

# **The Challenge of Climate Change: Adaptation and Mitigation**

IACC Project  
University of Regina  
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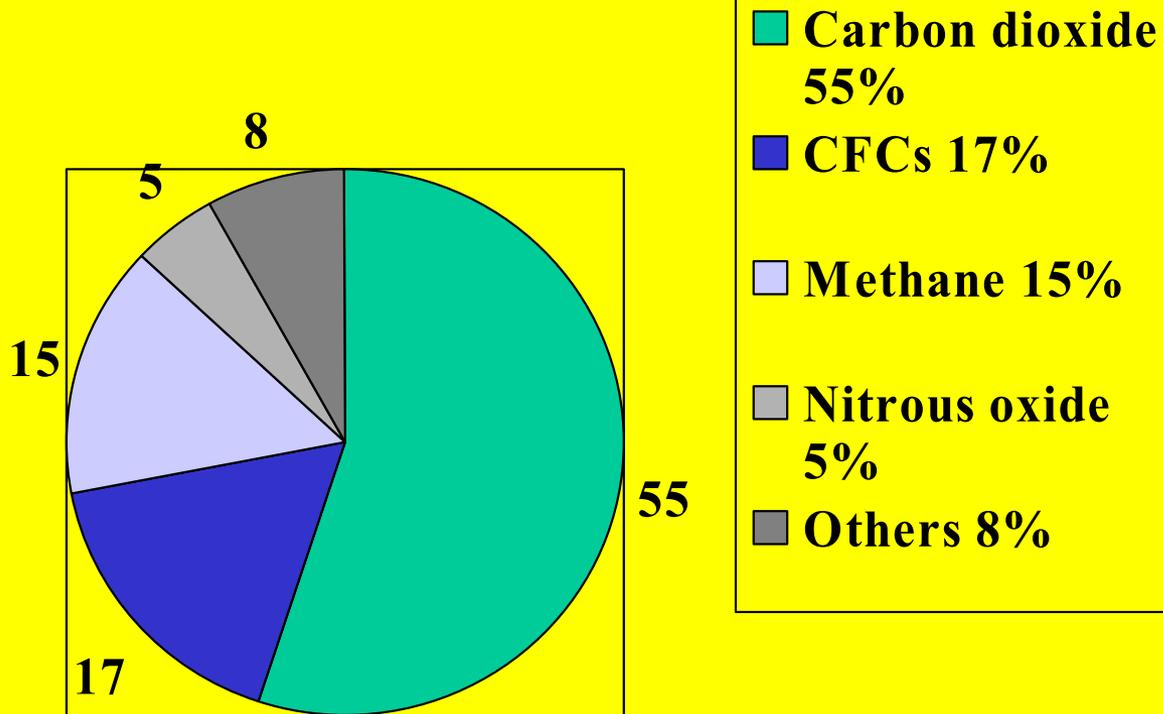
# **Institutional Adaptations to Climate Change: Comparative Study of Dryland River Basins in Canada and Chile**

A project supported by  
the Major Collaborative Research Initiatives  
(MCRI) Program of SSHRC  
(2004-2008)

