Comparing Human-Climate Interactions between Dryland River Basins in Western Canada and Northern Chile

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A comparative study of dryland river basins

- The Elqui Basin, Coquimbo Region, Chile: 9,600 km^2
- The South Saskatchewan River Basin, Alberta – Saskatchewan, Canada: 420,000 km^2

Funding:

- Social Science and Humanities Research Council (SSHRC) of Canada - $2.43 M over five years (2004-2008)
- CIDA (2003-2007) - $997,170

Some similarities

- A similar environment–a dry climate adjacent to a major mountain system and landscapes at risk of desertification.
- In both regions agriculture plays a critical economic role and water resources are important to agriculture.
- The institutions serving the regions are relatively stable.
- Both the Canadian and Chilean governments have ratified the Kyoto Protocol.

Project Goal

The goal of the IACC project is to develop a systematic and comprehensive understanding of the 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.

The Objectives

1. To examine the potential scenarios of climate change in the two regions and their potential risks; and
2. To identify the current social and physical vulnerabilities related to the hydrological resources and climatic conditions in the rural sectors of the two basins.
3. To evaluate regional institutional capacities to reduce future vulnerabilities associated to climate change and its impact on the hydrological resources of both basins.

Team Members and their Institutions

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Athabasca University	Bruce Morito
University of British Columbia	Alejandro Rojas
University of Guelph	Barry Smit
PFRA	Darrell Corkal
Universidad de la Serena	Sonia Salas, Jorge Cepeda-Pizarro, Melitta Fiebig, Hector Morales, Humberto Zavala, Hernan Cortes
Instituto de Ecologia Politica	Bernardo Reyes

Partners

- Canadian Plains Research Center
- PARC/C-CIARN Prairies
- Prairie Farm Rehabilitation Administration (PFRA)
- Alberta Environment
- Saskatchewan Watershed Authority
- Transboundary Waters Unit , Environment Canada
- National Water Research Institute

- Centro de Estudios Regionales
- Comision Nacional del Medio Ambiente de Chile (CONAMA)
- Centro del Agua para Zonas Aridas y Semiaridas (CAZALAC)
- Instituto de Ecologia Politica (IEP)

What is institutional adaptive capacity?

- The ability to identify climate change risks, find solutions, and to implement solutions.
- The need to do this in a fair, efficient, and sustainable manner.

What are the Elements of the Adaptive Capacity of Institutions?

1. The institutional knowledge of the current physical and social vulnerabilities in the basin and of the potential impacts of climate change upon those vulnerabilities;
2. The actual institutional ability:

   (a) to coordinate with other institutions in order to facilitate the process of adaptation;

   (b) to engage in practices that could involve using resources to achieve sustainability objectives, e.g. appropriate water management policies and practices to ensure water conservation; and (c) to modify norms (policies, regulations) that act as constraints to adaptation;

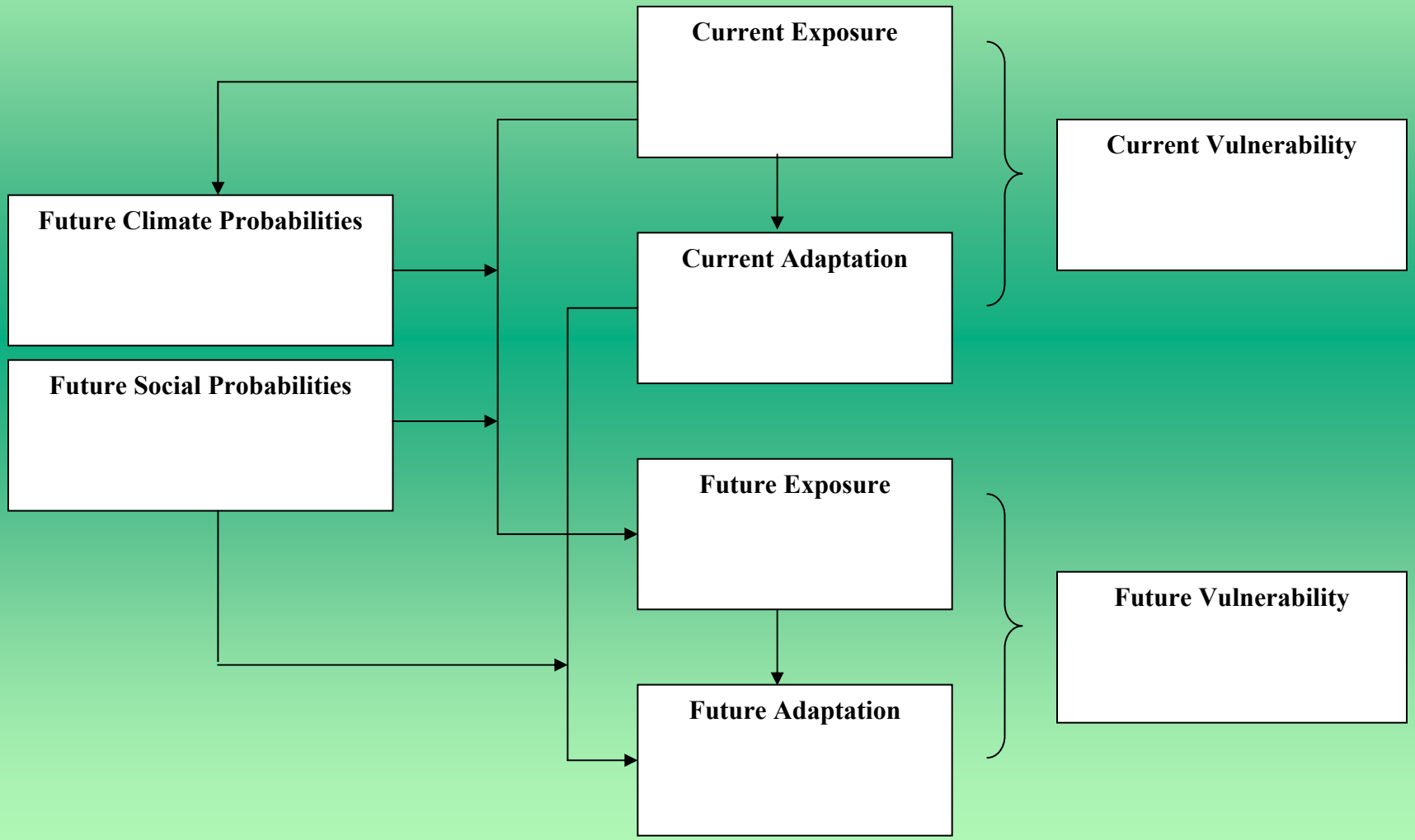
… What are the Elements of the Adaptive Capacity of Institutions?

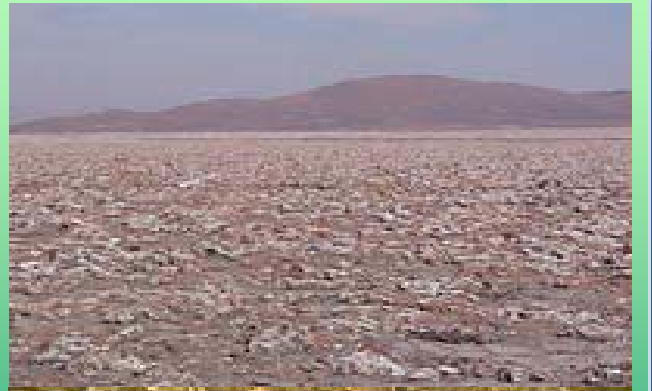
3. The internal characteristics of public organizations – such as the levels of human capital, instrumental rationality, coherence, and resilience – that could facilitate the process of adaptation;
4. Their ability to identify needs and problems; to find solutions to those problems in a way that different interests are considered; and to execute and implement those solutions;

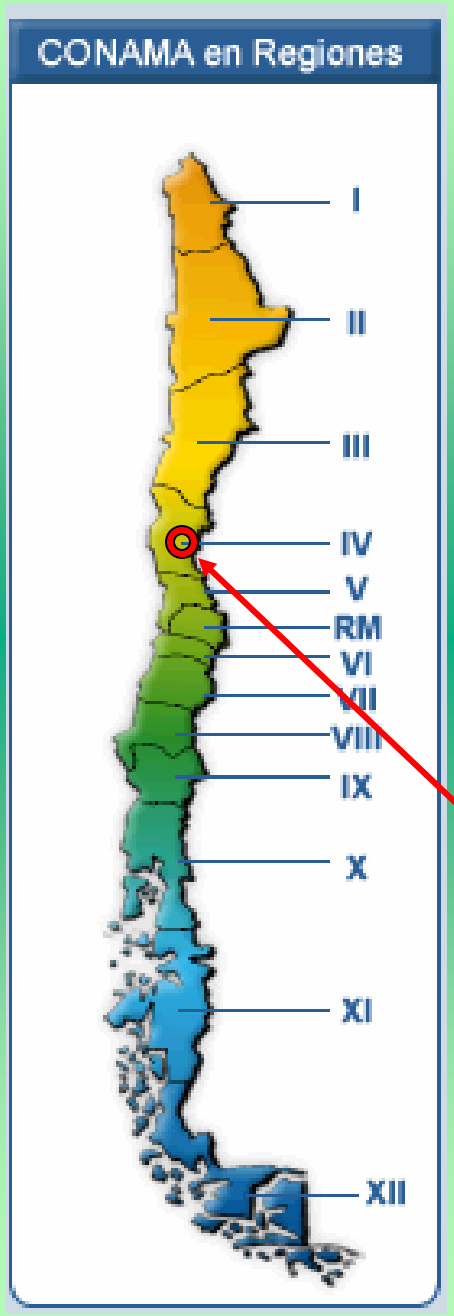
… What are the Elements of the Adaptive Capacity of Institutions?

5. Their ability for establishing planning and decision-making processes able to recognize and evaluate the risks posed by climate change, its impacts, and develop appropriate adaptive responses (e.g. the use of climate change risk in SEA).
6. Their awareness of the ethical and moral values that inform principles of sustainability in support of the functioning and decision-making processes of their institution.

