The Environmental Monitoring Network of Riegos del Alto Aragón (Spain)

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Introduction

Irrigation in Spain accounts for 14% of the arable land and 50% of the agrarian product (MAPAMA 2017) and is a key sector in the maintenance of population in rural areas (Ruiz-Olano and Oliván-Villobas 2003). However, irrigation return flows (IRFs) contribute to water pollution by salts, nutrients and pesticides. The General Community of Alto Aragon Irrigation Districts (RAA; 132,000 ha) is located in the NE region of Aragón (Spain), within the Ebro River Basin. Since 2002, some 1.1 Mha (67,000 ha RAA) have been or are being modernized under the National Irrigation Modernization Plans in Spain. The prevalence of irrigation among water users points out the need to assess the environmental effect of irrigation on water quality, in order to preserve water quality and in compliance with the European Water Framework Directive —WFD— (EU 2000).

Objectives

1. To establish the RAA contribution to the pollutant loads in the Ebro River and determine the influence of crop patterns, irrigation and fertilization management on surface water quality.

2. To check the effect of the on-going or recently concluded modernization of the irrigation systems in RAA on water resources availability and water quality.

3. To provide an empirical basis for the development of agronomic/hydrologic models that can be used for minimizing environmental effects of irrigation.

4. To help develop an approach to environmental quality standards based on pollutant loads emitted —not only concentrations.

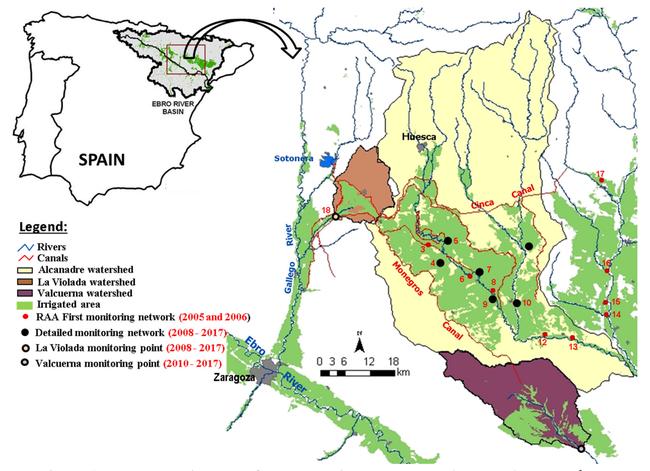
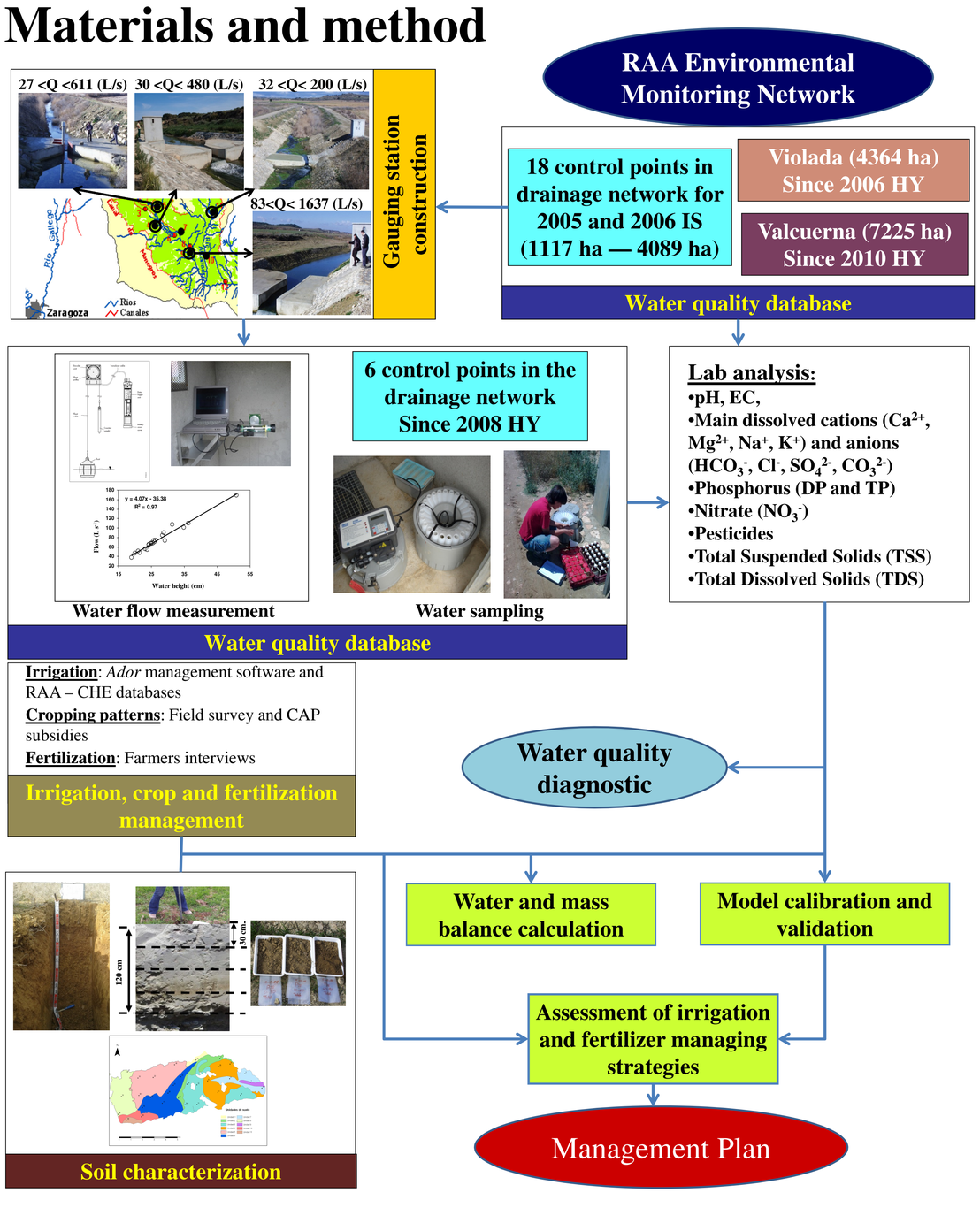