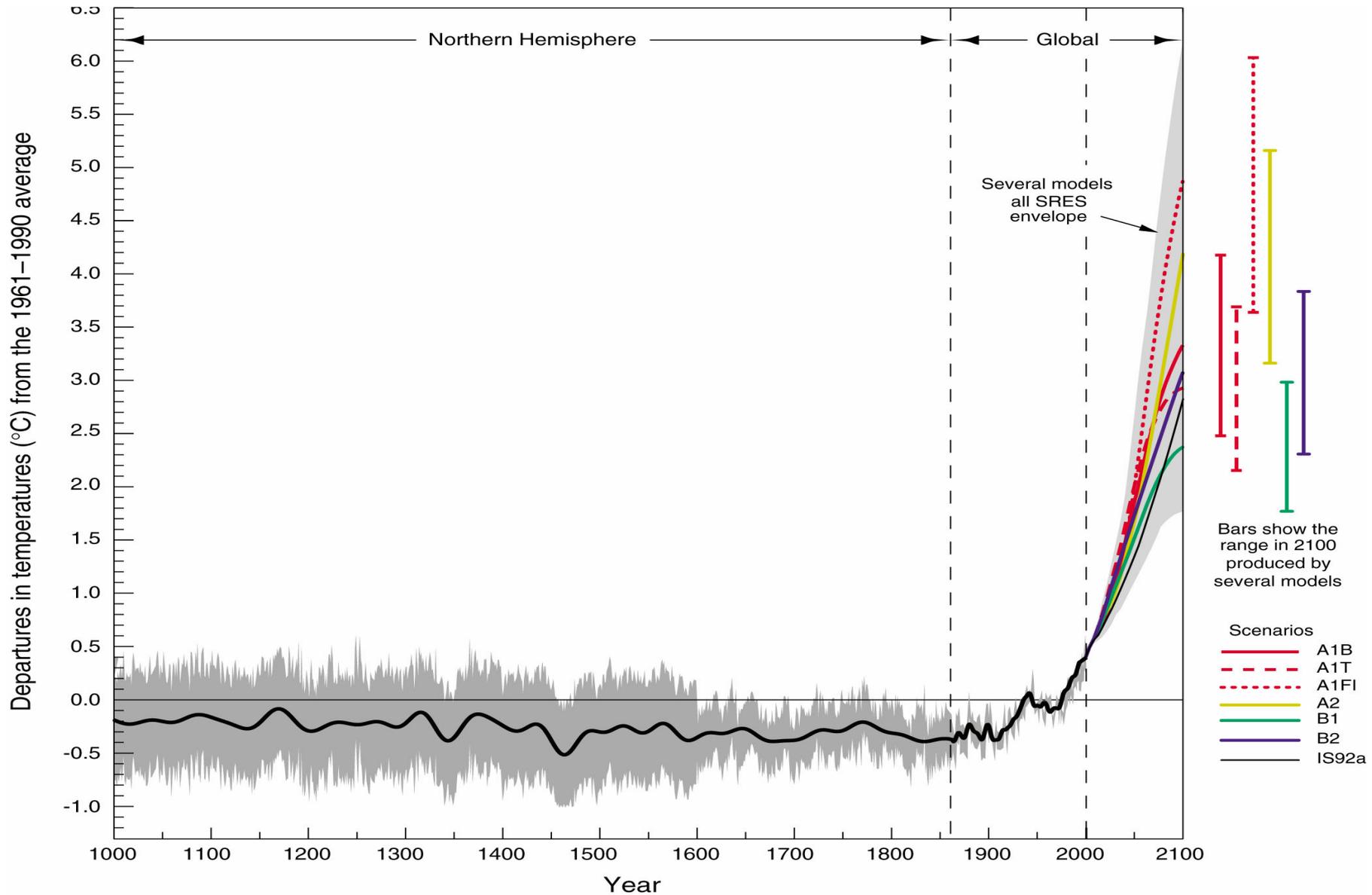
# Outline

- Climate change issues

# Contribution of the major greenhouse gases to global warming

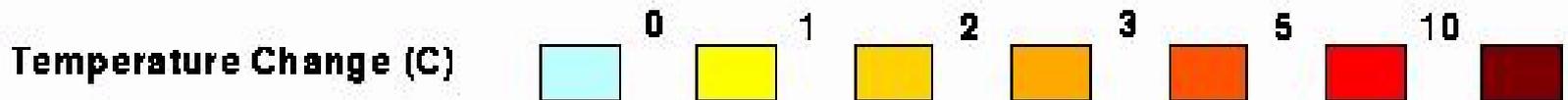
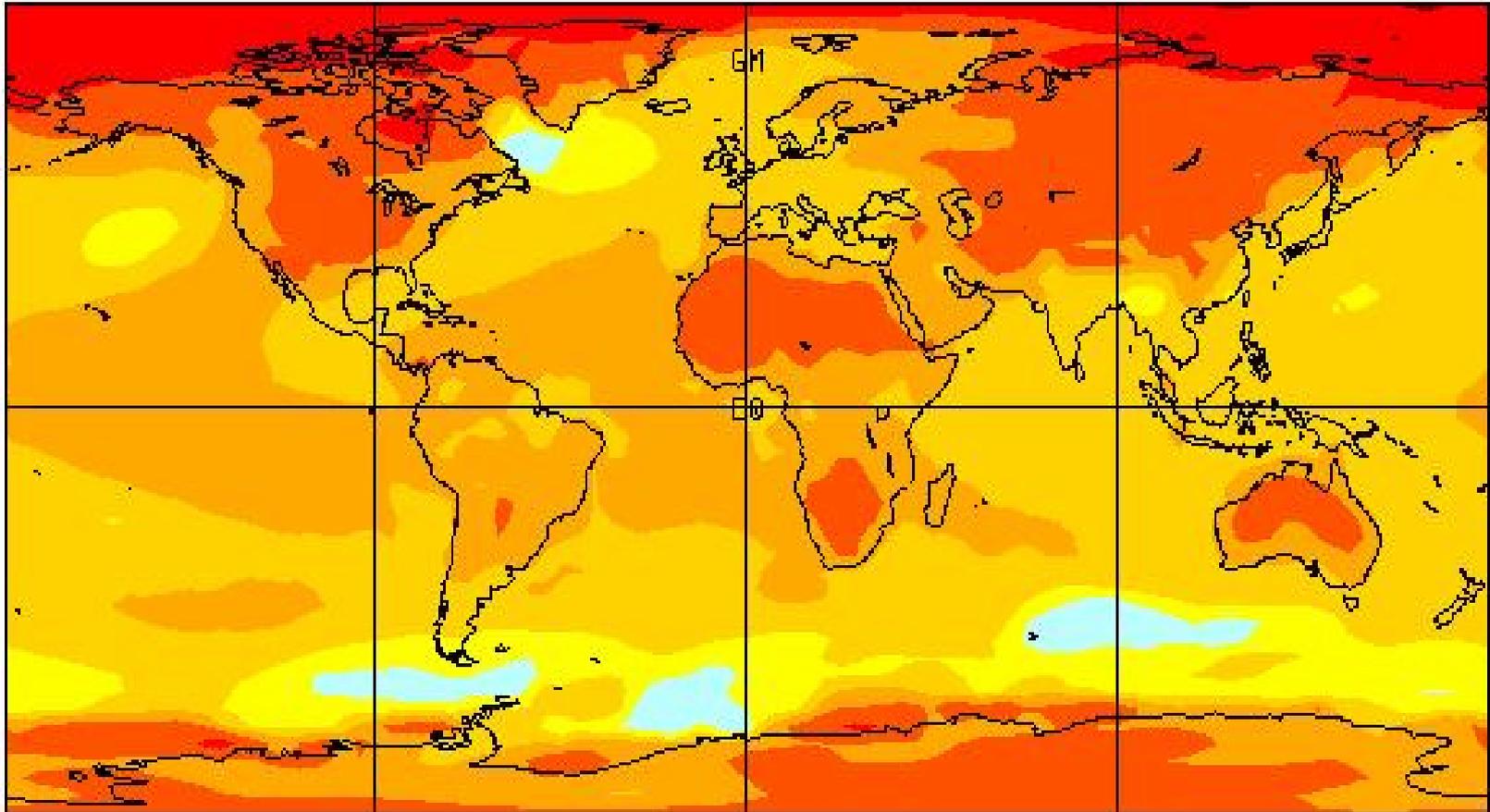