Conceptual Framework

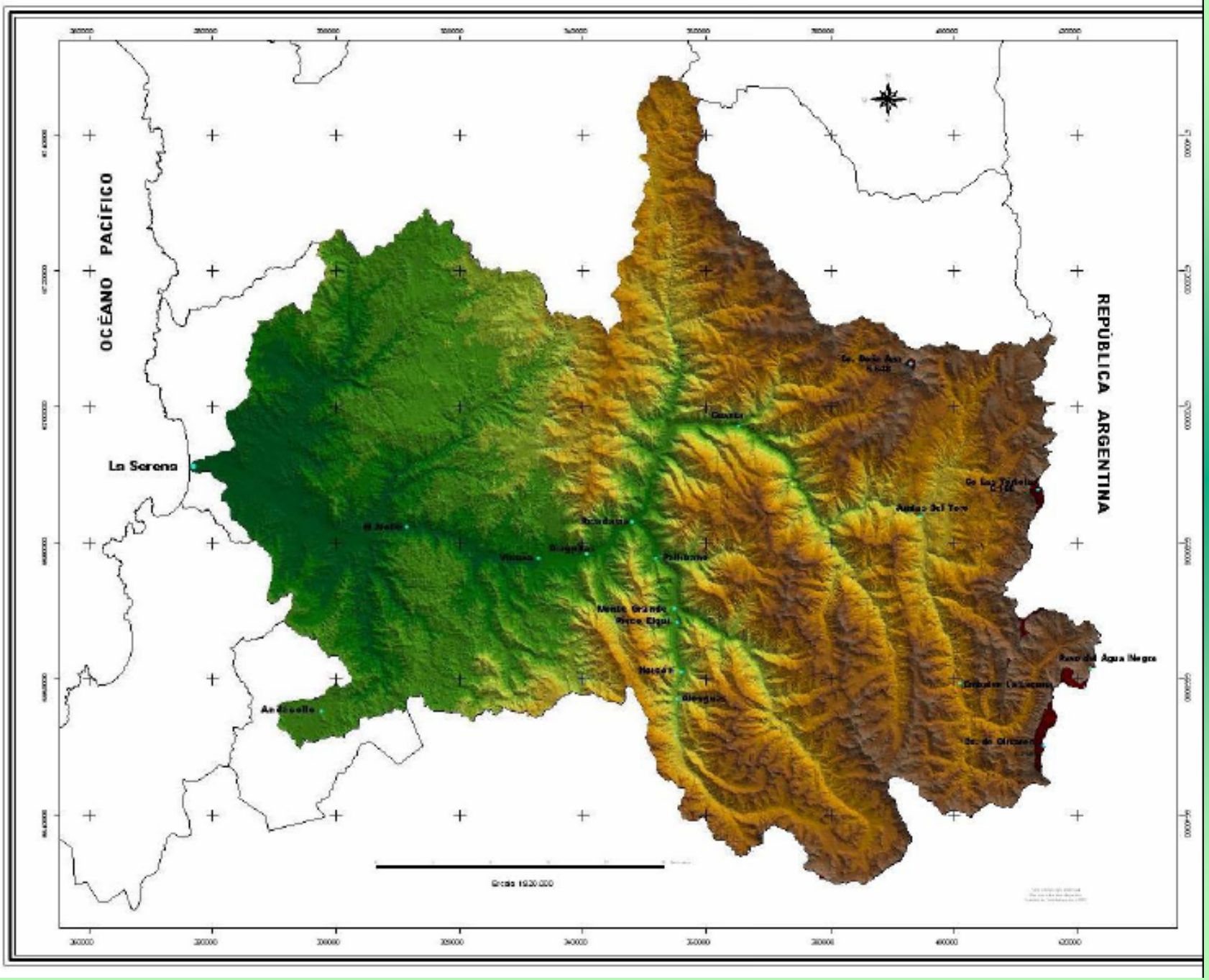


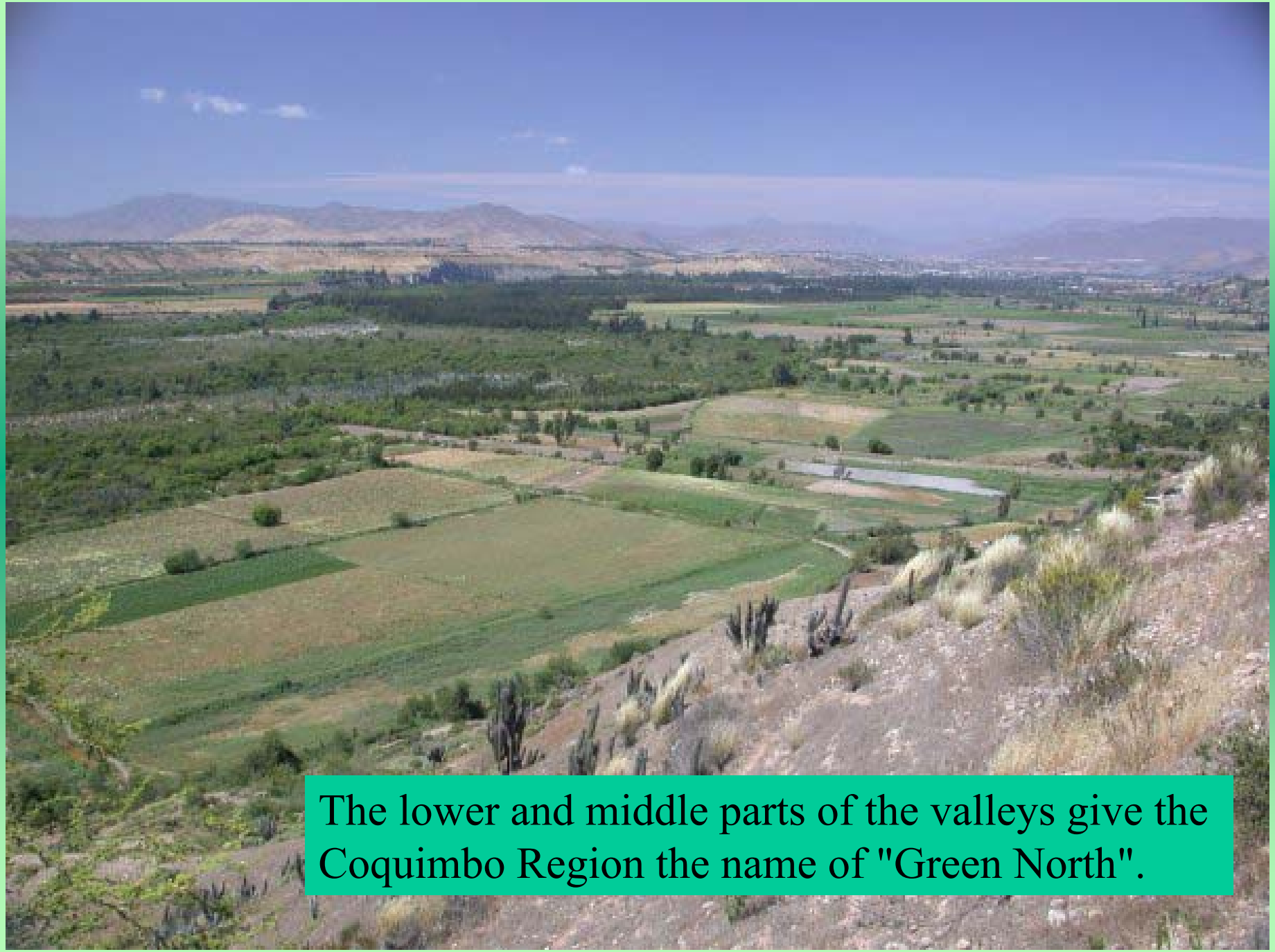


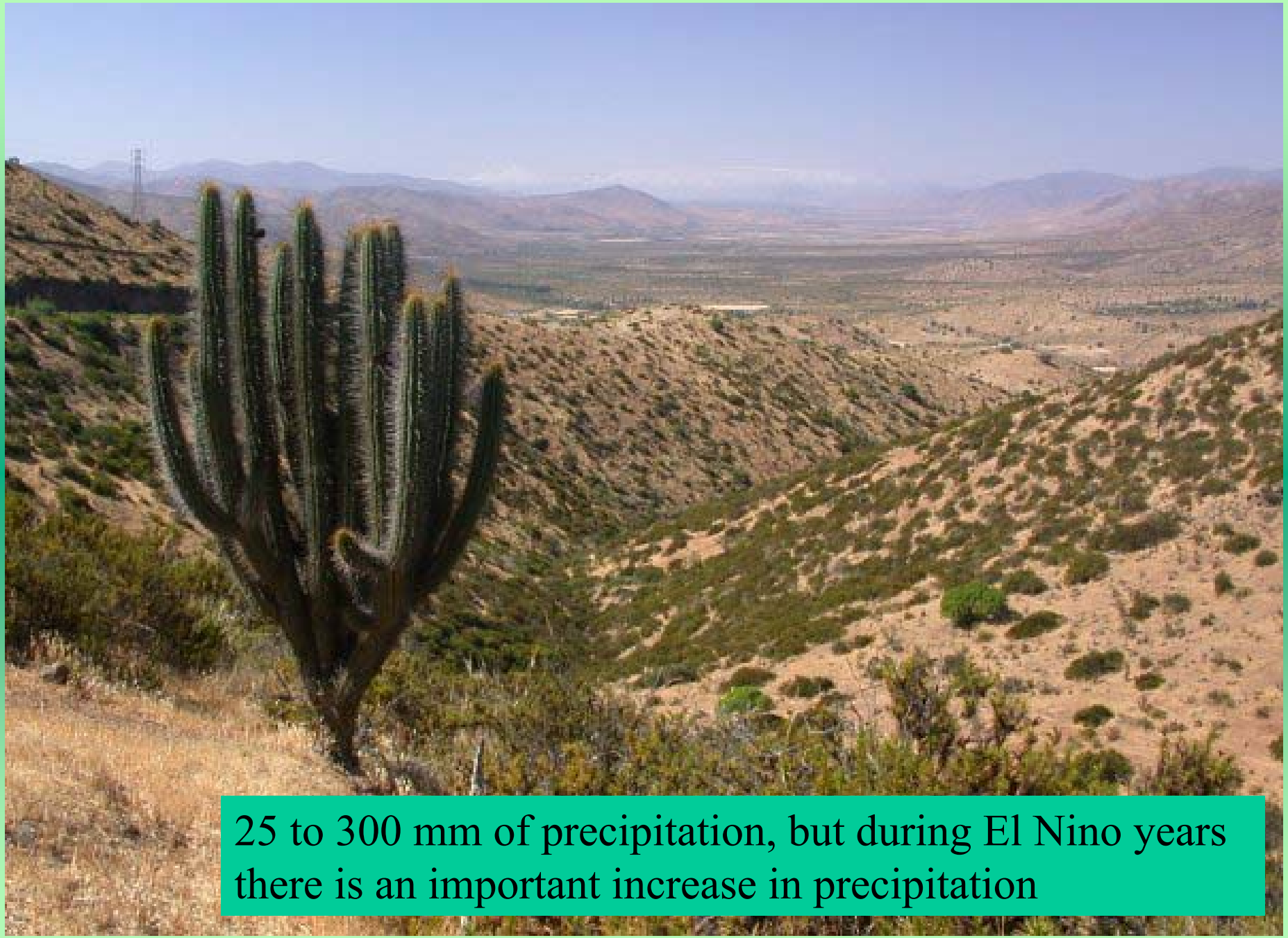


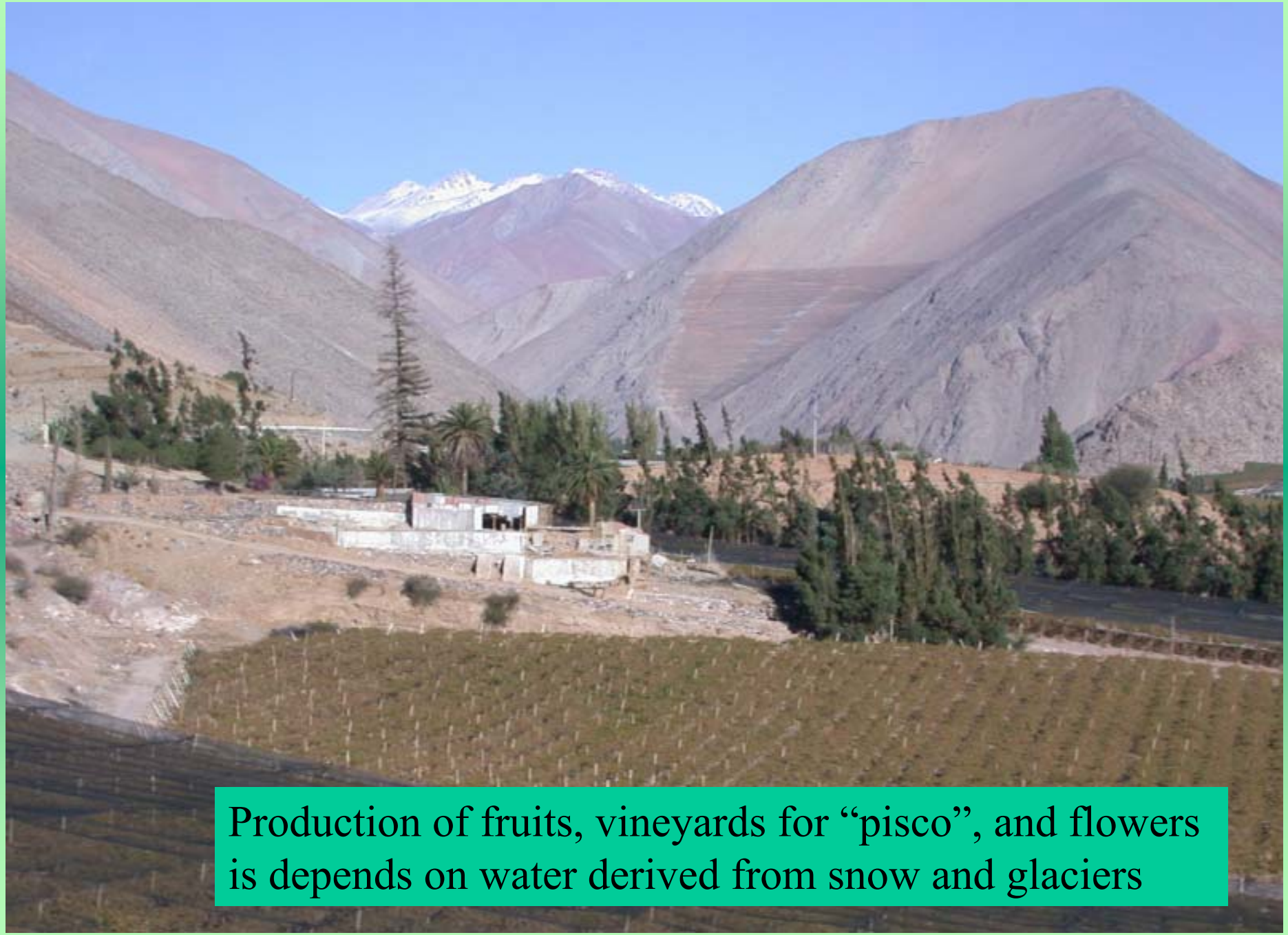
Region IV

Elqui River Basin


OCÉANO PACÍFICO
REPÚBLICA ARGENTINA
La Serena
Andacollo
Escala 1:230.000


The lower and middle parts of the valleys give the Coquimbo Region the name of "Green North".

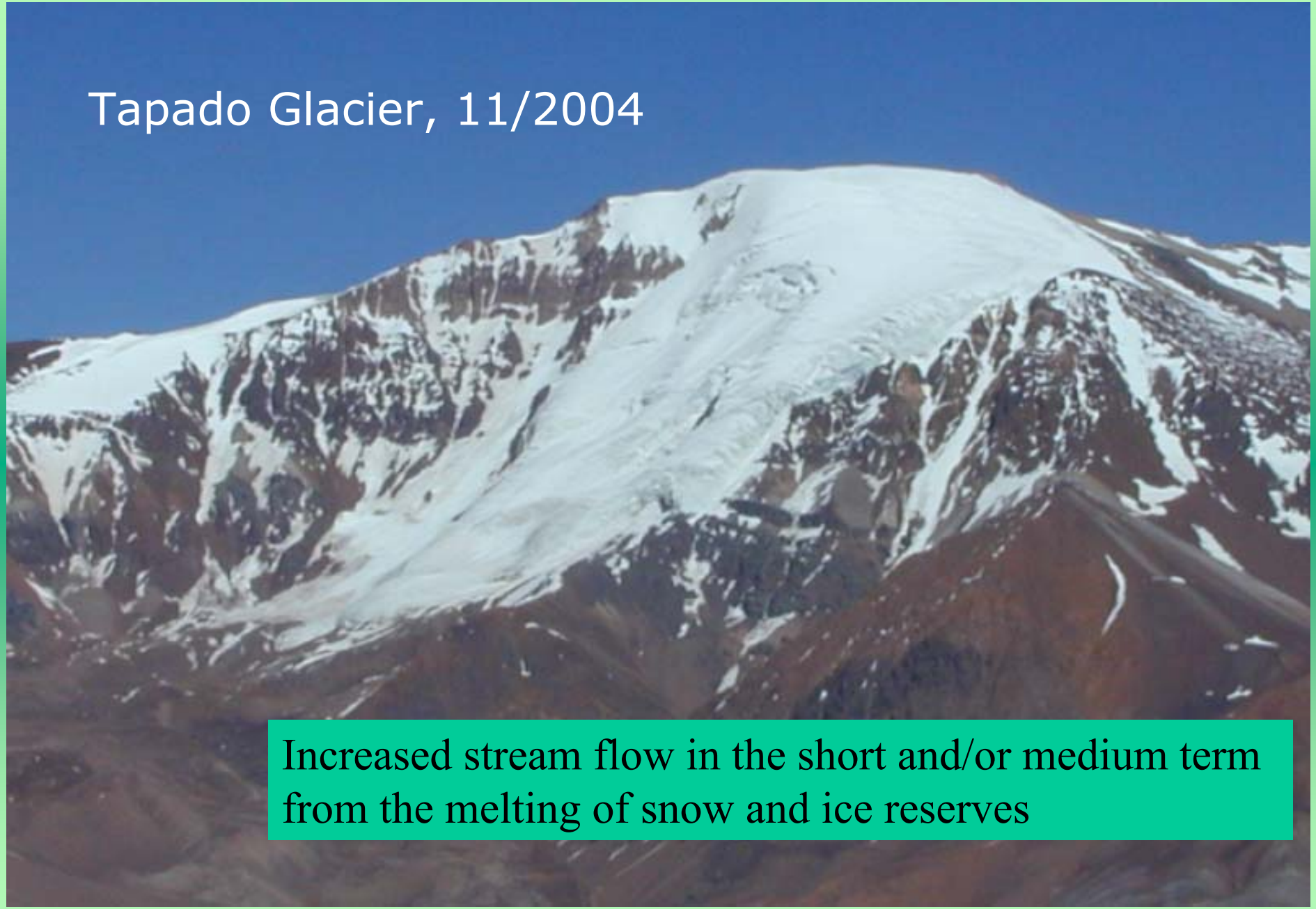

25 to 300 mm of precipitation, but during El Nino years there is an important increase in precipitation


Production of fruits, vineyards for “pisco”, and flowers
is depends on water derived from snow and glaciers

Economic activities are more diverse than in the adjacent regions, where gold and steel mines are the most important; almost 43% of the Coquimbo region's surface dry land is dedicated to agriculture


CUALLICUAICA


Puclara Reservoir



Increased stream flow in the short and/or medium term from the melting of snow and ice reserves

