



INTER-AMERICAN INSTITUTE FOR GLOBAL CHANGE RESEARCH

Climate change and irrigated agriculture towards a better understanding of driving forces and feedbacks between decision makers and biophysical environments and their impacts on hydrological cycle and land use (SGP-HD003)

Increasing competition for water resources together with changes in temperature, precipitation and runoff affect agriculture. Access to irrigation water is key to reduce the impacts of climate variability and change on food security and regional economies. As a consequence, farmers need to adapt strategically, switching crops, changing sowing dates, increasing irrigation and possibly even selling land and/or water use rights. These decisions in turn will reshape problems and opportunities for land use, and will change irrigation and water management needs. Such feedbacks between decision processes and the biophysical environment need to be understood if adaptation research is to be policy relevant.

Goals

- Evaluate the impacts of climate and land use change on irrigated agriculture and characterize feedbacks between environment and adaptation decisions
- Assess changes in water demands and irrigation needs at the regional level in response to changes in hydrometeorological conditions and land use
- Characterize the socioeconomic conditions of decision makers
- Estimate the productivity of irrigated areas as a function of water availability (baseline scenario)
- Analyze the vulnerability of water and land use systems
- Develop and test methods to communicate research results
- Identify and evaluate adaptation opportunities for decision makers

Results

- Rio Segundo basin, formerly the “peanut core of Argentina”, has seen a drop in groundnut, livestock production and hay crops in favor of soy bean, the area of which grew almost 18 times, doubling the total agricultural area in little more than a decade.
- In Rio Segundo, precipitation and minimum temperatures steadily increased during the last decades of the 20th century. Globalization and the increased rainfall together contribute to the agricultural expansion in the area.
- The main perceived climate risks affecting agricultural production in Rio Segundo, besides shortages of irrigation water, are early frosts during April and late frost in the middle of November. Farmers also mentioned hailstorms as being particularly damaging to crops.
- What more rains may mean for agriculture is shown by higher precipitation during El Niño years which raised grain yields in summer crops, while lower rainfall in La Niña years reduced yields. The opposite trend was found for wheat (yields higher under La Niña, lower under El Niño). Winter (May-August) precipitation is correlated to the El Niño Southern Oscillation (ENSO).
- Under this often unpredictable rainfall, supplementary irrigation improves grain yields and helps stabilize production. The greatest impact was observed in wheat with yields that more than doubled under irrigation.
- Irrigation systems are an economic strategy to improve the economic position of farmers, rather than an adaptation to local climate change which, in fact, has revealed a tendency to increase humidity.
- The vulnerability of permanent water rights under two climate change scenarios was analyzed for the Maipo river basin. The probabilities are that these water rights may fail the increased demand under global warming in up to 40-50% of the cases, compared to the current 6-20% failure rate. While water rights may provide the same yields under future climate change, their adaptation will be imperative.

Principal investigator and lead agency

Francisco J. Meza - fmeza@uc.cl

Facultad de Agronomía e Ingeniería Forestal, Pontificia Universidad Católica de Chile

Co-investigators

Guillermo Donoso, Luis Gurovich, Horacio Gilabert (PUC, Chile), Daniel S. Wilks (Cornell University, USA), David Letson (UM/RSMAS/Marine Affairs and Policy, USA), María Isabel Travasso (CIRN-INTA, Argentina), Enrique Garrido (DMC, Chile)

Links to other IAI projects

This project builds on **CRN 2031 “Land use change in the Rio de la Plata basin: Linking biophysical and human factors to predict trends, assess impacts, and support viable land-use strategies for the future”**, and **CRN 2047 “Documenting, understanding and projecting hydrological changes in the American Cordillera”**. Master fellowships have been granted in collaboration with **CRN 2031**.

List of publications: <http://iaibr.ljai.int/bs?publications/SGPHD003.pdf>



Maipo River Basin, Chile



View of the Maipo River at El Manzano, Chile



Recent land cover changes: Citrus and wineyards in Melipilla, Chile



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