# Temperature Projections for 21st Century



# Projected Temperature Change, 1910 – 2040

*Effect of Projected Greenhouse Gas and Sulphate Combined Aerosol Increases. Canadian Model*

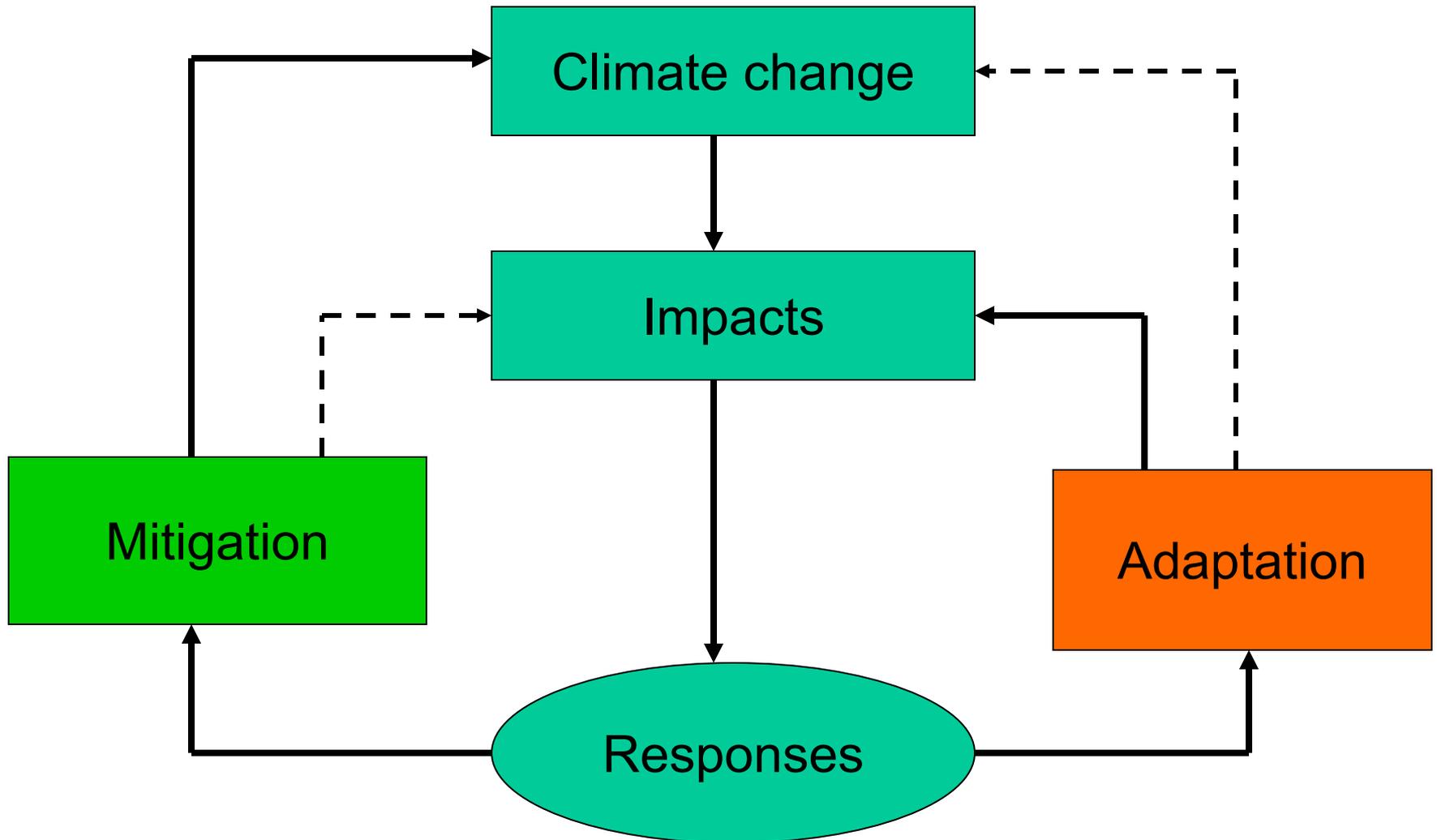


# Who are vulnerable?

**Geographical space:** “people who live on arid or semi-arid lands, in low-lying coastal areas, in water limited or flood-prone areas, or on small islands.....”

**Social space:** “developing countries... have lesser capacity to adapt and are more vulnerable to climate change damages, just as they are to other stresses. This condition is more extreme among the poorest people” (double-exposure).

# Dealing with Climate Change: Mitigation and Adaptation



# Mitigation Measures

**A. Reduction of activities.**

**B. New alternatives: technologies, behaviors, sources of energy.**

**C. Sequestration (capture): forests, soil, ocean, and underground**

# The need for adaptation

Mitigation will not work. So it is necessary to