Vicuña

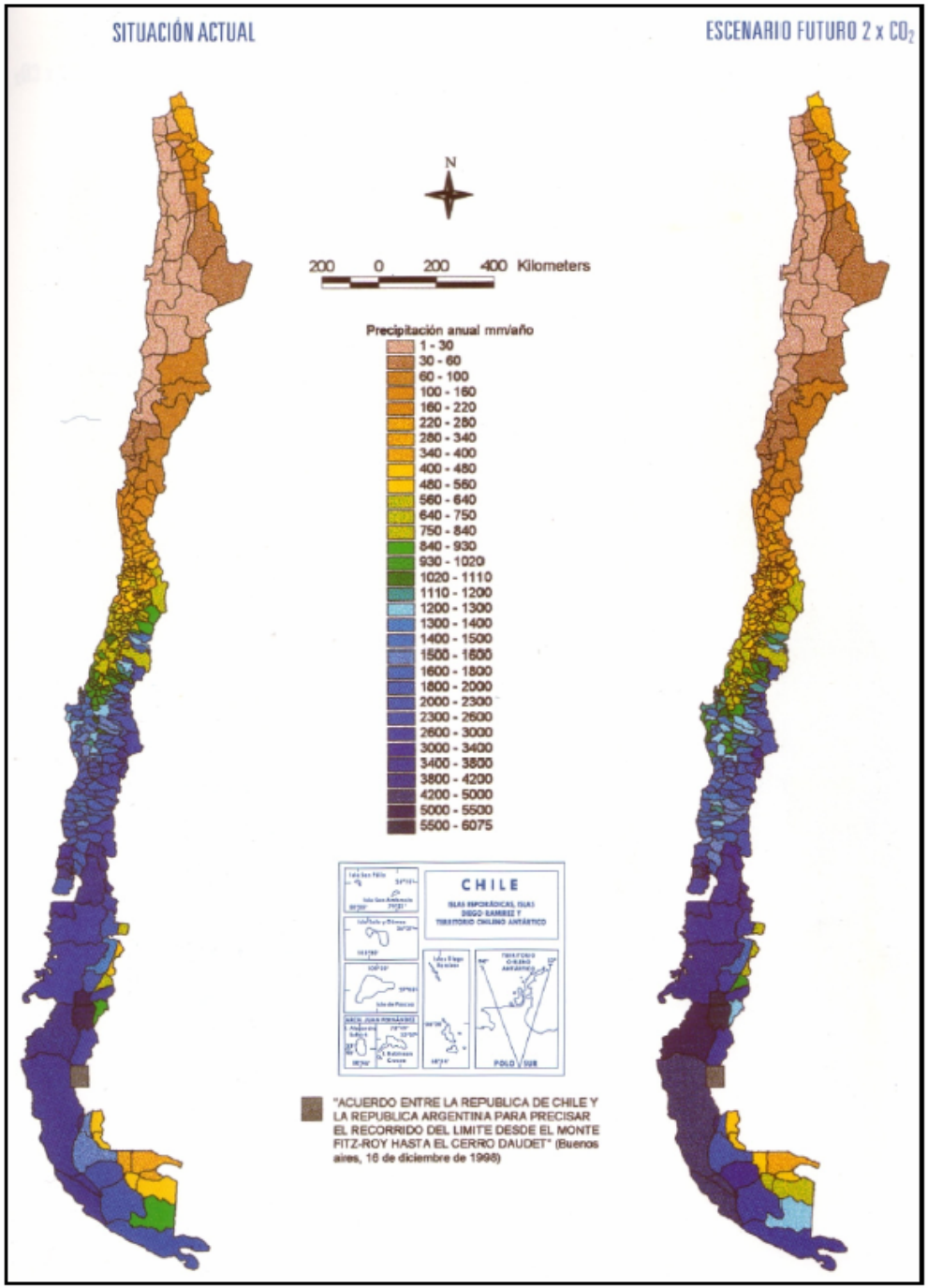
Diaguita

Otros Comunas

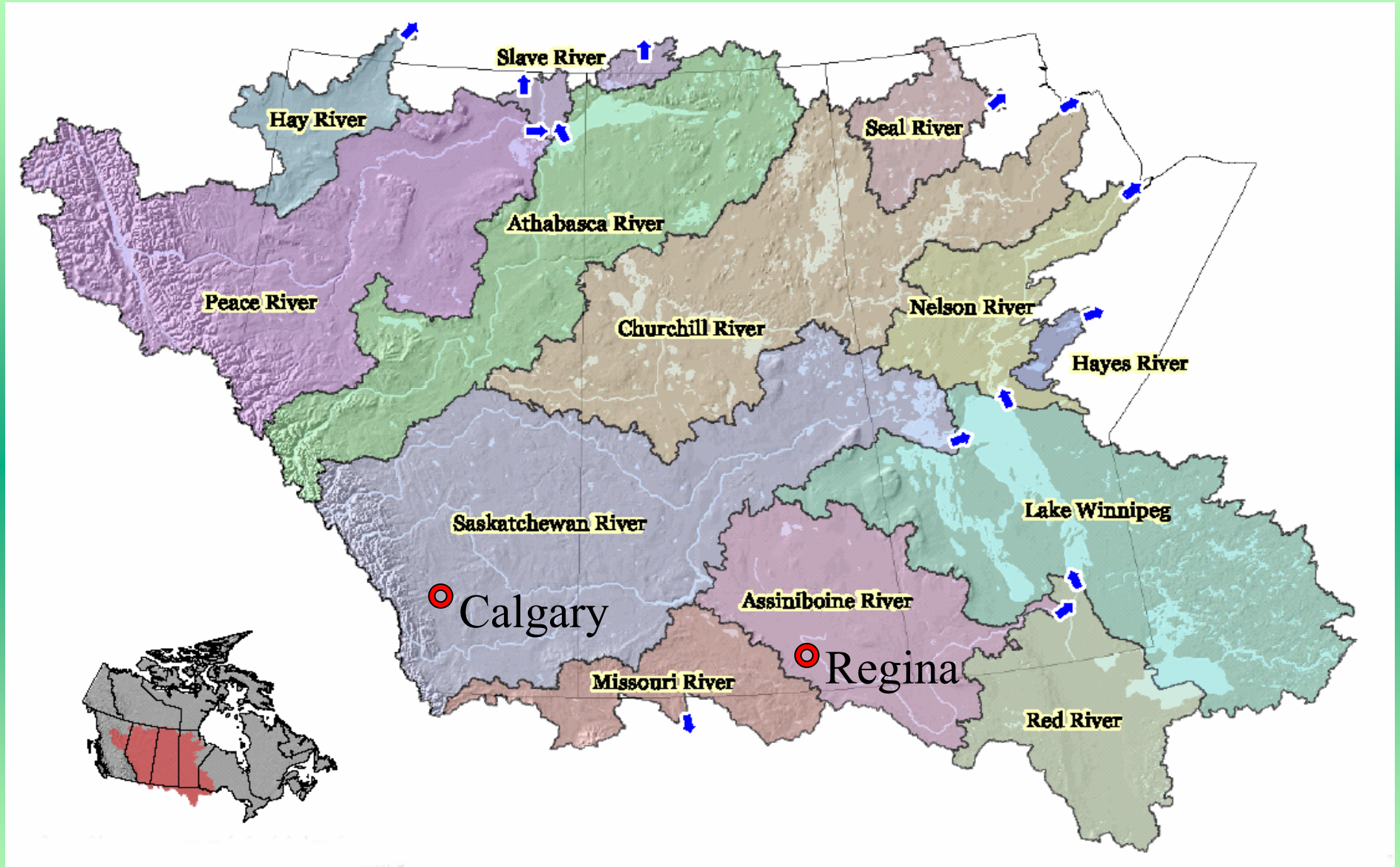
- Punitaqui
- Canela
- Paiguano
- La Higuera

Climatic Scenarios for the Coquimbo Region for the 2020s: 1) a warming of 2º C to 3º C, 2) a 10% increase in precipitation the mountains and foothills

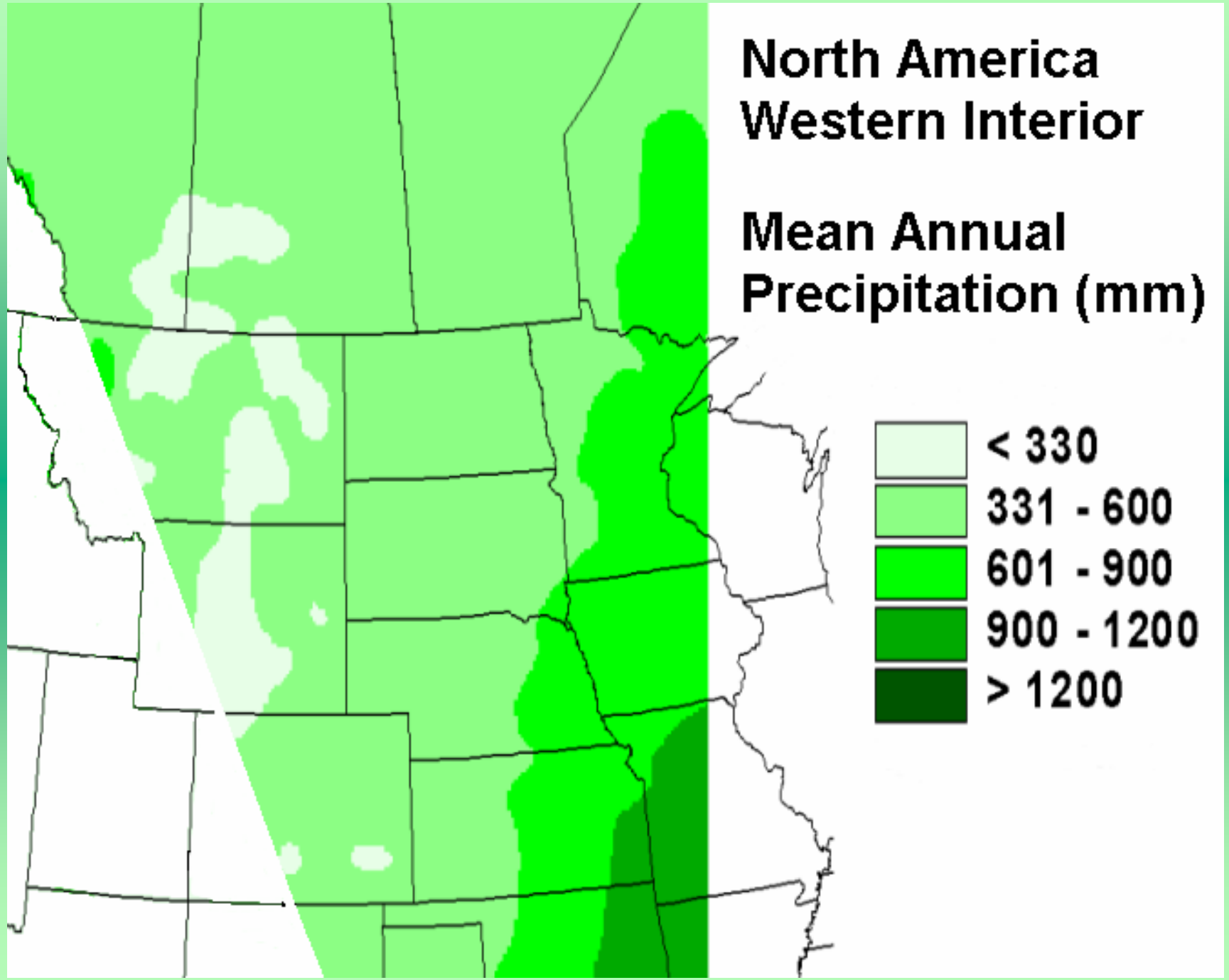
Figura 3.8 Media móvil de 30 años de las precipitaciones registradas en La Serena, desde 1869 hasta 2000.



