# Landscape management and nutrient transfers through a watershed. How to decrease nitric pollution in the intensive agricultural basin of the Seine (France)?

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Nitric pollution issued from point sources, but especially from diffuse agricultural sources in watersheds, is at the origin of imbalanced nutrients at the river outlet, leading to coastal eutrophication; it is also a threat for producing drinking waters from aquifers and surface water. The control of N pollution is therefore at the junction of the objectives of rehabilitation of the good ecological status of underground and surface waters (WFD, 2000), and of changing land use and agricultural practices for protecting ecosystem functioning by decreasing nitrogen fertilizers. In the Seine basin, N pollution issued from point sources is now rather well treated and is thus relatively low compared to N from diffuse origin. Thanks to the European Water Framework Directive, every agglomeration more than 2000 inhabitants will be indeed equipped with a modern wastewater treatment plant. Therefore the major challenge is nowadays to manage the diffuse pollution issued from agricultural activities. Two complementary challenging directions have been explored using the Riverstrahler biogeochemical modelling approach of large watersheds: 1. the upstream drastic reduction of chemical fertilisation in agriculture and 2. the creation and/or restoration of a more retentive rural landscape including ponds and wetlands.

A pond of about 3700 m2 wide was constructed in order to collect water drained from agricultural fields in the Orgeval basin (Brie region, 30 km East of Paris). A survey of this pond has been realised during three years from 2007 to 2010, including measurement of nitrate concentration at the entrance of the pond and at its outlet. It showed a nitrate abatement decrease up to 50% all the yaer but mainly during spring and summer.

In view of this spectacular effect, we explored the role of ponds at a larger scale. As a first step, we mapped historical ponds of the Seine basin by analysing the Cassini's Map (end of 18th century). At this period there were more than 2000 ponds on the Seine basin, representing about 0.25% of the total area of the watershed. Nowadays most of these ponds have been dried and converted into crop surface, and a challenging question is: how much the rehabilitation of these ponds or the construction of others into the present landscape would improve the water quality, in terms of N pollution? We used the Seneque-Riverstrahler model to explore the question. In some sub-basins the decrease of nitrate concentrations can reach about 30%. Nevertheless the denitrification capacity of ponds seems to be limited by phosphorus. To achieve a noticeable decrease of nitrate levels within the drainage network, it seems necessary to combine the introduction of ponds with a reduction at the source (e.g. organic farming) on targeted areas. Several scenarios have been analysed with the model.