organize in order to take advantage of the **new opportunities** (longer growing season) and avoid some of the **negative impacts** (extreme weather variability, drought).

# Adaptive capacity

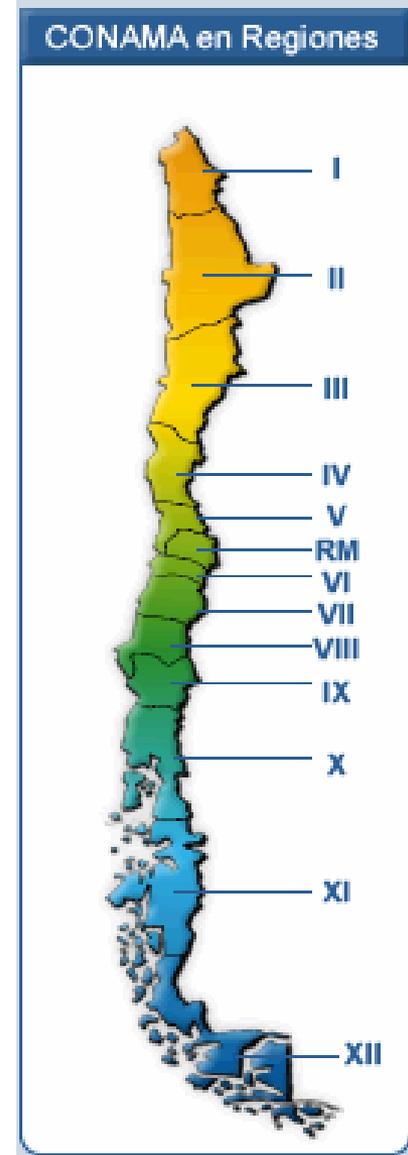
Determinant	Explanation
Economic resources	Greater economic resources increase adaptive capacity Lack of financial resources limits adaptation options
Technology	Lack of technology limits range of potential adaptation options Less technologically advanced regions are less likely to develop and/or implement 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

# Expected Climate Changes (double concentration of CO<sub>2</sub> –1990)

**Precipitation:** increase in the altiplano area and from Chiloe to the south; decrease up to 20-25 % in the rest of the country.

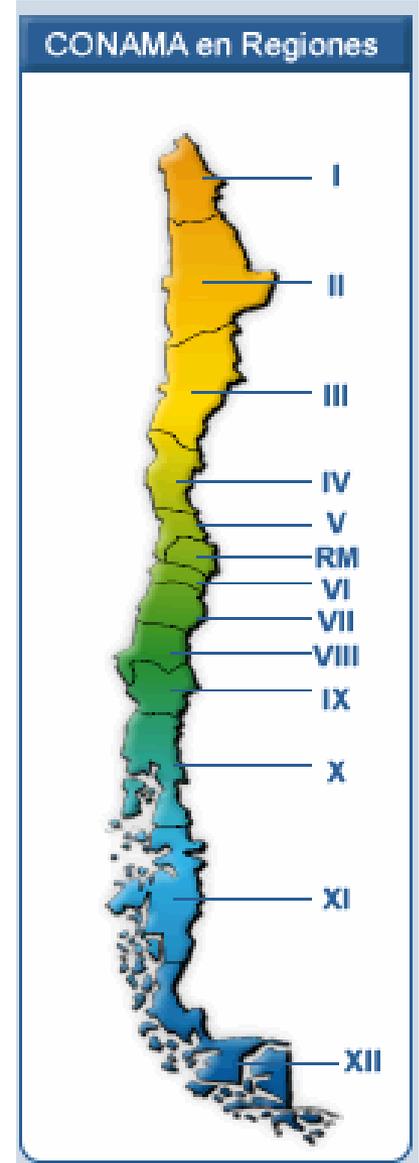
**Temperature:** in Regions I and II an increase than less than 2 degrees C.; in the rest of the country it could increase 3 degrees C.