Precipitación anual para el escenario actual (1999) y el escenario futuro 2xCO2. Fuente:
CONAMA 1999.



Source: Prairie Farm Rehabilitation Administration (PFRA)

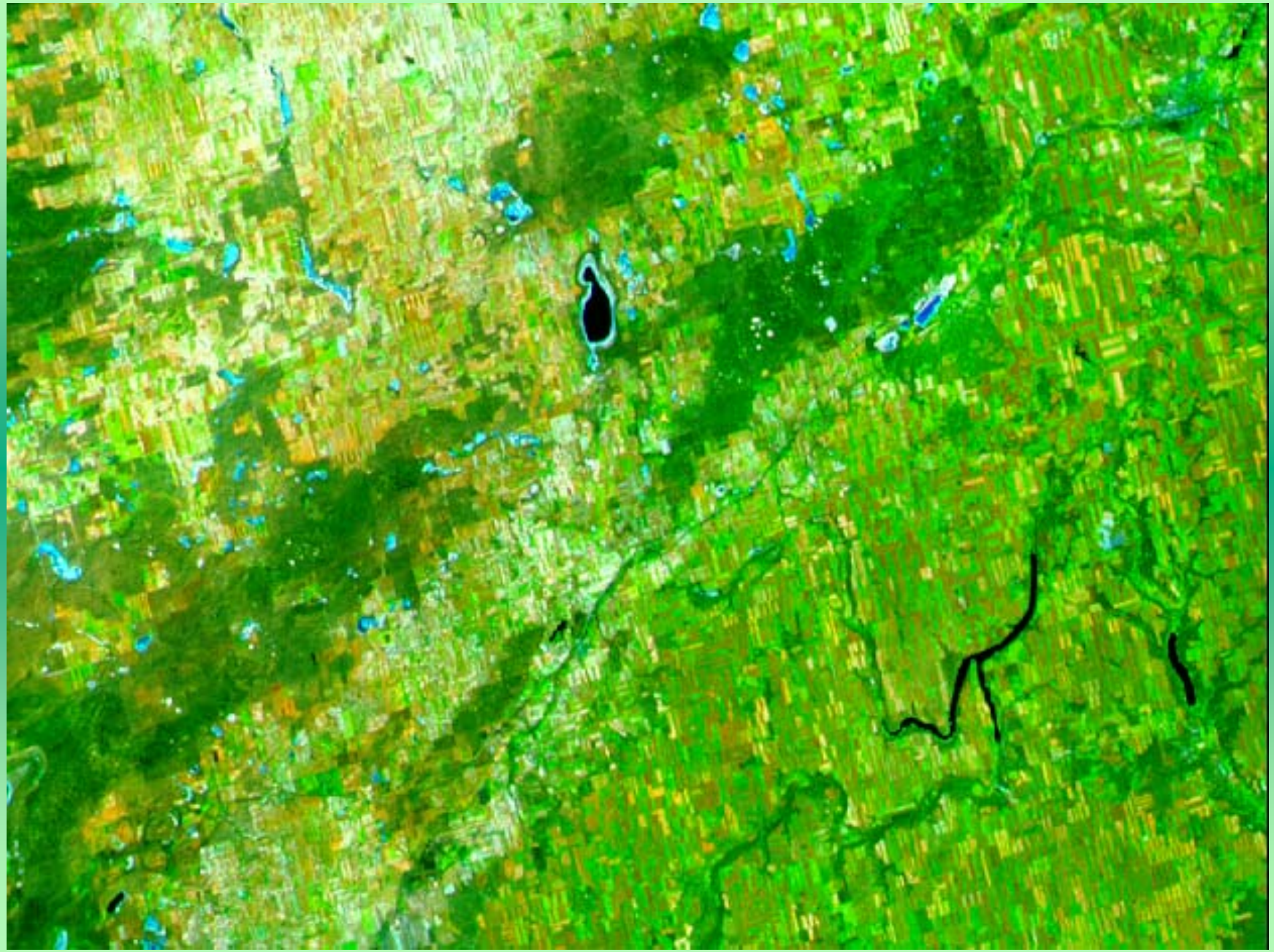

North America
Western Interior
Mean Annual
Precipitation (mm)
< 330
331 - 600
601 - 900
900 - 1200
> 1200

This large belt of country embraces districts, some of which are valuable for the purposes of the agriculturalist, while others will for ever be comparatively useless. The least valuable portion of the prair
square mile

