Assessing the Impact, Vulnerability and Adaptation of Agroecosystems to Climate Change in Entre Ríos, Argentina

Ana B. Wingeyer, Octavio Caviglia, Ricardo Melchiori
Instituto Nacional de Tecnología Agropecuaria, Estación Experimental Agropecuaria Paraná, Ruta 11 Km 12,5, 3101 Oro Verde, Entre Ríos, Argentina. *wingeyer.ana@inta.gob.ar*

Rationale

Climate change has an important impact on agriculture productivity, challenging stable food supply by droughts, floods, heat, torrential rains and hail events. Agriculture contributes to climate change with emission of greenhouse gases (GHGs) (Figure 1). On the other side, some of the impacts of climate change like the increase of spring-summer precipitation, higher temperatures and less days with freezing temperatures in some areas have helped agriculture to move into marginal areas. The need to assess the impact of, and vulnerability, mitigation and adaptation to climate change of agroecosystems ranges from stakeholders to policy makers across the globe. The National Institute of Agricultural Technology (INTA, Argentina) has a National Program that includes research and extension to evaluate the impact, and develop practices to mitigate and improve adaptation of agroecosystems to climate change. Our objective is to present a framework to assess the climate change impact, vulnerability and adaptation at the regional level in Entre Ríos Province, Argentina. This framework is proposed in two steps: 1) Assessment of Impact and Vulnerability of agroecosystems across the landscape; 2) Assesment of Adaptation and Mitigation strategies for across the landscape.

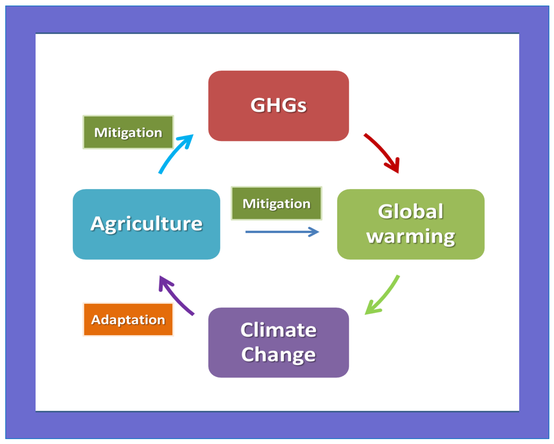

Figure 1. Agriculture contributes to and it is impacted by climate change. Mitigation and adaptation strategies can be developed to sustain food production under modified scenarios.

Definitions[1]

Adaptation: refers to the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damage, to take advantage of opportunities, or to cope with the consequences.

Climate change: changes in the mean and/or the variability of climate variables that persists for an extended period, typically decades or longer.

Mitigation: refers to reduce the impact of agriculture on climate change by reducing GHG emissions and/or increasing C sequestration, and by reducing surface warming.

Vulnerability: is the degree to which an agricultural system is susceptible to, and unable to cope with, adverse impacts of climate change

[1]IPCC 2014. Glossary of Terms used in the IPCC Fourth Assessment Report. http://www.ipcc.ch/pdf/glossary/ar4-wg1.pdf

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Framework Development

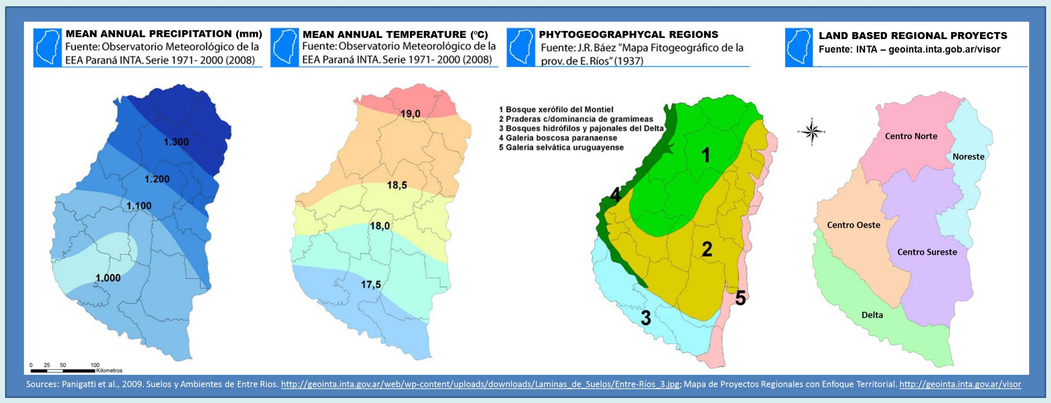
Context: This framework is proposed in the context of the project "Climate and Climate Change" of INTA. The main goals of the Integrated project are:

- Identify regional productivity under modified climatic scenarios.
- Quantify the vulnerability of production systems to climate change.
- Identify actions to reduce risk associated to climate change.
- Quantify GHGs emissions from agriculture.
- Identify measurements to reduce GHGs.
- Propose actions for adaptation to and mitigation of climate change.
- Organize a platform for exchange of research findings on climate change
- Identify and propose new research needs.