**Aridity:** Increase aridity in the North and Central areas of the country as a result of a decrease on snowfall and snow accumulation on the Andes.



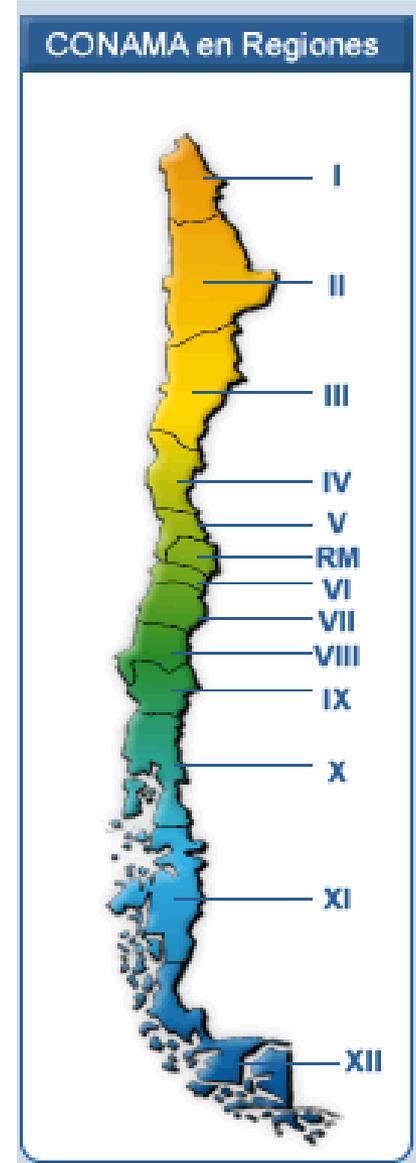
# Potential Impacts: Grasslands

- Favorable in the altiplano and south and far south (an extension of the area and with higher yields). Between the IV and the IX Region there will a marked decrease in productivity.



# Potential Impacts: Forestry

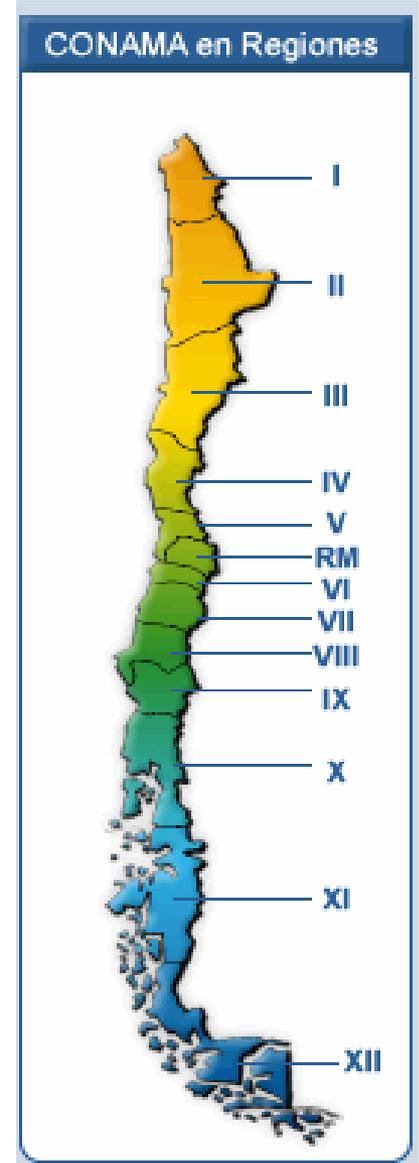
- A notable decrease in the potential of Regions V and VI.
- A marked expansion from the VIII Region to the south



# Potential Impacts: Crops

The outlook is positive as long as water is available.

For dry farming the situation might be negative in the north-center (IV and V Regions), but to the south a reduction on winter temperatures could reduce frosts, allowing spring planting.



