

Cooperation on Water management issues, Argentina

Project in the framework of Bilateral Cooperation between
Argentina and the Netherlands

Inception report

Dr. E.P. Querner



Wageningen, May 2006

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This project is carried out with support from the Ministry of Agriculture, Nature Management and Fisheries of the Netherlands in the framework of Bilateral Cooperation.

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1 Introduction

Within the framework of Bilateral Cooperation of the Ministry of Agriculture, Nature Management and Fisheries of the Netherlands, a project will be carried out to find solutions for the water management problems in Argentina. The Pampas suffers from too much water and agriculture is hampered; the Province of Mendoza has a semi-arid climate and has too little water. Further details of the problems are given in the introduction of the work plan (Chapter 4).

The cooperation is carried out with two institutes from Argentina:

INA-CRA, Instituto Nacional del Agua; Centro Regional Andino (Mendoza) and INTA, Instituto Nacional de Tecnología Agropecuaria, Instituto de Clima y Agua (Castelar, Buenos Aires Province).

The first activity of the projects is an inception phase in which the project is formulated in more details together with the partners from Argentina. An inception mission was carried out to Argentina by Dr. Erik Querner of Alterra to Argentina from the 17th – 28th of April. The report of the visit is given in Annex 1.

In the discussions with INTA and INA-CRA the objectives of the project, the pilot studies and time table were discussed. Further details on the cooperation with both Institutes for the project are given in Chapter 2 and 3. Information on the selected pilot areas is given in Annex 2 and 3.

During the inception phase a work plan for the project has been elaborated in more detail, as given in Chapter 4.

Applications for Fellowship

Part of the project is the exchange of knowledge in using hydrological tools to give solutions for the water problems in Argentina. For this activity applications will be submitted for two fellowships from LNV (via Wageningen International). Training for one person from INA-CRA and one from INTA to Wageningen is envisaged to take place in spring 2007.

2 Cooperation with INTA: Institute of Water and Climate

At INTA the cooperation will be linked to their project they are formulating concerning the flooding of the Humid Pampas: 'Desarrollo de Tecnología para el Ordenamiento Hidrológico Superficial y el Control de Excedentes Hídricos'.

The Humid Pampas is suffering from increased rainfall and as a result serious flooding occurs.

Objective of their study:

To assure sustainable rural development through integrated water management on a river basin scale for the Humid Pampas to control the excess of water.

Specific Objectives:

- To simulate and to predict hydrological phenomena for a short, medium and long term perspective, through mathematical models to obtain relations for cause versus effect;
- To identify, analyze and quantify water flows (excesses, drainage and water storage) in the study area and analyze possible alternatives of handling the water, using groundwater and changes in land use: study its efficiency and impact on the environment;
- To stimulate the cooperation between experimental stations, agencies of extension of INTA and other organizations that have responsibilities in water management;
- To set criteria of water handling on a river basin scale;
- To train personnel in the use of hydrological models that adapt to the hydrological characteristics of Argentina;

Pilot area:

Region Noroeste (the Northwest region of Buenos Aires Province) with focus on the area around Pehuajó. For a description of the area see Annex 2.

Tentative scenarios to study:

- Effect of forestation;
- Change of cropping patterns: agricultural crops in dryer years and pasture in wetter years;
- Storage of water in dedicated areas;
- Improvement of drainage conditions.

Time table:

- Field measurements: from July 2006 onwards;
- Collection of field data, digitizing and conversion to GIS files: Aug – Nov 2006;
- Build SIMGRO model of study area and model calibration: in 2007;
- Scenario analysis: 2007 and 2008;
- Final report: 2008.

3 Cooperation with INA-CRA Mendoza

For INA-CRA the cooperation will be linked to their project: 'Modelación hidrológica de la cuenca norte de Mendoza'.

Mendoza Province is a semi-arid region where irrigation is crucial for agricultural production. The available water resources are heavily exploited and the study should focus on the wise use of the water resources.

Objective of their study:

To assure sustainable rural development through integrated water management on a river basin scale and the wise use of water in irrigated areas

Specific Objectives:

- Analyze the feasibility to improve the water allocation in the areas irrigated by Mendoza River;
- To give solutions to reduce the soil salinization.
- Analyze the effects of changes in the river basin on the efficiency of the irrigated areas within the basin (Malargue River Basin);

Pilot area:

The irrigated areas by Mendoza River and further the Malargue River basin with special focus on the wise use of water in a River Basin with conflicting interest: water for agriculture and water for nature. For a description of the areas see Annex 3.

Tentative scenarios to study:

- Changing of the water allocation in the irrigated areas;
- The effects of water losses from the irrigation canals;
- The effects of land use changes.

Time table:

- Collection of field data, digitizing and conversion to GIS files: Aug – Nov 2006;
- Build SIMGRO model of study area and model calibration: from Sept 2006 onwards and first half of 2007;
- Scenario analysis: 2007 and 2008;
- Final report: 2008.

4 Work plan: Water Management Argentina

1. Project definition

1.1 Problem statement

In Argentina parts of the country have problems encountered from too much water or suffer serious water shortages. Since the 1970's, rainfall has considerably increased in the Humid Pampas. This increase in rainfall regime has resulted in serious flooding. A recent spell of wet years has increased the problem drastically. By November 2001, about 5.5 million km² of agricultural land was flooded or semi-permanently waterlogged, resulting in 900 million dollars losses and disrupting rural life for years to come.

The Province of Mendoza (central western part of the country) contains more than twenty percent of the total irrigated land in Argentina. As the annual average rainfall is approximately 200 mm, irrigation is crucial for agriculture. The important problems observed in the Mendoza river basin are the water shortages; salinization of water and soil; contamination of both superficial water and groundwater because of human activities; the rigid distribution of surface water and a reduction in farmers interest in these problems. The construction of the Potrerillos storage dam enhances these problems even more and it requires an innovation of the actual water management to solve the problems by applying hydrological modelling.

1.2 Background

Co-operation on water management aspects between Institutes in Argentina and Alterra started in 2003 after a mission by dr. E. Querner to Argentina funded by the Dutch Embassy (Nov. 2002). Since then Alterra has provided some assistance for the assessment of the hydrology in rural watersheds and the impact of both natural factors and human intervention. Recently requests were made by INA and INTA to strengthen the cooperation, because they want to apply the hydrological model SIMGRO as a decision support tool for the water problems in the Pampas and for the irrigated area in Mendoza Province.

1.3 Project objective

To strengthen the co-operation between governmental organizations in Argentina and The Netherlands in the field of water management for food production and ecosystems. This cooperation intends to use decision support tools in order to give solutions to the problems in Argentina in the field of water management for agriculture, a crucial factor for food production. The envisaged solutions should lead to sustainable rural development and a wise use of the water resources. The project will focus on carrying out two case studies, one in the Pampas and the other in an irrigated area in Mendoza Province.

For INA-CRA and INTA the Dutch experience in water management issues and especially the modelling tools are essential for them to analyse their problems and give solutions for sustainable development. For INTA the cooperation will be linked to their project initiative they formulated recently for the problems in the Pampas: 'Desarrollo de Tecnología para el Ordenamiento Hidrológico Superficial y el Control de Excedentes Hídricos'. For INA the activities will be in relation with the Project: 'Modelación hidrológica de la cuenca norte de Mendoza'.

The main objective for INTA and INA are:

- To assure sustainable rural development through integrated water management on a river basin scale and the wise use of water in irrigated areas
- To use decision support tools to give solutions for their water problems
- To model the dynamics of groundwater levels and drainage using the hydrological model SIMGRO.
- To contribute to the understanding and dissemination of information related to the regional hydrology making it available to the scientific and regional communities in Argentina.
- Capacity building in the field of rural hydrology within their organizations.

Objective for our Ministry of Agriculture:

- Demonstrate in case studies the wise use of water for food and ecosystems;
- Stimulate the cooperation between Argentina and the Netherlands in the field of water management.

Target groups for the research project in Argentina are: Farmers; Rural NGOs; Private consultants; Ministry of Social Development, National Under Secretariat of Water Resources.

1.4 Project results

For 2006 the following outputs are envisaged:

- Report of Inception phase;
- Pilot studies in the Pampas and in Mendoza Province to give recommendations for the wise use of water (focus in 2006 on collection of field data and model build up);
- Inventory of training needs for Argentine staff and applications for fellowships LNV (Wageningen International), to be carried out in 2007;
- Report of Dutch students from their thesis in Argentina;

2. Approach

The project will use hydrological modelling tools to develop insight in the relation and interactions between water use for food production and ecosystems, as a basis for sustainable water management in Argentina. The training of two persons from Argentina in the use of the SIMGRO model is envisaged to take place at Alterra in 2007, using fellowships of LNV.

A pilot study in an area of the Pampas and in an irrigated area in Mendoza Province will be set up by INA and INTA. The collection of data and model set up will be carried out by the Argentine partners, with the assistance of Alterra. Research topics for Dutch students will be described together with the Argentine partners and carried out by students partly at Alterra and partly at institutes in Argentina. For the pilot areas a scenario analysis should give solutions for the problems encountered, among others: human intervention, salinity control and the management of ground water.

The following activities are envisaged:

- Inception workshop with Argentine partners (April/May 2006);
- Define pilot areas for regional studies (Pampas and Prov. of Mendoza);
- Inventory of training needs Argentine staff and research topics for Dutch students;
- Application for training of Argentine staff at Alterra (Fellowships);
- Dutch students will do a thesis carried out partly at Alterra and at institute in Argentina.

3. Management plan

3.1 Cooperation

The project is carried out in collaboration with INTA, Institute of Water and Climate in Buenos Aires and INA-CRA in Mendoza.

3.2 Time frame

For 2006 the inception workshop will take place in April/May 2006, where the pilot studies will be defined and data collected follow (Argentine partners). Some minor improvements to the SIMGRO model are envisaged in the period June-Sept because of the conditions encountered in Argentina. The model applications for the pilot areas will start in October.

The overall time frame for the project is:

Item	2006				2007				2008			
	1	2	3	4	1	2	3	4	1	2	3	4
Inception phase												
Tools and training												
Pilot studies												
Final Reporting phase												

3.3 Division of roles and responsibilities

Alterra: Advise on regional hydrological modelling; improve hydrological tools and training
 Argentine counter partners: Carry out the studies in the pilot areas.

Participation of Wageningen University for thesis of students from the Dept. of Hydrology and Quantitative Water Management are envisaged.

Further cooperation in the framework of this project is envisaged with other Dutch organisations like a Water board and ITC Enschede.

3.4 Reporting and communication:

A half yearly report will be made on the progress and the activities carried out.

5 Conclusions

The work carried out during the inception phase will be a good basis for future co-operation between Alterra, INTA and INA-CRA.

6 Acknowledgement

The author thanks the staff of INA-CRA from Mendoza and INTA Castelar for their hospitality and valuable discussions during the inception mission.

Annex 1 Report of inception mission, April 2006

17-18th of April:

Flight to Buenos Aires

19th-20th of April:

Worked at INTA Castelar with Graciela Rebori and Damiano Francisco. Discussed their project proposal and the Bilateral Cooperation project for our Ministry of Agriculture (LNV). They informed about their activities in the Humid Pampas region. They have formulated a project concerning the Flooding of the Pampas called: Development of Technology for Excessive Surface Water in the Humid Pampas. In this project they want to use the SIMGRO model to give solutions for the water crisis in the Pampas.

We discussed objectives, time table and anticipated scenarios for their study in relation to the Alterra project. Further more the required data for the hydrological modelling was given attention and information on the fellowship of LNV was exchanged. INTA would also like to apply the Simgro model to the Carcarana area in Santa Fee Province. In the Carcarana area they have set up field experiments of forest plantations, one of the solutions to consider in the reduction of the flooding.

22nd of April:

Flight from Buenos Aires to Mendoza..

24th-26th of April:

Worked at INA-CRA (dr. J.A. Morábito). We exchanged information on the related activities of INA-CRA and Alterra on each others projects. We discussed the time frame of the cooperation; possible pilot areas for the study and the training. Information for the inception report was compiled. We discussed the writing of a joint paper about the work carried out.

With Diego Tozzi and a student from the Agricultural University discussed the Simgro applications of Lavalle area. For the irrigation application data on land use in GIS format was compiled. The AlterraAqua procedures were followed and input files for the Simgro model were obtained. The model was run for the irrigation season of 1997 and 1998. Improvements to be done are: extract the water from a tertiary unit and give procedures to allocate water to the secondary. We discussed the writing of a joint paper about the work carried out.

27th – 28th of April:

Return flight to the Netherlands.

Annex 2 Pehuajó pilot area

In the Province of Buenos Aires the Salado River basin is the major river draining parts of the Pampas. The region is well known for its cattle and grain production. Originally the basin was about 90,000 km², but recent human interventions increased the drainage area to about 140,000 km². The Pampas is a flat grassland region, humid, with a poorly developed drainage network, low soil infiltration, and high wildlife diversity. The Salado basin has three remarkable features:

1) floods and droughts are frequent events; 2) ecosystems are adapted to the wide fluctuation in water levels, and 3) the wealth of the terrestrial fauna, fishes and birds provides an economic potential, either of productive or recreational value.