Source: http://inta.gob.ar/proyectos/pnnat-1128021

Strategy: research and extension activities of INTA are based on integration of disciplines on the landscape through the Land Based Regional Projects (Proyectos Regionales con Enfoque Territorial).

Region: Entre Ríos Province (32º S 59 º 20' W) extends over 7.6 mill ha and has vast hydrographic resources. Climate ranges from subtropical without dry season (North) to temperate (South), with average annual precipitation of 1100 mm. Mean temperatures average 23 ºC during summer and 8 ºC during winter. Native vegetation includes xerophytes, temperate grasses, and subtropical shrubs and trees. Soils include Vertisols, Mollisols, Alfisol, Entisols, and Inceptisols. Main agroecosystems include cash crops (soybean, wheat, corn, sorghum and rice), citrus farms, and beef and dairy cattle ranches, and forestry. Based on climate, physical environment, and socio-economical features, the province has been divided in 5 main research and extension regional projects.



Impact and Vulnerability Assessment

The impact of climate change on agroecosystem´s indicators can be either positive or negative. It is proposed to base the framework on four *target characteristics:* ***Productivity (P), Resilience (R), and Carbon and Water footprints (C/W)****.* Vulnerability to climate change on agroecosystems is the outcome of the interaction of 3 main features: climate, the physical environment and the management. Thus agroecosystem´s indicators will be evaluated on different combinations of these features over the landscape. This evaluation will be repeated using modified climatic scenarios to evaluate vulnerability to climate change. Information from research studies in the region will be also used to incorporate the potential impact of management on impact and vulnerability.

Sources of information:

Climate: Climate and Water Institute (INTA), Hydraulic Department of Entre Ríos, Weather Stations (INTA, EEA Paraná).

Physical Environment (soil, water, vegetation): http://geointa.inta.gov.ar/visor/, EEA Paraná – GIS Laboratory.

Management and Production: INTA, Cereal Market of Entre Ríos, Grower associations and organizations.

Expected Outputs: regional maps for different agroecosystems depicting P, R, and C/W indicators under current climate conditions, and projected climate scenarios.

Adaptation and Potential Mitigation Assessment

Short term adaptation strategies: Information from Impact and Vulnerability Assessment of agroecosystems will be used to identify management strategies already used by farmers/ranchers that result in reduced vulnerability or improved performance.

Mid term adaptation strategies: Information from the Impact and Vulnerability Assessment with research data will be used to identify improved management strategies not used by farmers/ranchers to reduce vulnerability or improve performance of farming practices, which can be adopted through extension/demonstration.

Continuous adaptation: Information generated during the Impact and Vulnerability Assessment under potential scenarios of climate change will be used to identify research needs for adaptation to climate change.

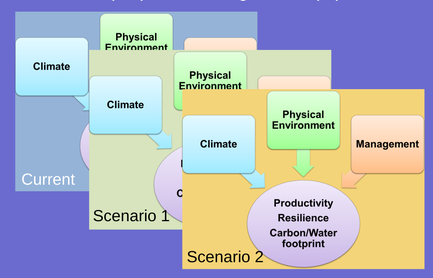
Potential Mitigation: Information already available and generated by research in the region will be integrated to estimate landscape scale GHGs emissions of agroecosystems and the potential mitigation of GHGs by the adaptation measurements proposed.

Expected Outputs: regional maps for different agroecosystems depicting P, R, and C/W indicators under current climate and projected climate scenarios with the adoption of short and mid term adaptation strategies.

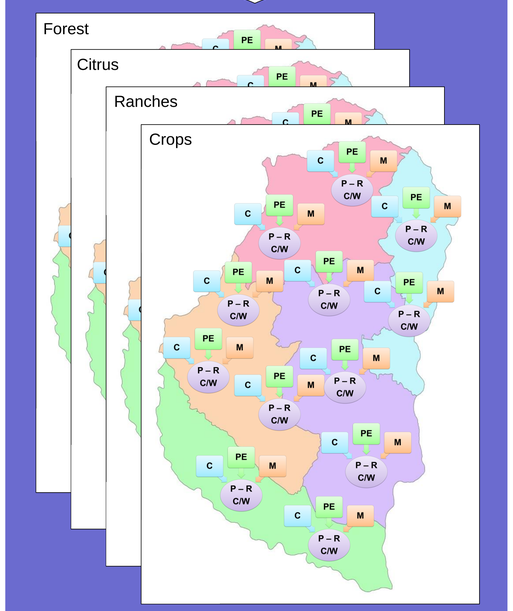
Public Awareness of the results generated will be achieved through extension activities.

Expected Outcomes: Improve the productivity and reduce vulnerability to climate change of agricultural firms in Entre Ríos.

Assessment of Impact and Vulnerability in the territories will involve evaluation of agroecosystems Productivity (P), Resilience (R), and Carbon and Water (C/W) footprint. Influenced by climate (C), physical environment (PE) and management (M)



This evaluation will be repeated for different climatic scenarios, and also using research data



Integrated over the landscape, P, R, and C/W indicators will be assessed with improved management strategies to reduce vulnerability to climate change.