Modelling nutrient emissions into the Baltic Sea from rivers of German catchments 1983-2005

U. Hirt, J. Mahnkopf

* Leibniz-Institute of Freshwater Ecology and Inland Fisheries; Dept. of Lowland Rivers and Shallow Lakes; Müggelseedamm 310; 12587 Berlin; Germany; Tel.: +49 30 6392 4086; Email: mahnkopf@igb-

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Introduction

To implement the European Water Framework Directive (WFD, European Parliament and Council of the European Union 2000) into German law, measures have to be taken to reduce the high nutrient input into rivers and seas. High nutrient emissions come especially from catchments near the coast, due to a high level of tile-drained areas. Emissions from this pathway underlie hardly a nutrient retention. Therefore, a quantification of nutrients emissions into the river systems of this region is undertaken with the nutrient emission model MONERIS. Results led as a base to identify the most effective measures for nutrient reduction in the rivers.

Method

The MONERIS model is applied, which quantifies nutrients emissions into river basins, via various point and diffuse pathways, as well as nutrient load in rivers (Behrendt et al. 2000, 2002, 2003). This conceptual GIS-based model was developed in the research group of the Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB Berlin). Basis of the spatial resolution are analytical units (sub-catchments in a river basin). The German Baltic Sea catchments cover an area of ~25000 km^2, the land use is dominated by arable land (54%), forest (18%) and grassland (16%, Fig. 1).

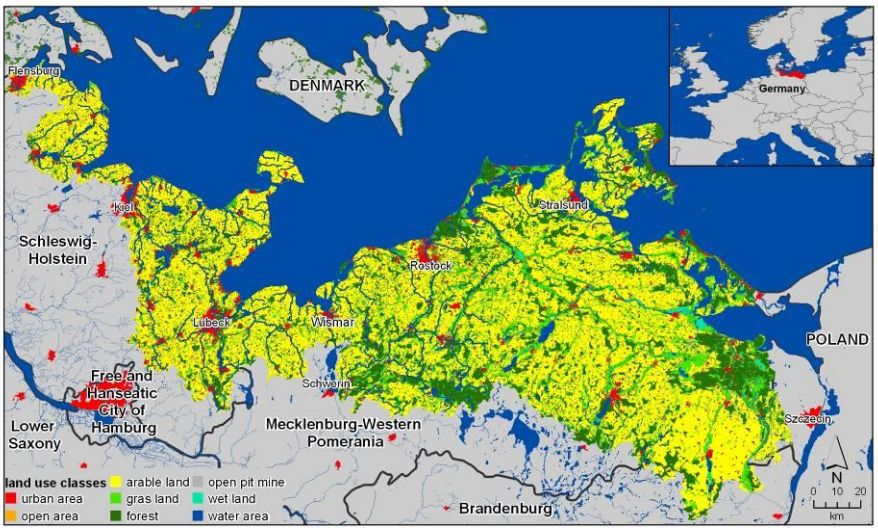

Figure 1. Land use within the German Baltic Sea catchments.

Results

Most nitrogen emissions come from tile drainages (58%), groundwater flow (27%), and point sources (5%), whereas most phosphorous emissions come from groundwater flow (32%), point sources (29%), erosion (17%) and overland flow (10%, calculations for the year 2005).

The temporal and spatial differentiation of nitrogen emission into the rivers of the German Baltic Sea catchments from 1983 to 2005 is shown in Fig. 2. Regarding temporal differences it can be that due to the German unification in 1990 and the following break-down of the agricultural structure in the New Federal States a

considerable reduction of the nitrogen emissions took place in Mecklenburg-Western Pomerania). In Schleswig-Holstein (part of the Old Federal States) no reduction is visible. In Mecklenburg-Western Pomerania nitrogen emissions increased again until 2000, and afterwards they stayed relatively constant. Differences are now mainly given through the different hydrologic situation of the specific years with higher or lower precipitation rates (similarly as for Schleswig-Holstein).

These results are relevant to set up a basis to assess effects of different measures for reducing nutrient loads under current climate conditions as well as under possible future climate conditions.

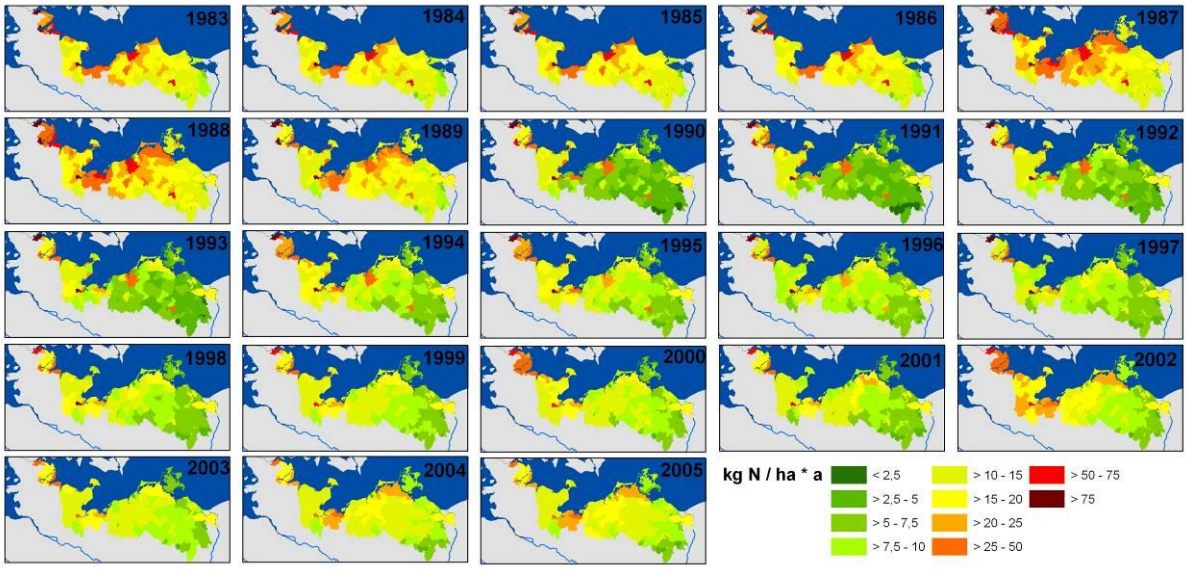

Figure 2 Nitrogen emissions into the rivers of the German Baltic Sea catchments.

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