CAPTN. JOHN

It would be
m

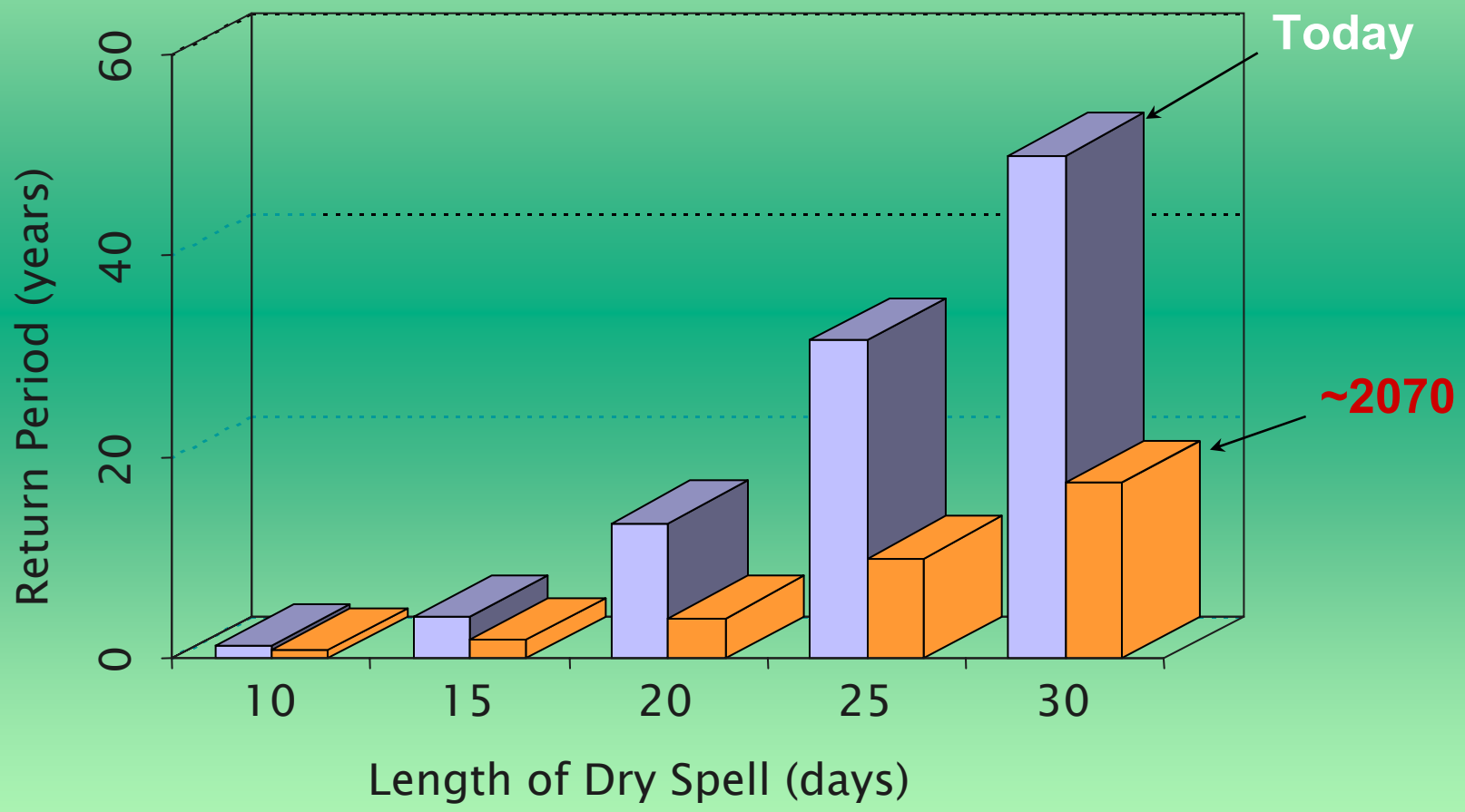
The



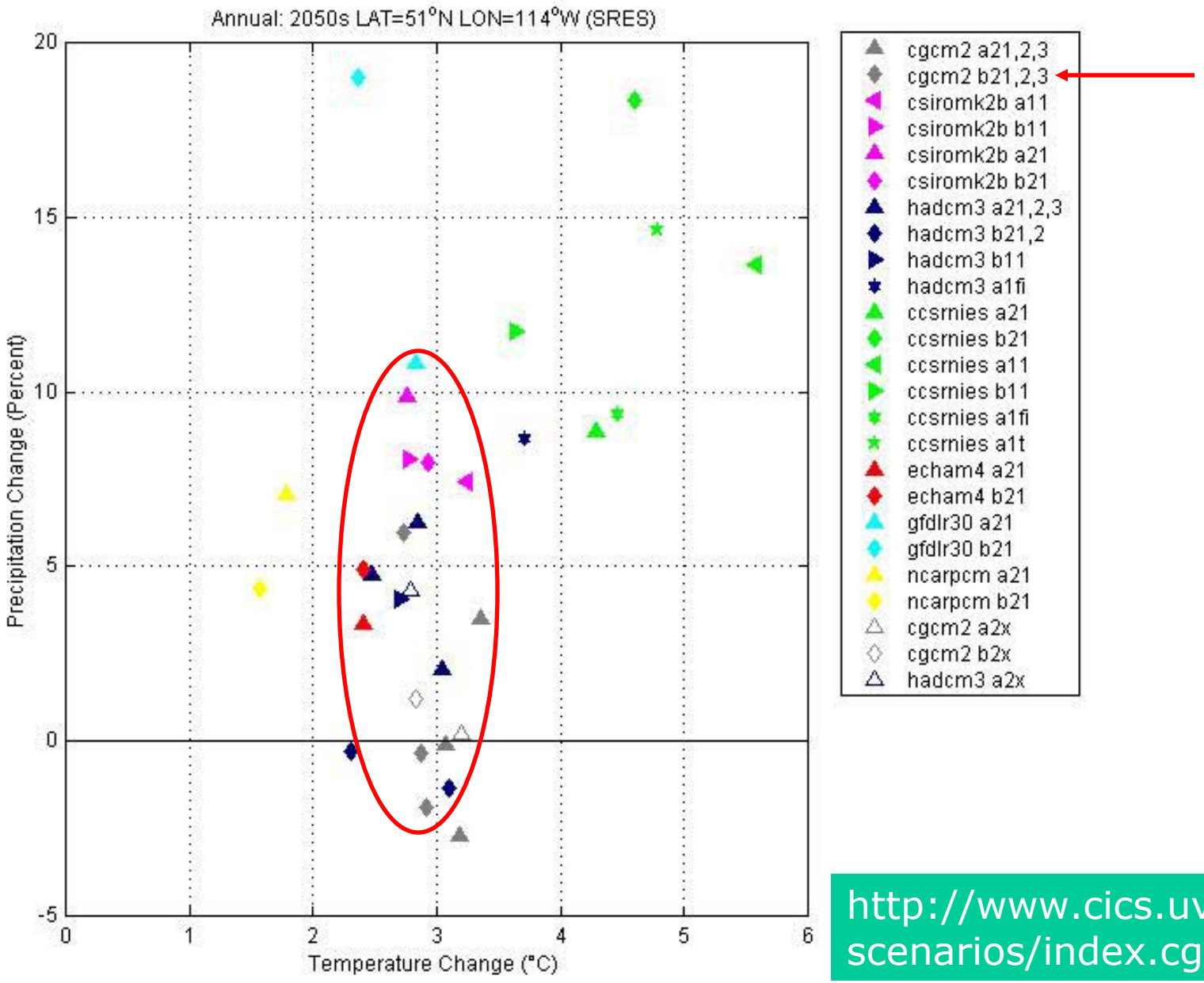
Soil drifting near Oyen, Alberta, May 5, 2002

