# Pesticide de-contamination of surface-waters as a wetland ecosystem service in agricultural landscapes

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In agricultural landscapes, pesticides can be transported by surface or tile-drained waters to aquatic ecosystems. To dampen pesticide transfer fluxes, vegetative filter strips have been widely implemented. However, in sub-surface tile-drained watersheds, vegetative buffer strips are short-circuited leading to a drastic reduction of their efficiencies. In such situations, artificial wetlands, directly connected to drainage pipe outlets, are suitable and efficient pesticide pollution remediation tools. Artificial wetland implementation and design largely depend on land availability which is particularly critical in Europe where land is scarce. Consequently, off- and in-stream configurations have been developed to collect and treat either a portion (off-stream, in parallel), or all water volumes (in-stream, in a series) generated by a watershed. Other design features also impact artificial wetland efficiency like wetland surface area, water storage capacity, vegetation density, hydraulic residence time, dry-out/fill-in alternations…

Two field experiments were carried out in France to compare pesticide dissipation efficiency of two kinds of constructed wetlands located at the outlet of subsurface tile-drained catchments. The two agricultural catchments were cultivated for similar crops (winter wheat, barley, rape or winter wheat, barley, sugar beet) on waterlogged tile-drained soils.

The Aulnoy artificial wetland was situated in-stream, at the outlet of a 36 ha watershed. It included a deep wetland totaling 9000 m3 water storage capacity. Its volume and surface area ratios to watershed area were 300 m3/ha and 1% respectively.

The Bray wetland was constructed off-stream, in parallel to the main agricultural ditch and associated with an open – close strategy managed by the farmer according to its pesticide applications. This artificial wetland consisted of three vegetated cells in a series with shallow water for a total volume of 330 $m^3$ corresponding to 7$m^3$/ha and 0.5% of a 46-ha catchment.

Inlet and outlet discharges and pesticide concentrations were continuously monitored and helped characterize the seasonality of pesticide export and the removal efficiency of the artificial wetland.

Both artificial wetlands showed positive impacts on water quality despite being attributable to distinct dissipation processes. Significant dilution at Aulnoy, frequently reduced pesticide concentrations below detection levels, making it difficult to discern whether significant degradation or retention were occurring in the wetland. Conversely, the Bray shallow artificial wetland showed significant pesticide adsorption, desorption and degradation. However these processes were limited in the Bray wetland due to insufficient retention time. In addition, it was observed that efficiency was related to pesticide properties. Indeed, strongly sorbing molecules, and those presenting the lowest applied doses in the catchment, were associated with the highest removal rates.