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Trend Analyses of Nitrate in Danish Groundwater

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This presentation assesses the long-term development in the oxic groundwater nitrate concentration and nitrogen (N) loss due to intensive farming in Denmark. Firstly, up to 20-year time-series from the national groundwater monitoring network enable a statistically systematic analysis of distribution, trends and trend reversals in the groundwater nitrate concentration. Secondly, knowledge about the N surplus in Danish agriculture since 1950 is used as an indicator of the potential loss of N. Thirdly, groundwater recharge CFC (Chlorofluorocarbon) age determination allows linking of the first two dataset. The development in the nitrate concentration of oxic groundwater clearly mirrors the development in the national agricultural N surplus, and a corresponding trend reversal is found in groundwater. Regulation and technical improvements in the intensive farming in Denmark have succeeded in decreasing the N surplus by 40% since the mid 1980s while at the same time maintaining crop yields and increasing the animal production of especially pigs. Trend analyses prove that the youngest (0-15 years old) oxic groundwater shows more pronounced significant downward nitrate trends (44%) than the oldest (25-50 years old) oxic groundwater (9%). This amounts to clear evidence of the effect of reduced nitrate leaching on groundwater nitrate concentrations in Denmark. Are the Danish groundwater monitoring strategy obtimal for detection of nitrate trends? Will the nitrate concentrations in Danish groundwater continue to decrease or are the Danish nitrate concentration levels now appropriate according to the Water Framework Directive?