Fig. 1. Location of the Riegos de Alto Aragón (RAA) environmental monitoring network

Materials and method



Results

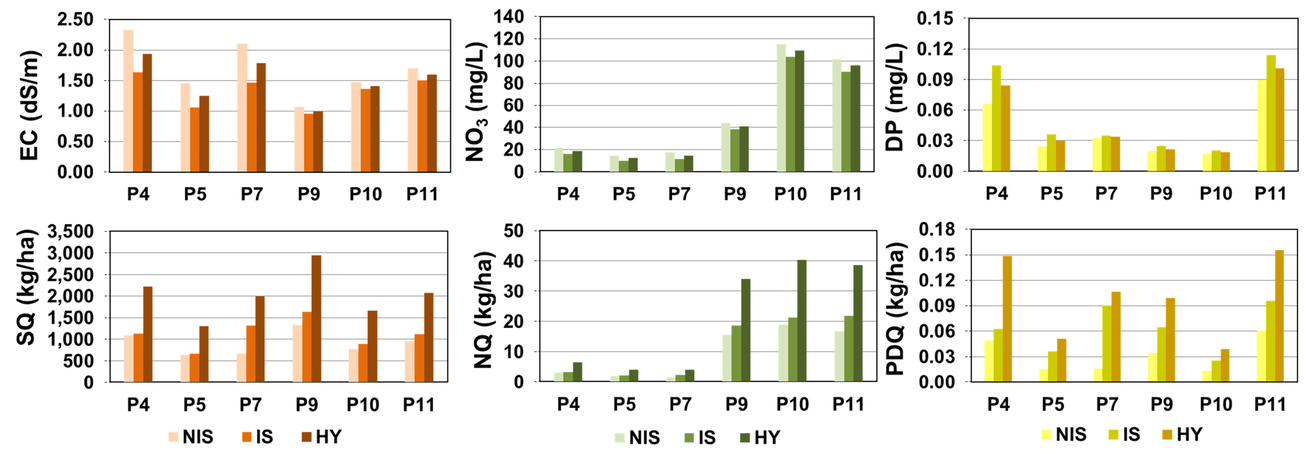


Fig. 2. Electric conductivity (EC), nitrate (NO_3) and dissolved phosphorus (DP) mean concentrations and corresponding exported mass per unit area (SQ, NQ and PDQ) at P4, P5, P7, P9, P10 and P11 monitoring stations. Data include the no irrigation season (NIS), irrigation season (IS) and hydrologic year (HY).

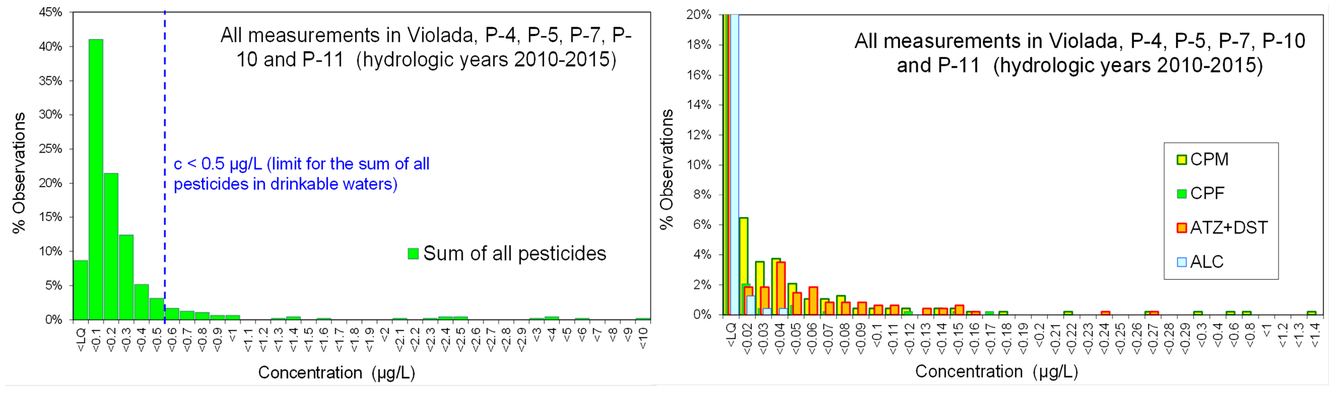


Fig. 3. Frequency histogram for the sum of pesticides (left) and for the most frequent pesticides (right: CPM=cypermethrine, CPF=chlor-pyrifos, ATZ+DST= atrazine plus desethyl-atrazine, ALC=alachlor) in the 6 monitoring stations monitored for pesticide control from October 2009 to September 2015.

- **The establishment of a monitoring network for IRFs by the General Community of RAA shows that the stakeholders are assuming their role in preserving water quality and complying with the environmental standards in the WFD.**
- **The collected database is essential for guiding future research and establishing corrective measures.**
- **The use of properly calibrated models in irrigated areas offers the chance to propose managing strategies (in irrigation, fertilization and crop management) that may help reduce pollutant loads and minimize the environmental effect of irrigation.**
- **The modeling works at basin scale already initiated in Violada (Cavero et al. 2011) and P-11 (Dechmi and Skhiri 2013) will be continued with a better characterization of soil properties (Jiménez-Aguirre et al. 2017) and the use of crop model DSSAT.**
- **The main outcomes of the modeling process will be the proposal of *Management Plans* directed at reducing pollutant loads from the irrigated areas.**
- **Finally, the results will be disseminated among farmers by means of talks and short notes.**

References

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Acknowledgments

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