

Nitrate and phosphorus in Spanish watersheds

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Contrasting with the situation in many countries of West and North Europe, phosphorus pollution related to non-point sources has not been described as a problem in Spain. However, nitrate pollution in surface and particularly in subsurface waters has been extensively described. In Andalusia (South Spain), there is not any particular concern about phosphorus in water reservoirs. Authorities (Confederación Hidrográfica del Guadalquivir and Agencia Andaluza del Agua) focus the control of the water in river and dams on human consumption: there is a strict control of nitrates but not of phosphorus (only after urban treatments in vulnerable zones, where P concentration should be less than 1 or 2 mg L⁻¹ depending on the population). The application of the European Water Framework is not still completely operative since “the good ecological state of water” is not well defined according to authorities (personal communication from Conf. Hidrográfica del Guadalquivir). Only the limit in the old “pre-drinking” water directive is still considered (less than 0.7 mg P₂O₅ L⁻¹ in water for human consumption).

The authority responsible of the water control in the Guadalquivir Valley (around 80 % of the surface of Andalusia) (Conf. Hidrográfica del Guadalquivir, www.chguadalquivir.es; in Spanish), has 149 stations for controlling water quality. Nitrate and phosphorus is determined periodically in dams and rivers, and chlorophyll content only in dams. It has been described total P concentrations in rivers even higher ranging from 1 to 5 mg L⁻¹ in areas of intensive animal production (river Guadaira). In the final part of the Valley, usual total P concentrations ranged from 0.05 to 0.65 mg L⁻¹, with mean values around 0.2 mg L⁻¹. These concentrations are not far from those described in rainfall simulation experiments or in the monitoring of small watersheds in representative soils of the area (Torrent et al., 2007; Saavedra and Delgado, 2006). There is a constant trend in P concentrations in the last fifteen years, which reveals that no actions have been adopted to control or reduce this concentration in rivers or reservoirs.

More severe has been the policy controlling nitrate pollution as implementation of the European directive on nitrate pollution from agricultural sources (Council Directive 91/676/EEC) with the definition of “vulnerable zones” and control measures of fertilizer application and crop management (<http://www.mapa.es/app/Condiciona/Documentos/Nitratos.pdf>; in Spanish). In these areas, the “rules of good agricultural practices” are obligatory, and restrictions in timing, rates, manure store and application and crop rotations defined.

Besides the control of water quality in river and dams by Water Authorities (Conf. Hidrográficas) depending on the Spanish Ministry of Environment or Regional Governments, there is not any intensive study of runoff water in watersheds or any demonstrative project focussed on the control of non-point pollution. Studies have been usually performed at plot or field scale in different parts of Spain, mainly focussed on the effect of soil properties and agricultural practices on nitrogen or phosphorus losses and frequently related to erosion studies (e.g. Delgado and Saavedra, 2005, 2006; Ramos and Martínez-Casnovas, 2009). During the last nineties, an intensive study about nitrate export from irrigated watershed was performed in Aragón (North East Spain) and some recommendations about N application and irrigation done in order to decrease nitrate loss from soils (Cavero et al., 2003). A project from the National Research and Development Plan funded by the Spanish Ministry of Education and Research was started in 2006 to study water quality resulting from irrigation in several watersheds from North Spain with no published results yet (Dechmi, personal communication). The most serious program was established by the regional government of Navarra (NE Spain) with an intensive monitoring program of two irrigated agricultural watersheds in 1996 to study erosion and water quality (Casalí et al., 2008).

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