Keynote Speech

Wetlands in Agricultural Areas in Sweden to Improve Water Quality and Increase Biodiversity

Prof. Ann Åkerman

Centre for Sustainability Studies, Lund University, Sweden

Eutrophication of lakes and seas with algae blooms, changes in fish stocks and deteriorating swimming water has been a severe environmental problem in Sweden for many years. The reason for this is the increased nutrient losses from arable land due to intensive agriculture, but also the to man-made changes of the hydrology and landscape, particularly during the past two centuries. Community development with the expansion of settlements and roads, and the rationalization of agriculture and forestry, among other things had a major impact on our water and wetland habitats. The area of wetlands has been drastically reduced, lakes have been lowered or drained, and many streams have deepened, straightened or put in tubes. The water is efficiently transported out of the catchment, which implies a decrease of the natural retention capacity of nutrients and an increase of nutrient loads to lakes and the sea. This has also resulted in a drastic loss of biodiversity as many wetland dependent plant and animal species have disappeared. Also the accessibility of areas for human recreation and outdoor activities has declined.

In the catchment of river Kävlingeån in south of Sweden these environmental problems have been very extensive and serious. The catchment occupies a total area of 1200 km2 and characterized by intensive cultivated farmland.

The light gray areas indicate open water in the year 1820 and the darker blue areas indicate open water in 1959. Only 12% of the wet areas remained in 1959 due to draining of wetlands and lowering of the water levels of lakes. (Modified, after P. Wolf, 1956. "Utdikadcivilization" (Drained civilization).

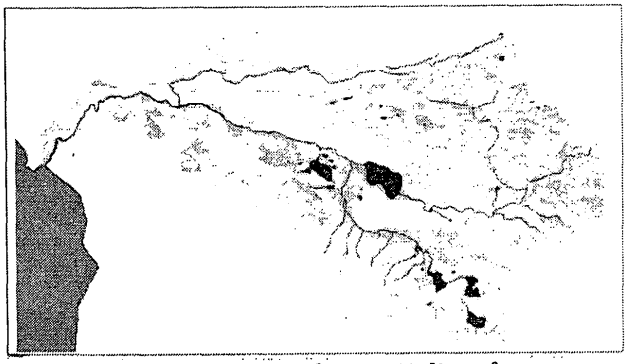


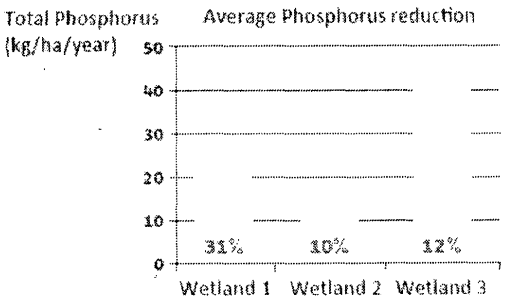
Figure 1.The catchment of riverKävlingeån

Already in 1995, the nine municipalities in the catchment formed a collaboration project to address these environmental challenges.

The main purpose of the project is to improve water quality, reduce nutrient transport and improve conditions for biodiversity and recreation in intensively cultivated farmland.
This paper is about the practical implementation of the project, the different measures used and their effect on water quality and biodiversity.

After more than 15 years of implementation of measures, 360 ha of restored and created wetlands and 224 ha of buffer zones, the trend towards an increasingly drier landscape has turned and the total area of wetlands in the catchment is increasing. This implies an increased natural nutrient retention capacity in the catchment and an increased number of many water and wetland related species in the region.

The total budget for the project in the period 1995 to 2009 was about 15 million USD (107 million SEK). It was largely funded by the participating municipalities,



government and EU. The largest costs consist of payments for construction of dams and wetlands, but also planning, design, land compensation. The costs of monitoring of then environmental effects have also been a large part of the budget.

In order to assess the nutrient reduction capacity of the wetlands, water samples have been taken regularly of in- and outlets of three wetlands. The results show that the temporal variation of the retention is large due to large variations in hydrology and climatic conditions. The variation between different wetland is also great, see figure 2.The Nitrogen retention varies between 450 and 2400 kg N/ha/year and the Phosphorus retention varies between 15 and 47 kg P/ha/year. This is mainly due to different nutrient load to wetlands.

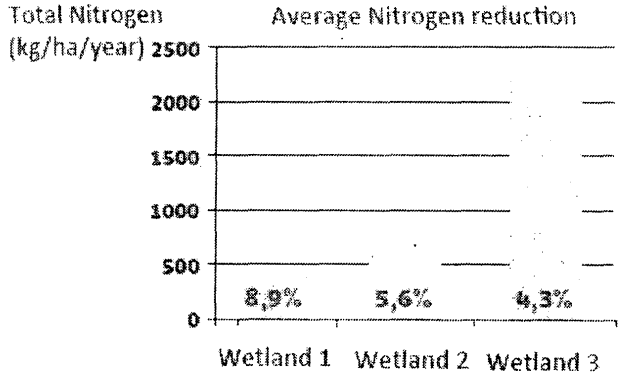


Figure 2: Reduction of nitrogen, phosphorus and in the three investigated wetlands. The bars show the absolute reduction. Each column also indicates the relative reduction in percent.

Studies have shown that wetlands in agricultural landscapes is an cost-effective measure to improve water quality, compared to the cost of nitrogen removal in waste water treatment plants. And if we include other ecosystem service generated by wetlands, for example removal of other chemicals such as pesticides, new recreational environments and the importance for biodiversity, investments in wetlands are a very cost effective measure.

Even if this project is success, the environmental problems are far from eliminated. Improvements have been made, but still the nutrient load is very high and the problems of algal blooms in lakes and oceans remain and the depletion of natural flora and fauna continues to be an urgent problem.