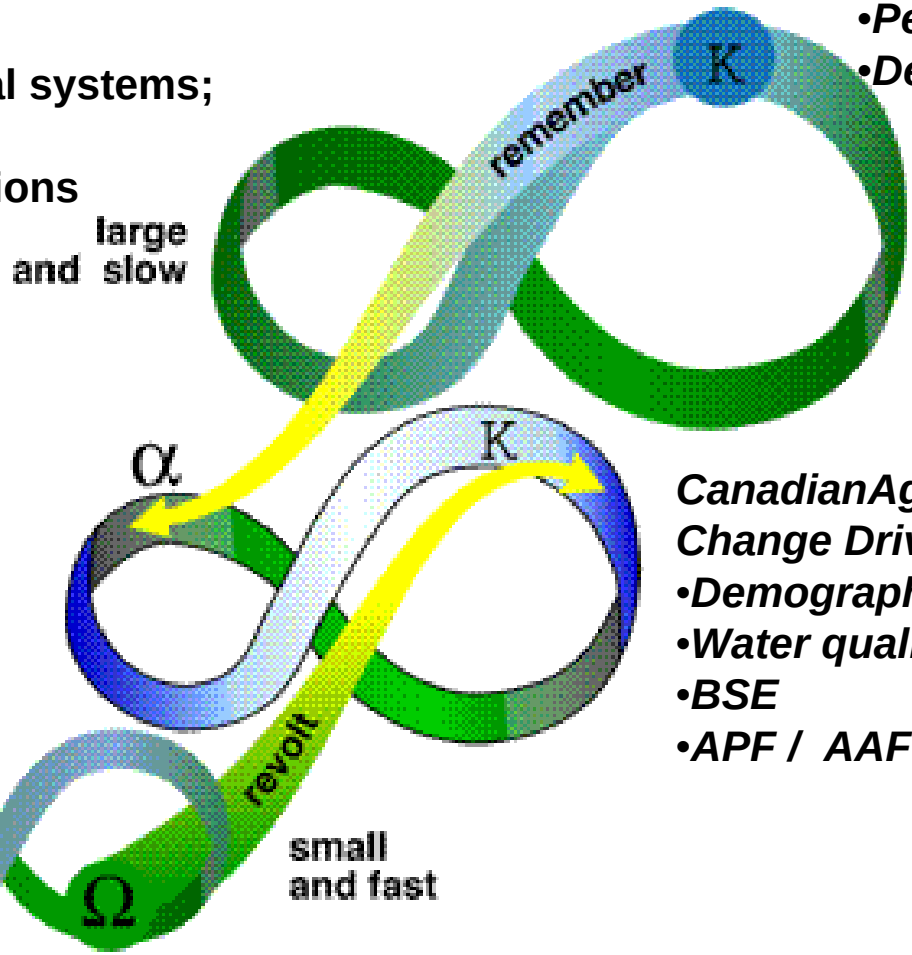
our research indicates a clear need for frameworks that are "adaptive" - that reflect uncertainties and can respond and adapt as contexts change or unforeseen problems emerge.

Specific solutions are less important than the existence of processes and frameworks that enable solutions to be identified and implemented as specific constraints and contexts change."

Multi-scale Resilience: Holling's Panarchy

Global change drivers:
•Climate Change
•Peak Oil Geopolitics
•Decentralization/SAP

Global environmental systems;
Trade policies;
International Institutions

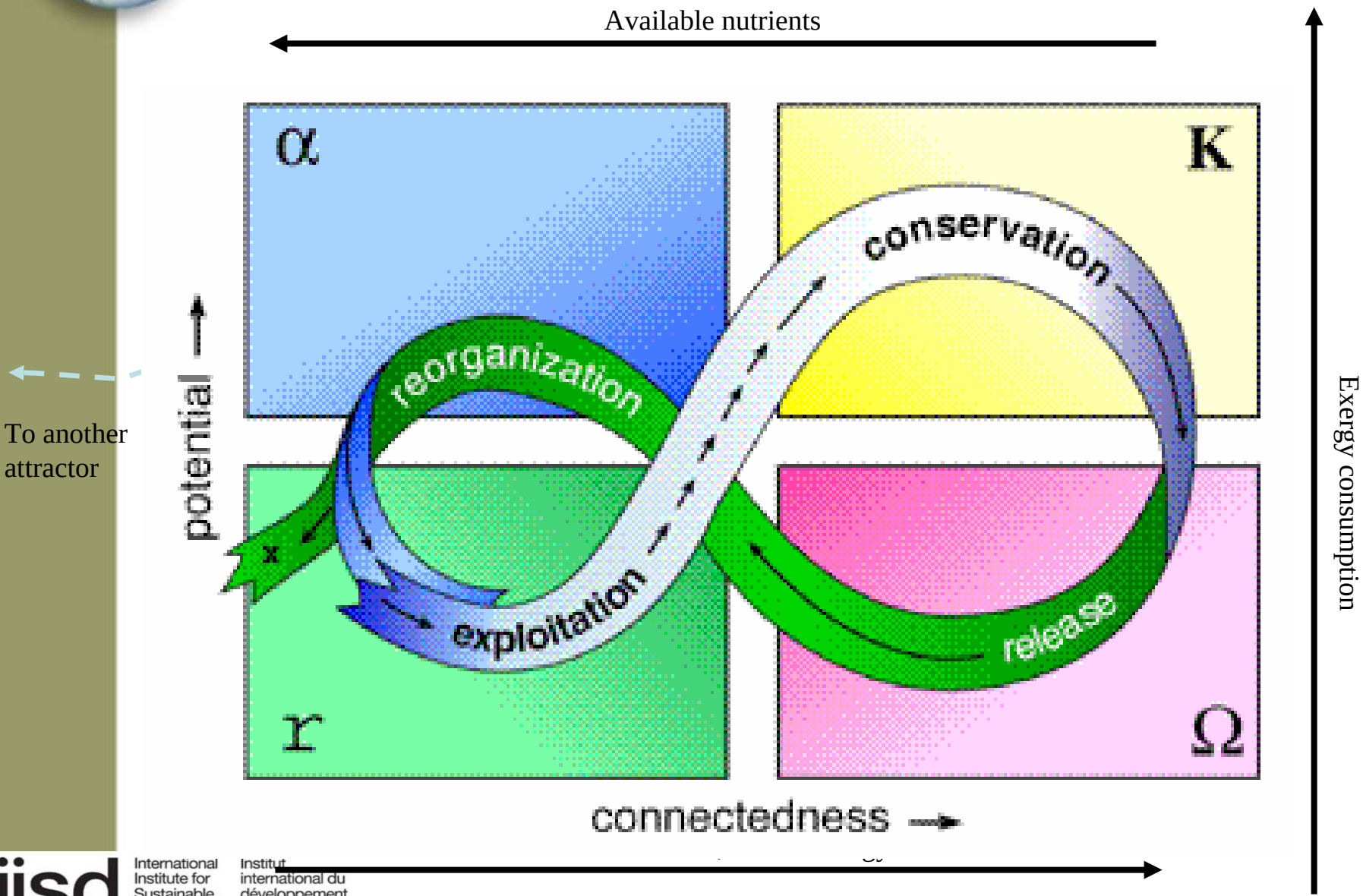


Domestic policies,
institutions
Regional landscapes

CanadianAgroecosystm
Change Drivers:
•Demographics
•Water quality
•BSE
•APF / AAFC

Ecosystems and
Community-scale
Adaptive co-management

The Holling Metaphor and the meaning of Resilience:



To do list: