

# Is the agricultural production of the upper basin of Pergamino stream responsible for soils and water degradation?

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## INTRODUCTION

The uncertainty associated with soil and water quality in the Argentinean Humid Pampa region is difficult to evaluate, especially the environmental impact of agriculturalization on ecosystem services.

## OBJECTIVE

To dimension the contribution of the production systems that are practiced in the upper Pergamino stream basin -strictly under agricultural use- to the degradation of soils and water.

For this purpose, annual element balances (N, P, SO<sub>4</sub>, Ca, Na, K), nitrate concentrations and pesticides presence (glyphosate, atrazine, clorimuron, dimethoate, epoxiconazole, tebuconazole and metconazole) were measured in groundwater and surface water.

## METHODOLOGY

Study area: upper Pergamino stream basin, Buenos Aires-Argentina (966 km<sup>2</sup>).

Land use: strictly under agriculture (breeding cattle in low-land and grain crops in mid-and up- land).

### Nutrient balances

Inputs: Atmospheric deposition, fertilizers and biological nitrogen fixation (50% for soybean).

Outputs: nutrient loads in surface water at the exit of the basin, leaching, volatilization from soil and exportation by grain and cattle.

### Nitrate and pesticides

Surface water: pesticides presence at the basin exit.

Groundwater: nitrate content and pesticides presence in 24 wells distributed in 5 sub-basins.

## MAIN RESULTS

### Nutrient balances

- Were negatives for all nutrients.
- N and P fertilization were lower than fertilization rates.
- N output was three times higher than input and biological N fixation (by soybean) did not compensate this output.
- The high amount of SO<sub>4</sub>, Na, Ca and K transported by the stream was due the stream borns in saline/alkaline soils developed on sediments of high salinity and concentration of sulfate and also due to the increase in the drainage produced by the construction of artificial canals.

### Nitrate and pesticides

- **Surface water (basin exit):** nitrate was not identified while all pesticides were detected in spring, summer and autumn, except for glyphosate and atrazine, which were also detected in winter.
- **Aquifer base:** nitrate concentration never exceeded the established threshold for human consumption (45 mg l<sup>-1</sup>). Pesticides were detected in ~ 50% of the wells, except for atrazine, which was detected in all of them.
- **Water table level:** 9% of measurements exceeded the threshold for human consumption. In relation to pesticides, chlorimuron was detected in 26% of the wells, glyphosate, dimethoate, epoxiconazole, tebuconazole and metconazole were detected in 63% of cases while atrazine was detected in all of them.

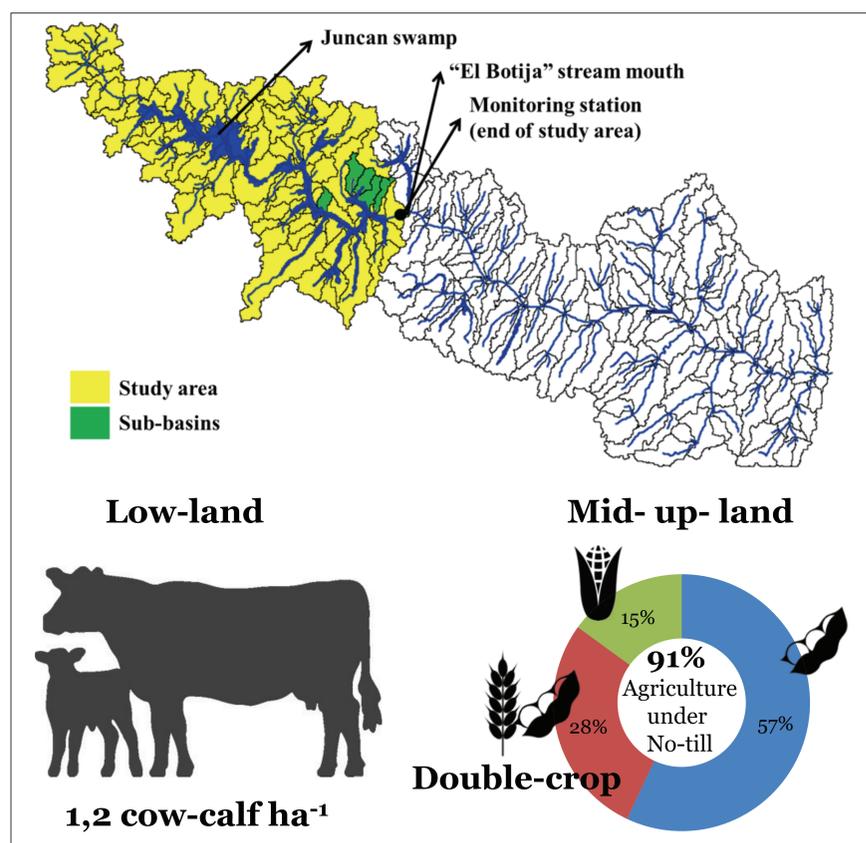


Fig. 1: Study area and production systems characteristics.

Element	Input		Output				ΔE	
	AD	Fert	BE	Gr	Cat	Lix		Vol
	kg ha <sup>-1</sup> year <sup>-1</sup>							
N	6.1	20.5	5.9	82.0	3.1	5.3	3.0	-72.7
P	na	12.7	1.3	17.7	0.1	0.0	-	-6.4
SO <sub>4</sub>	7.2	21.8	2513.1	26.6	0.8	0.0	-	-2511.5
Ca	3.3	2.0	160.6	7.0	0.0	50.4	-	-212.7
Na	12.3	sd	2407.9	sd	sd	322.0	-	-2717.6
K	3.1	0.0	128.5	46.0	0.3	32.8	-	-204.5

Tab. 1: Nutrient balances in the upper Pergamino basin

## CONCLUSION

- The system produces food and energy, but it is not efficient since it affects water quality and some soil ecosystem functions.
- The main cause could be associated with the loss of soil organic matter (~ 40% after 120-150 years of continuous agriculture), since it governs most soil functions.
- Cover crops inclusion could reduce nitrate leaching risk.
- The generalized spatiotemporal distribution of atrazine, when corn occupies only 15% of the surface, is worrisome.