

Comparing two surface flow wetlands for removal of nutrients in agricultural drainage water.

Carl Chr. Hoffmann^{1*}, Charlotte Kjaergaard², Bo Levesen³, and Matthew Cochran³.

1. Department of Bioscience, 2. Department of Agroecology Faculty of Science and Technology, University of Aarhus. 3 Vejle Municipality. * corresponding author cch@dmu.dk

In Denmark there is a growing interest for using constructed wetlands as a mean for removal of nutrients from agricultural run-off, such as drainage ditches and tile drainage systems. We have studied two surface flow constructed wetlands from district Vejle, Jutland, Denmark.

The Vicarage Wetland was constructed in 2006 and put into operation in December 2006. It is the pond type with an area of 877 m² and a volume of 200 m³. The inlet, which stems from a drainage system, consists of a small stream with wet riparian areas with an area of 1222 m² and 103 m² open water. Mean hydraulic load is 3.7 l s⁻¹ giving a mean residence time of 15 hours. The pond is densely covered with macrophytes and algae, while the riparian wetland is completely overgrown with watercress.

The Willowfarm Wetland was constructed in 2008 and put into operation in April 2008. It consists of two ponds with an area of 500 and 1485 m², respectively. In between the two ponds is a small wetland with an area of 745 m². Inlet water comes from a drainage system and mean hydraulic load is 5.7 l s⁻¹, and the volume of the ponds is 90 and 400 m³, respectively, thus giving a residence time of approximately 24 hours. The two ponds only have sparse vegetation cover, while the wetland is covered with grasses.

At the Vicarage Wetland nitrate is the dominant nitrogen species and mean concentration in inlet drainage water is 17.7 mg NO₃⁻-N l⁻¹, while concentration of total nitrogen is 17.9 mg N l⁻¹. Mean concentration of nitrate and TN at the outlet is 14.6 and 15.0 mg N l⁻¹, respectively, thus giving a reduction in concentration of 17 and 16 %. Mean concentration of phosphate, filtered TP and unfiltered TP in the inlet water is 0.029, 0.041 and 0.115 mg P l⁻¹, respectively. At the outlet the mean concentration of phosphate, filtered TP and unfiltered TP is 0.030, 0.042 and 0.082, respectively, and this reveals that there is a net retention of particulate P.

At the Willowfarm wetland the mean inlet concentration of nitrate is 11.8 mg NO₃⁻-N l⁻¹ while mean TN concentration is 12.8 mg N l⁻¹. The mean outlet concentration of nitrate shows a 17 % decrease to 9.8 mg NO₃⁻-N l⁻¹, and TN concentration decreases with 19 % to 10.5 mg N l⁻¹. Mean inlet concentration of phosphate, filtered TP and unfiltered TP is 0.033, 0.062 and 0.162 mg P l⁻¹, respectively, while mean outlet concentration of phosphate decreases to 0.015 mg P, filtered TP decreases to 0.020 mg P and unfiltered TP decreases with 75 % to 0.040 mg P l⁻¹.

The results from this study seem to indicate that constructed surface flow wetlands are able to remove nitrogen and retain phosphorus from agricultural drainage run-off although the nutrient concentrations are much lower as compared to concentrations in wastewater.