Ecological and nutrient retention effects of river and floodplain restoration: experiences from Denmark

Brian Kronvang and Carl Christian Hoffmann
Aarhus University, National Environmental Research Institute, Vejlsøvej 25, DK-8600, Silkeborg Denmark

River restoration was allowed in Denmark with the Watercourse Act from 1982. Since then, more than 64 large re-meandering projects have been carried out but only a few have included monitoring of the ecological and nutrient retention effects. In this presentation results from re-meandering projects covering small headwater streams (1st and 2nd order), medium-sized streams (3rd and 4th order) and large streams (5th and 6th order). All three re-meandering projects included pre-monitoring and post-monitoring of macrophytes and macroinvertebrates the longest monitoring period being 19 years after re-meandering. We found large differences in the recovery of macroinvertebrate and macrophyte diversity in the three different stream types. The 1st order Gudenå stream had a poorer ecological quality two years after re-meandering work had finished, the 3rd order river Gelså had recovered after two years, and the 6th order river Skjern had already regained or even improved the ecological quality after one year. The nineteen years of post-monitoring in the Gelså case study show that passive restoration by ceasing stream maintenance (weed cutting) can be as effective a restoration measure as active re-meandering of the stream channel.

Most river re-meandering projects carried out in Denmark during the last 8 years are projects initiated as part of the Danish Action Programme II and III for reducing nutrient loadings to the aquatic environment. We have monitoring data from a number of restoration projects showing that the restored hydraulic interaction between river and floodplain results in significant reductions in riverine nitrogen loadings (39-372 kg N ha^{-1} inundated floodplain), whereas the phosphorus loading can both decrease and increase depending on the iron and P content of the rewetted former agricultural soils. However, research data from inundated floodplains shows that the deposition of particulate P on floodplains (10-70 kg P ha^{-1} inundated floodplain) will reduce riverine phosphorus loadings on a longer time perspective. River and floodplain restoration projects as well as ceased stream maintenance are expected to be widely used as a cost-effective mitigation measure for reducing diffuse nutrient loadings to coastal waters as part of the River Basin Management Plans under the Water Framework Directive.