In the basin a gradient in land use intensity is found: larger populations, more agriculture land use and industries are in the upper part of the basin and the most important natural reserve of Buenos Aires Province, a Ramsar site, is where the Salado River drains into the Plate River. Human interventions have caused noticeable changes such as: 1) an increase in the drainage area with water from the west has disrupted the seasonal pattern of water flow and increased the size of the runoff; 2) water quality shows an increase in salinity which in turn may alter the potential use of the marshes; 3) the amount of pollutants (organic matter, agrochemicals and heavy metals) carried away by surface water is on the rise. As both the construction of channels to reduce the flooding and agricultural intensify, one priority has to be to preserve the structure and functioning of natural ecosystems.

The pilot area for this study is a very wet area around Pehuajó. Pehuajó is situated approximately 350 kilometres southwest from Buenos Aires (see figure 1). The study area is about 320,000 hectare and is very suitable to study the different solutions to reduce the flooding in the Pampas. Figure 2 shows an example of semi-permanent flooding near the town of Pehuajó.

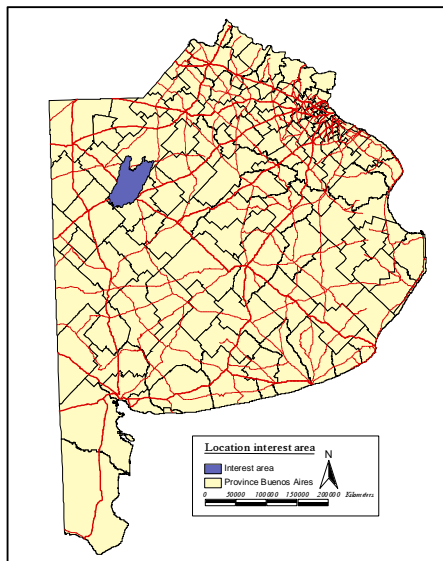


Figure 1 Location of the Pehuajó area in the Province of Buenos Aires, Argentina.



Figure 2 Semi-permanent flooding of agricultural land near Pehuajó

Annex 3 Pilot areas in the Province of Mendoza

Mendoza River irrigated area

With only 800 km², the Mendoza River basin has more than 800,000 inhabitants and contributes 68% of the provincial GDP, while 25% of its water is used for domestic and industrial purposes. The main crops grown in the irrigated areas are: grapes, fruit trees, olives, summer and winter vegetables and grass. The altitude of the area varies between 1200 and 570 m above mean sea level. In the higher parts, phreatic levels are relatively deep and in the lower parts they are shallow, resulting in water logging and salinization. The decentralized and participatory management model for the irrigation management, in force for more than 100 years, has still problems that affect water distribution, maintenance and, above all, water use control. The area's mean irrigation application efficiency is therefore poor, being 59%. Soil salinity is increasing in the areas with high groundwater tables. The recent construction of the Potrerillos dam in the Mendoza River will allow river regulation and scheduled delivery to users in the irrigation areas. Given this complex situation, an integrated study of the Mendoza River becomes mandatory in order to devise a proposal to supersede the current management model and the sustainability crisis that is bound to occur in the oasis. Figures 3 and 4 gives an impression of the area. Figure 5 shows the abandoned land due to an increase in soil salinity.



Figure 3 – Irrigation canal with water from Mendoza River



Figure 4 – Vineyards in the upper part of the area irrigated



Figure 5 – Example of soil salinity in the area with high ground water levels

Malargue River basin

The Malargue River basin is situated some 420 km south of Mendoza city and has an area of about 4600 km² (Figure 6). In the basin there is situated the Llancanelo lagoon and nature reserve, which was declared as a Ramsar site in 1995. The semi-desert ecosystem is located at the foot of the Andes mountains (see also Figure 7). The lagoon is approximately 40,000 ha and there are different types of “humedales”: seasonal lakes of fresh water and lakes of saline-alkali water. The area is an important area for birds and is a resting place on the migration routes. Some 73 different kind of birds have been reported, incl. the flamingo and the white and black swan. Around the lagoon the soil is very saline (sodium) and has a low level of organic mater. Under these conditions halophytes and xerophytes vegetation is growing (*Atriplex* sp., *Suaeda* sp., *Prosopis* sp., etc.). The seasonal variation of the water level in the lagoon depends on the inflow from the Malargue River and local streams.

The nature reserve suffers from two problems. On one hand the increasing population of Malargue city and its demand for drinking water and further more water from the river is

used in an irrigated area of about 2,700 hectares. As a result of the water use, the water level in the lagoon is slowly declining. Further threats are the exploitation of a number of oil extraction wells within the nature area.



Figure 6 - Mendoza Province and the city of Malargüe situated 400 km to the south.

Figure 7 - The Andes mountains in the west and the Llanquanelo lagoon