Increasing Drought Frequency

Central North America



Kharin and Zwiers 2000



http://www.cics.uvic.ca/scenarios/index.cgi

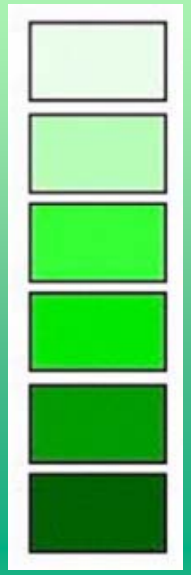
1966

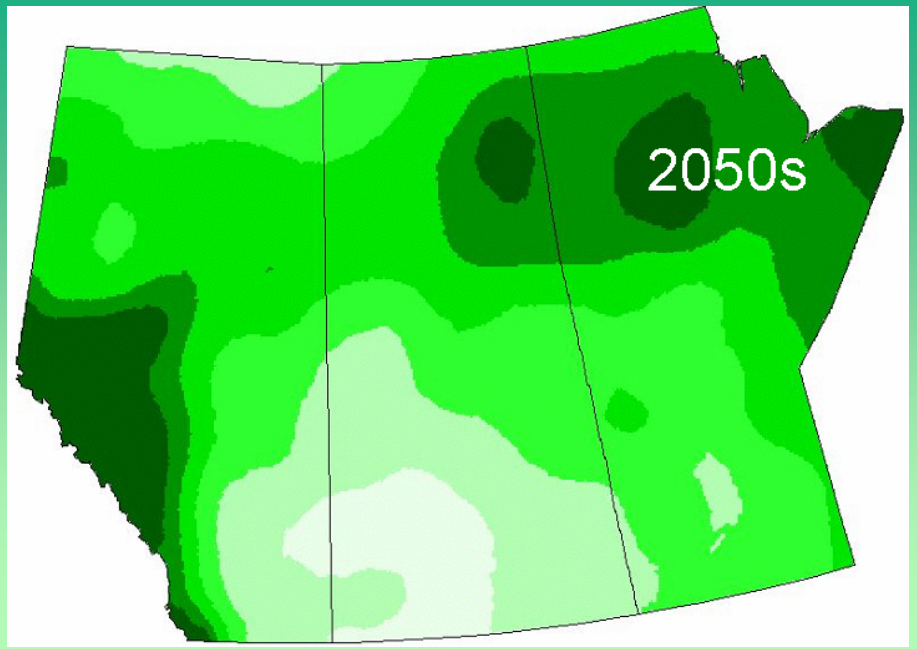
W.E.S Henoch

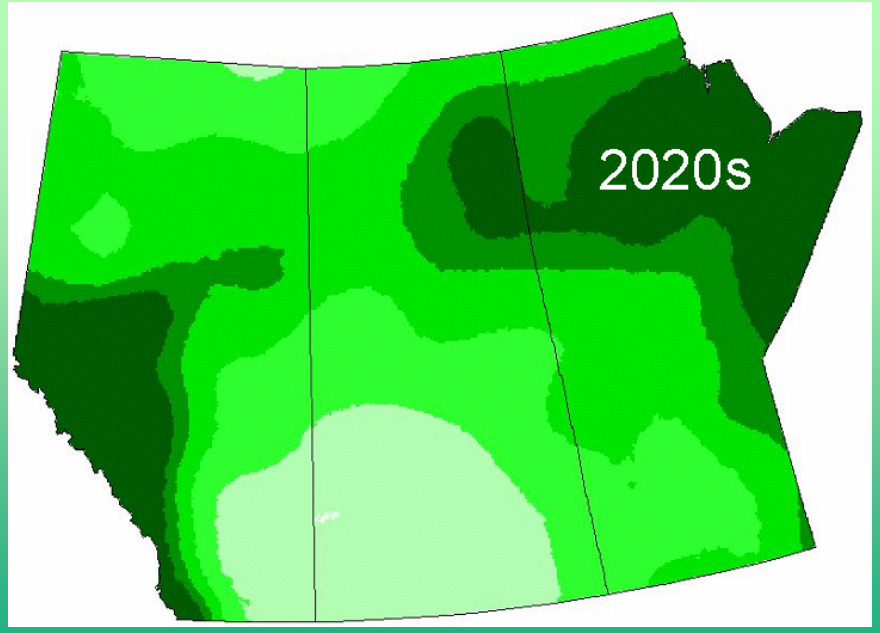
2001

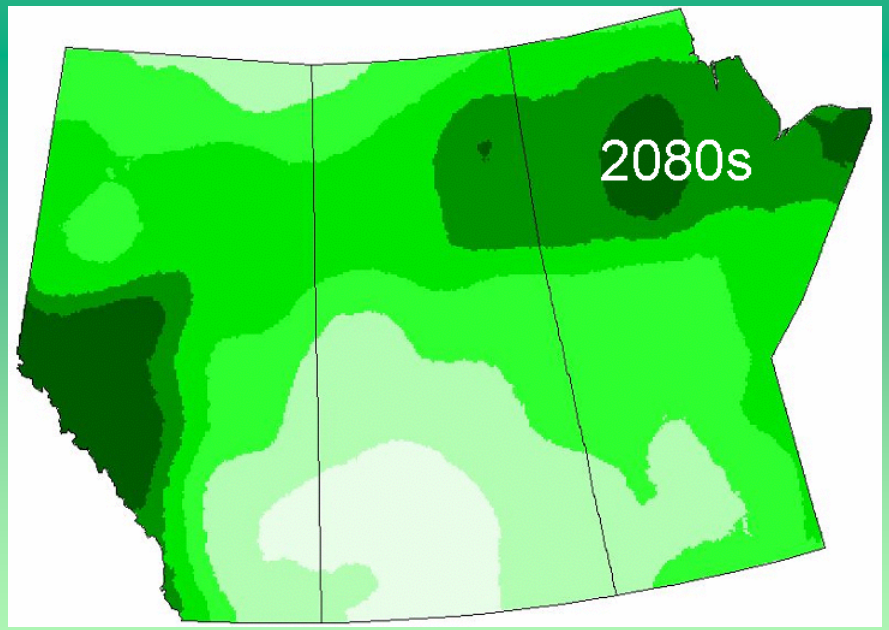
M.N. Demuth

Aridity Index CGCM2 A21





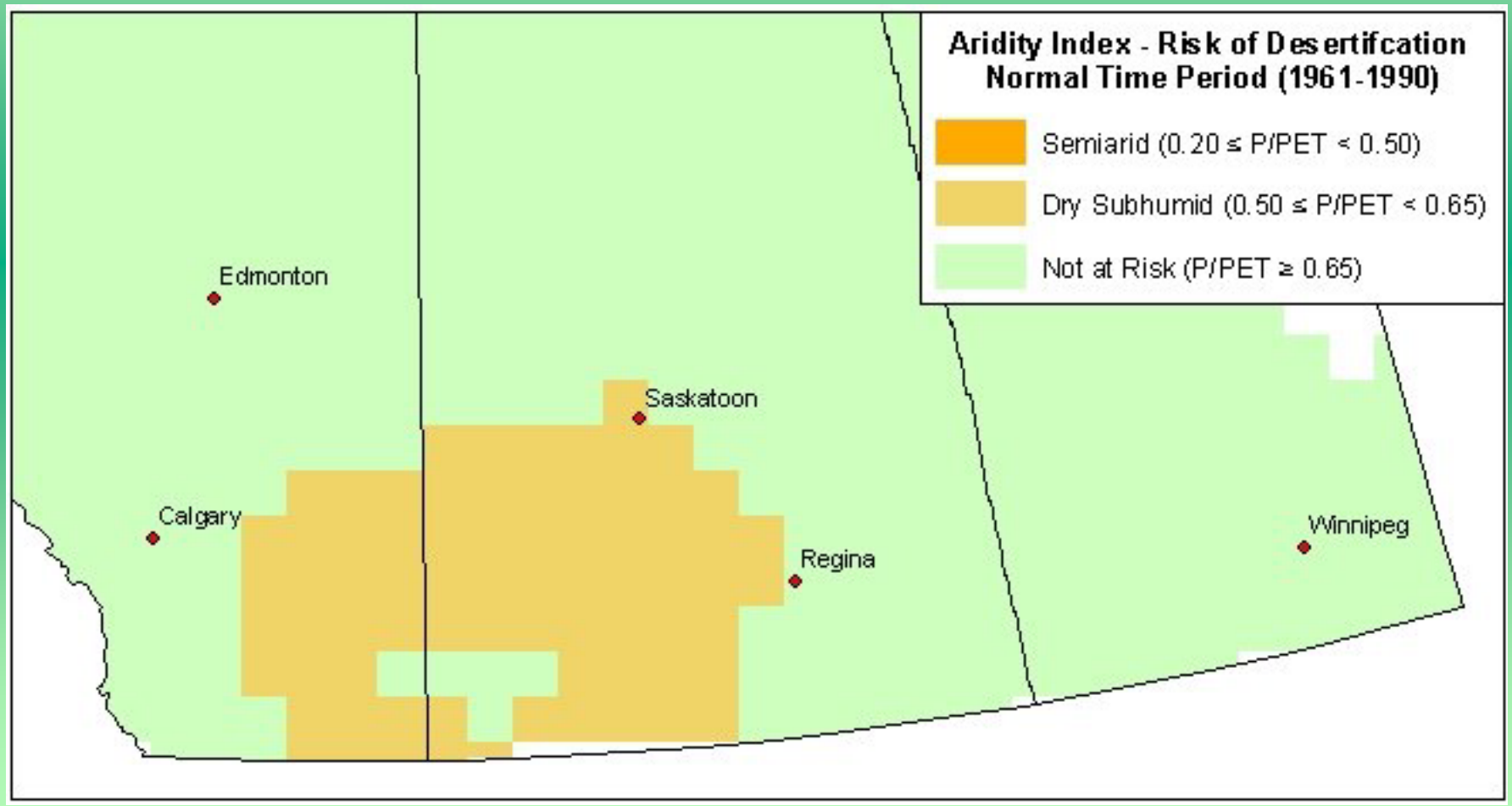


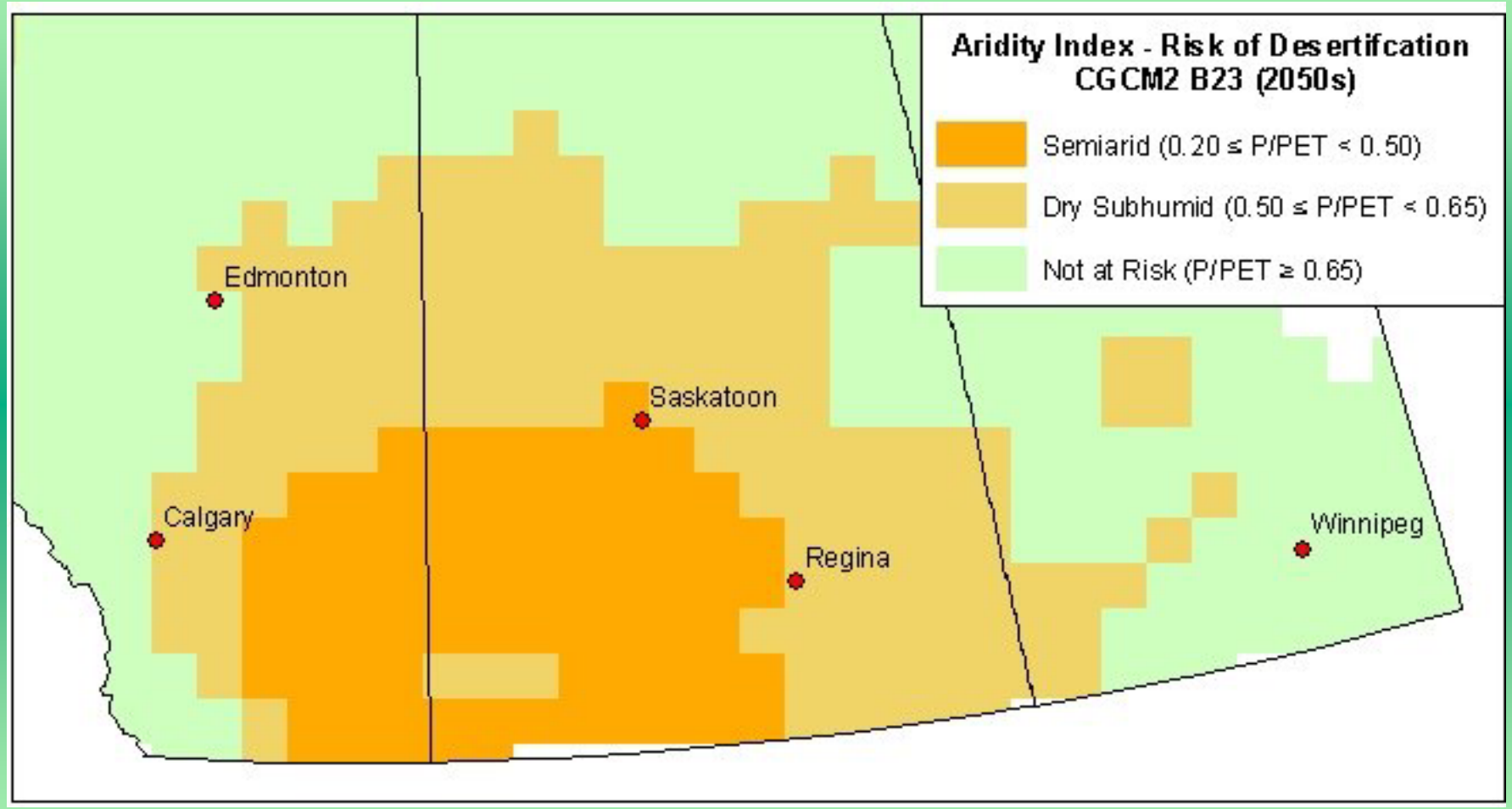


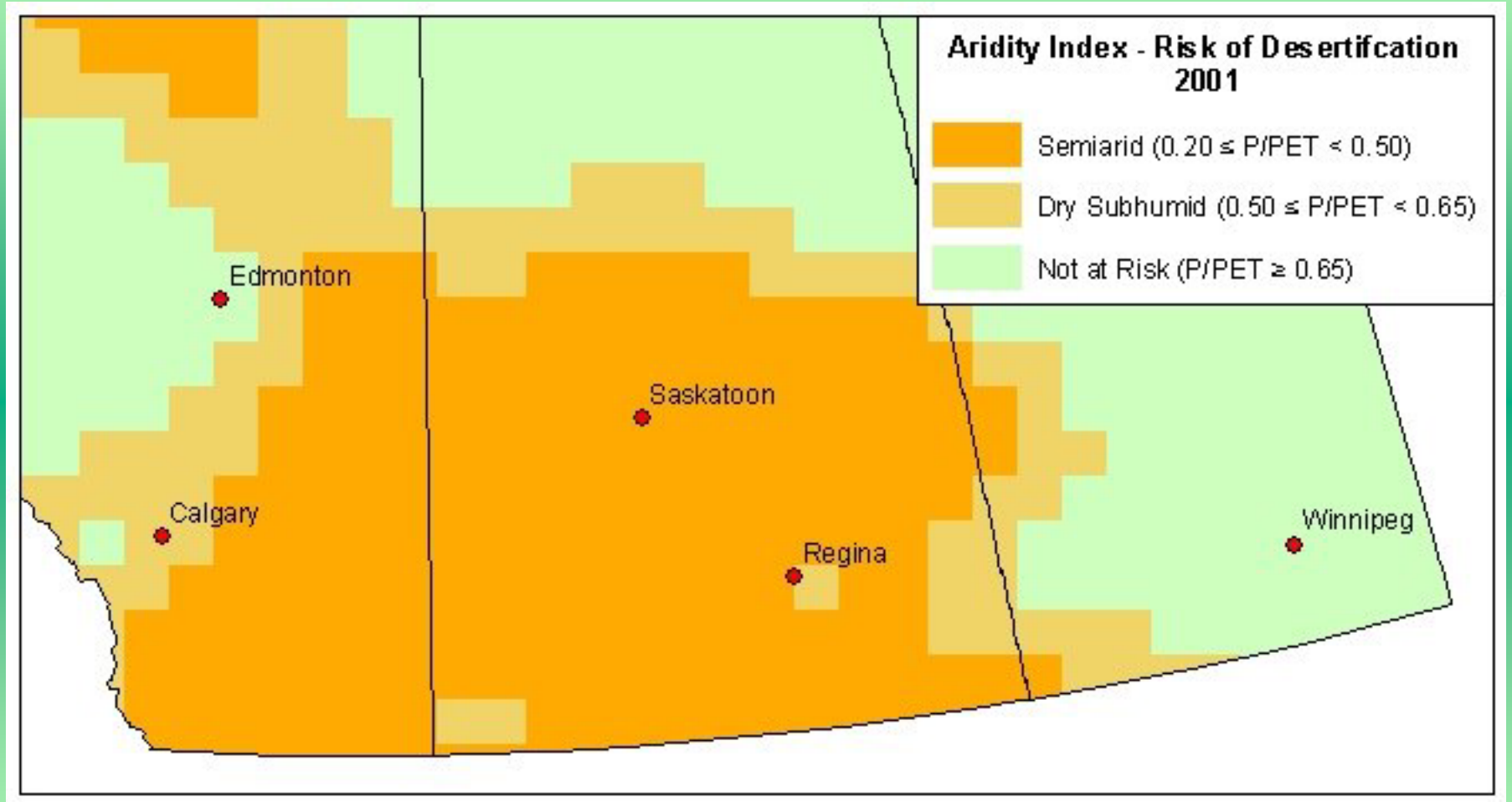
Sauchyn, et al. 2002

Desertification:

