

River-groundwater interaction in agricultural watersheds

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Most river basins of Po Plain (Northern Italy) are exploited for agriculture and animal farming, determining diffuse N pollution. River water quality worsens in stretches crossing areas with permeable soils and occurrence of springs. We hypothesize that N excess from fertilizers and manure, combined with flood-based irrigation over permeable soils could drive: 1) vertical N transfer to groundwater, 2) rise of the water table during irrigation period and, 3) replacement of low-nitrate river water used for irrigation with nitrate-rich groundwater. Aims of the work, part of the INTEGRON project, are to quantify the main N sources and sinks at watershed scale, evaluate the risk of water contamination and measure N-rich groundwater input to rivers. Soil N budgets were calculated for Adda and Ticino watersheds and were coupled to experimental field activities. During 2016 we performed reach-scale N balances by seasonal samplings of river water in segments crossing the springs area. At both basins, N sources (mainly livestock manure and synthetic fertilizers) exceed sinks (mainly crop uptake), resulting in a soil N surplus and water contamination risk. In summer, during the irrigation period, where rivers cross the springs area, we measured a marked increase of nitrate in river water and we found that 90% of the rivers flow is diverted for irrigation practices. Concurrently, reach-scale N balances suggested diffuse ingression of nitrate-rich groundwater into the riverbed, replacing part of the abstracted water. Agriculture and animal farming produce an unsustainable pressure in the Po Plain and positive feedbacks for N pollution.