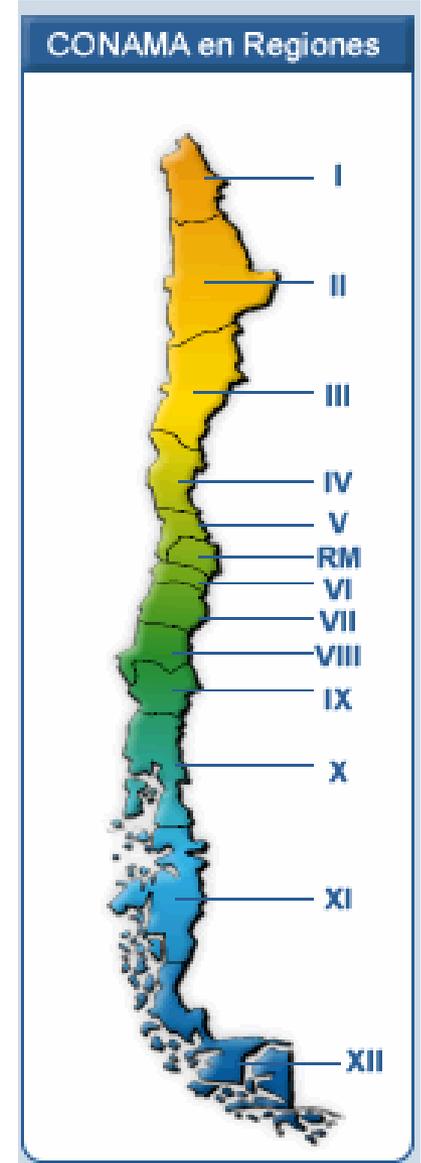
# Potential Impacts: Fruits

The productive area for fruit expands both to the north and the south.

Vines are greatly benefited by the attenuation of the frosts toward the interior of Chile.

Sub-tropical fruit production will benefit, extending the range of its production to the south (coast and valleys)

Production conditions for temperate climate fruit growing will improve considerably (decrease of frost and milder spring temperatures) but a decrease in cold temperatures may affect flower fecundity affecting production.



# Impacts on the Norte Chico

- Effects on annual crops are mixed. The new conditions may reduce wheat yields, but not for maize and potatoes.
- Warm winters will result in less rest for vines, reducing flowering quality and fertility (spraying and alternative varieties may compensate, but at an extra cost)
- Increased irrigation requirements (7% more irrigation water for each degree of temperature increase).
- More frequent and prolonged droughts.
- The social impacts of a regional agricultural crisis will be different in each valley, but likely reflect the existing process of social differentiation.

Source: Downing, T., 1992, *Climate Change and Vulnerable Places: Global Food Security and Country Studies in Zimbabwe, Kenya, Senegal, and Chile*, Environmental Change Unit, University of Oxford.

# What Chile has done?

**It has signed and ratified all the international agreements dealing with climate change:** the United Nations Framework Convention on Climate Change (1992); the Kyoto Protocol (1997, ratified in 2002); and has become a member of the Inter-American Research Institute for Global Change (1996)

**It has created the National Advisory Committee on Climate Change,** a coordinating entity that advise the government on climate change issues) and produced the **First National Communication,** a diagnostic tool that assesses the status of the country in the area of climate change.

# The National Advisory Committee on Climate Change (NACCC)

It is led by the Ministry of Foreign Affairs and the National Environment Commission (CONAMA – the administrative arm of NACCC) and by representatives of 16 institutions, including the Ministry of Agriculture, the Hydrographic and Oceanographic Service of the Navy, the National Energy Commission, the General Directorate of Maritime Territory and Merchant Marine, the National Oil Company, Production and Commerce Confederation, Fundacion Chile, and the National Scientific Research and Technology Commission (CONYCIT).

# The Working Plan on Climate Change

- Reaffirm the commitments assumed in the FCCC and promote the ratification of Kyoto.
- Application of the Clean Development Mechanism.
- Design basic guidelines on new ways to limit and/or reduce the emissions of GHG for developing countries
- Develop and implement a National Plan for Climate Change
- Create a special fund for research and training in Chile

# Aggregate GHG Emissions (Gg of CO2 Equiv), 1994

<b>Sector</b>	<b>Carbon Dioxide</b>	<b>Methane</b>	<b>Nitrous Oxide</b>	<b>Total</b>
Energy / Ind. Proc / Solvents	37.097,0	839.3	832.0	38.768,3
Non-energy	-29.709,3	5,688.1	7,065.6	-16.955,6
<b>Total</b>	<b>7.387,7</b>	<b>6.527,4</b>	<b>7.897,6</b>	<b>21.812,7</b>

Source: CONAMA, *Primera Comunicacion Nacional*, CONAMA, Santiago, 1999

# Mitigation Plans

- Implementation of the Clean Development Mechanism to reduce the emission of GHG ( identify mitigation options for the transportation sector).
- An increment of the forestry and cultivated areas (sequestration) and better management of forests and soil (preservation of the capital of carbon)

