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AN EMISSION-BASED APPROACH FOR REGULATION OF NITROGEN LOSS FROM AGRICULTURE

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ABSTRACT

Over the past thirty years, nitrogen loss from Danish agricultural lands to marine waterbodies has been reduced by 50%. This has been achieved by implementing nationwide regulations regarding agricultural nitrogen use and farming practices. However, there is substantial variability in geology, hydrology, and vulnerability to eutrophication between catchments, as well as differences in the nitrogen utilization efficiency between individual farms. Thus, overregulation occurs in some catchments while nitrogen loadings fail to reach environmental targets in others. In addition farmers with a high nitrogen utilization is regulated as strictly as farmers with a poor nitrogen utilization. Therefore, nationwide regulation is not cost effective and does not directly reward farmers for maximizing their nitrogen utilization. Moreover, the cost effectiveness of nationwide regulation will be even poorer as further load reductions are implemented. This study aims to develop concepts for an emission-based regulation of nitrogen loss from agricultural land to surface waters on the scale from individual farms to sub-catchments. The emission monitoring concepts are demonstrated in a pilot study in three catchments differing in geology and hydrological conditions. The overall aim is to develop a new regulatory system, where farmers are regulated based on their actual nitrogen emissions, rather setting a quota for their nitrogen application to their crops.

The project investigates three concepts for quantification of nitrogen emissions from single farms or sub-catchments. i) Measurements of nitrogen transport in tile drains. ii) Measurements of nitrogen transport in streams. iii) Measurements of soil mineral nitrogen content (N-min) in the autumn. The focus here will be on the measurement of N-min.

N-min in the autumn is used as a proxy for nitrogen leaching. The relation between autumn N-min and nitrogen leaching is established by measuring N-min on experimental plots, in which leaching is measured with ceramic suction cups. From the measured N-min and knowledge of the nitrogen reduction in the hydrological system, the nitrogen loading to surface waters can be estimated. N-min is monitored on six Danish farms in three small catchments. From the relation between N-min and leaching and the retention in the catchment, nitrogen loss from the individual farms to surface water can be estimated. The

challenges and advantages of implementing a regulation based on N-min measurements will be discussed.