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Mitigation measures for improvement of agricultural drainage water and surface water quality in Denmark

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Nutrient losses from agricultural areas constitute a major cause for the degradation of aquatic ecosystems worldwide. Sixty percent of the area in Denmark is arable land and thus there is a huge need for mitigation measures to decrease the transport of nutrients from agricultural areas to downstream recipients. We discuss results, experiences and challenges for an optimised implementation of nutrient transport mitigation measures targeting agricultural nutrient losses to fresh and marine water. In 2016 the Agricultural Package was adopted by the Danish Parliament and Danish farmers were again allowed to fertilise their crops to economic optimum. To compensate for the consequent increase in fertilisation rates and the potential negative consequences on water quality, a new nitrogen (N) and phosphorus (P) management plan was introduced. This plan consists of measures to mitigate N losses in smaller catchments ($\approx 15 \text{ km}^2$) and knowledge of the N-retention capacity of the individual catchments is used for optimisation of the implementation of mitigation measures. A series of nutrient transport mitigation measures has been scientifically approved for use in this new regulation, and more measures are currently undergoing scientific testing. This study focuses on documenting the nutrient retention effects of already approved nutrient transport mitigation measures, such as restoration of riparian wetlands, lowland fens and swamps, re-establishment of shallow lakes, constructed wetlands (surface flow and subsurface flow), as well as measures not yet approved and still under development such as integrated buffer zones, saturated buffer zones and controlled drainage.