# Adaptation Plans

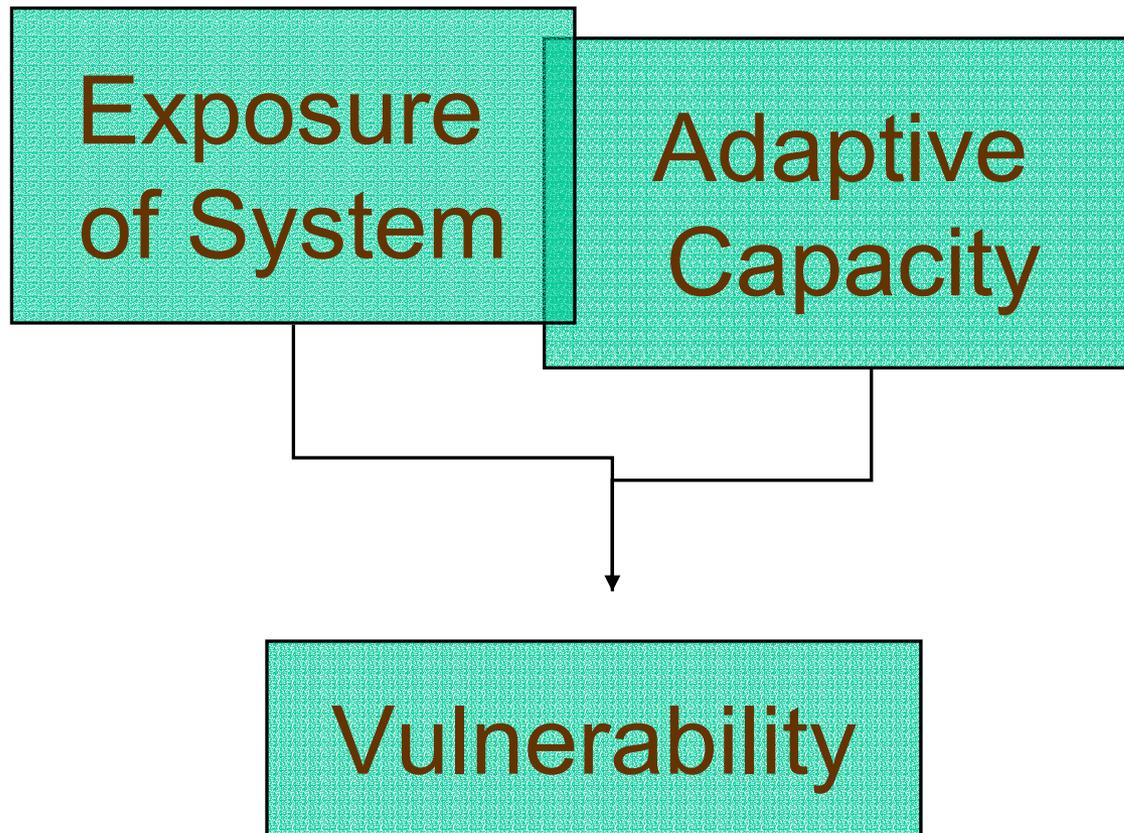
- The development of **vulnerability and adaptation studies** in areas such as:
  - a. replacement of crop varieties;
  - b. changes in planting dates and feasibility of relocation;
  - c. impact of climate change on desertification;
  - d. impact of heat conditions on native forest species;
  - e. pest and disease control;
  - f. design and implement early warning systems for El Nino y La Nina.

