

Synthesis of the Danish Experience with Combating Nutrient Pollution of Surface Waters: The Old Regulatory Approach and a New Targeted Approach Utilising the Natural Attenuation Capacity in Landscapes

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Excess nitrogen (N) and phosphorus (P) emissions to surface waters are a high priority environmental problem worldwide for protection of water resources in times of population growth and climate change. As clean water is a scarce resource the struggle for reducing nutrient emissions are an ongoing issue for many countries and regions. Since the mid 1980s a wide range of national regulatory general measures have been implemented to reduce land based nitrogen (N) and phosphorus (P) loadings of the Danish aquatic environment. These measures have addressed both point source emissions and emissions from diffuse sources especially from agricultural production. Following nearly 4 decades of combating nutrient pollution our surface waters such as lakes and estuaries are only slowly responding on the 50% reduction in N and 56% reduction in P. Therefore, the implementation of the EU Water Framework Directive in Danish surface waters still call for further reductions of N and P loadings. Introduction of a new paradigm of targeted implemented measures was the proposed outcome of a Commission on Nature and Agriculture established by the Danish Government in 2013. Their White Book points to the need of increased growth and better environment through more targeted and efficient regulation using advanced technological mitigation methods that are implemented intelligently according to the local natural attenuation capacity for nutrients in the landscape. As a follow up a national consensus model for N was established chaining existing leaching, 3D groundwater and surface water models. The new model concept enables a calculation of the N dynamics and attenuation capacity within a scale of 15 km². Moreover, several research projects have been conducted to investigate the effect of a suite of targeted mitigation measures such as restored natural wetlands, constructed wetlands, controlled drainage and intelligent buffer zones. The outcome of six Danish management plans for nutrient load reductions to groundwater and surface waters during the period 1990-2014 and the new Danish paradigm for combating diffuse nutrient pollution utilizing a suite of targeted measures will be shared in this presentation.