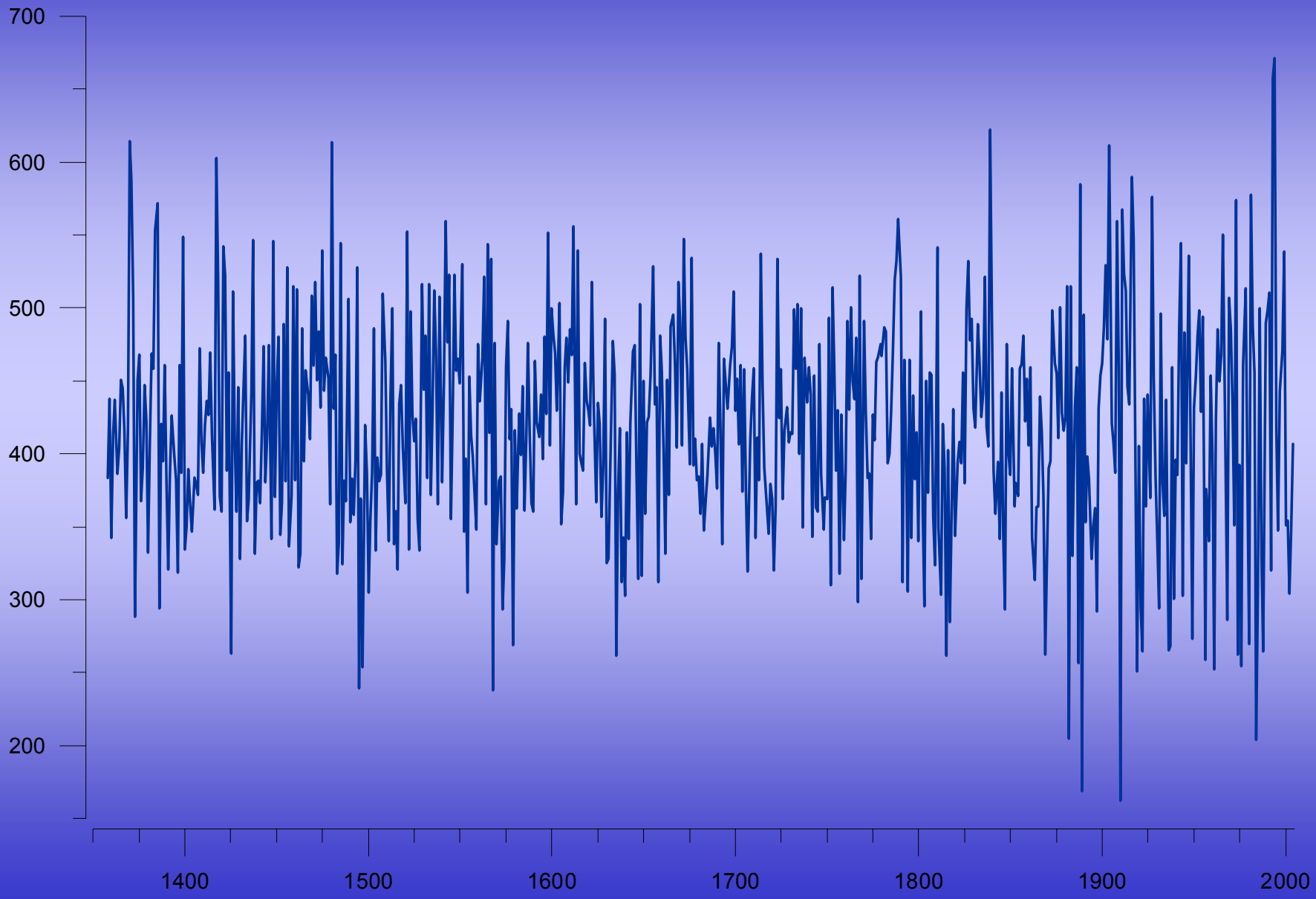
"Land degradation in arid, semiarid and dry sub-humid areas, resulting from various factors, including climatic variations and human impact" (UNEP, 1994).



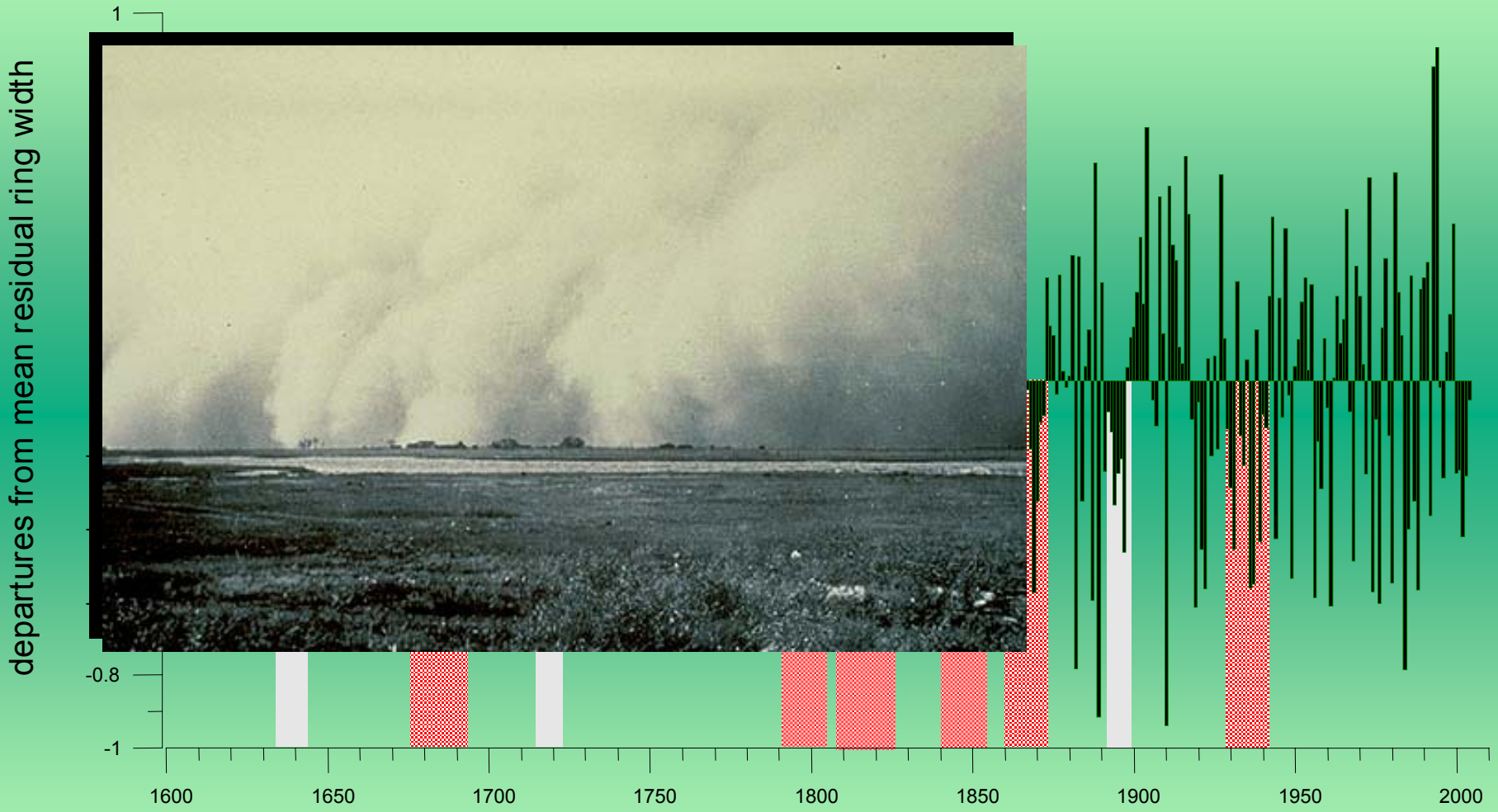

Aridity Index - Risk of Desertifcation
CGCM2 B23 (2050s)
Semiarid (0.20 ≤ P/PET < 0.50)
Dry Subhumid (0.50 ≤ P/PET < 0.65)
Not at Risk (P/PET ≥ 0.65)
Edmonton
Saskatoon
Calgary
Regina
Winnipeg


Aridity Index - Risk of Desertifcation
2001
Semiarid (0.20 ≤ P/PET < 0.50)
Dry Subhumid (0.50 ≤ P/PET < 0.65)
Not at Risk (P/PET ≥ 0.65)
Edmonton
Saskatoon
Calgary
Regina
Winnipeg

Annual Precipitation (mm), Calgary, 1358-2004



Wildcat Hills Tree-Ring Chronology, 1600-2004



http://www.parc.ca/mcri/