Source: CONAMA, *Primera Comunicacion Nacional*, CONAMA, Santiago, 1999

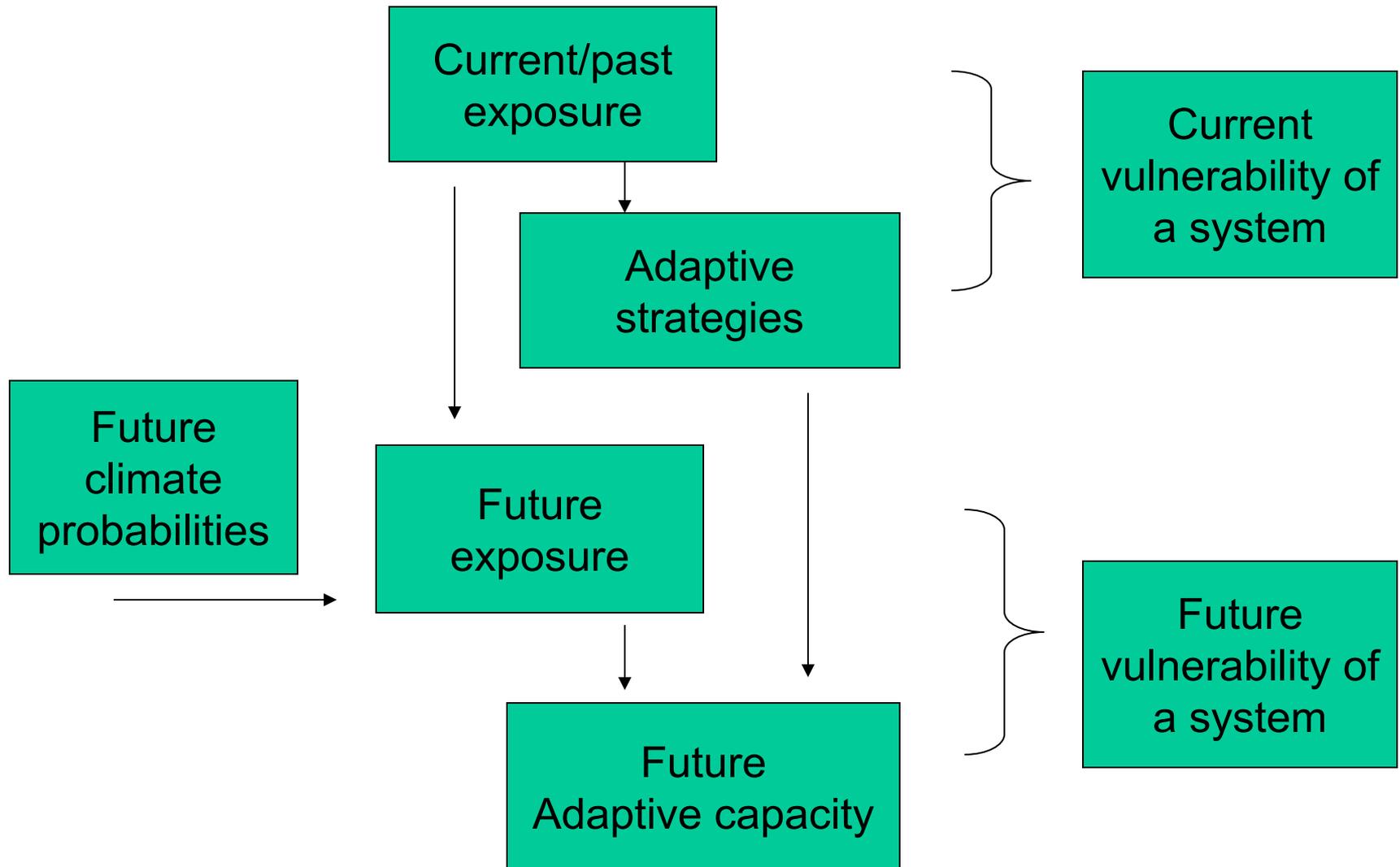
# Adaptive capacity

- Adaptation is a technical issue related to the vulnerability of economic activities
- Social vulnerability and institutional adaptive capacity are ignored

# Conceptual Vulnerability Model



# The Vulnerability Approach



# Vulnerability

- Vulnerability = impact of climate condition  
– the adaptive capacity of society
- The adaptive capacity = technology, resources, infrastructure, human capital, well developed institutions, and equity.

# An example : water resources

- A significant decrease in yearly precipitation and increased evapotranspiration.
- Increased aridity in the Norte Chico and central valley.
- Increment of water conflicts
- Need to have an adequate system of water management (institutional capacity).

# National Water Demand by Sector (m<sup>3</sup>/s)

Sector	1993	2015
Agriculture	6550.7	9925.4
Human Con.	354.0	603.6
Industrial	639.6	1580.4
Mining	546.0	799.2
Energy	19236.6	172138.0
Total	27,326.9	185,046.6

# Has Chile the institutional capacity to deal with water scarcities?

- Very restricted due to legal and political conditions
- Access and use of water is defined by the Water Code of 1981, which has created a **water market** and **limited the state's power to regulate water resources.**

# The Water Code's core

- Water rights are separated from land rights and can be freely transferred, sold and bought.
- Application for water rights is not conditional on the type of use and there is no priority list for different uses of water.
- Water rights are allocated by the state at no charge.
- The role of the state in resolving conflicts is very limited.

Source: Galaz, V., *Privatizing the Commons, Natural Resources, Equity and the Chilean Water Market*, FLACSO, Santiago, 2003

## The Chilean Water Market: as assessment

- Positive : it has facilitated investments in infrastructure, the leasing of water rights in times of drought, and the transfer of water rights from agriculture to urban water companies.
- Negative: the actual transfer of water rights has been very limited; serious conflicts have emerged between consumptive and non-consumptive uses of water; the existence of unused water rights (speculation); and “stealing from the poor”.

Source: Galaz, V., *Privatizing the Commons, Natural Resources, Equity and the Chilean Water Market*, FLACSO, Santiago, 2003

# Stealing Water from the Poor

- “The Chilean water market is characterized by the “law of the jungle”, where the powerful can do what they want with the water rights of the small”.
- The incapacity of public and private institutions to resolve these conflicts.
- The judicial system is too slow, too costly, and unpredictable.

Source: Galaz, V., *Privatizing the Commons, Natural Resources, Equity and the Chilean Water Market*, FLACSO, Santiago, 2003 O, Santiago, 2003

# Final words

- The need to have new institutional arrangements.
- The separation between the economic, the social and the environment
- A neo-liberal approach to adaptation?

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