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Trends of nitrogen and phosphorus input into Lake Neusiedl from wastewater treatment plants and non-point sources

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Lake Neusiedl (Austria) is a mesotrophic to eutrophic shallow steppe lake. Due to its low water volume and the lack of a natural outflow, excessive nutrient input is a special risk for this lake. In recent years, improved waste water treatment technologies have reduced the N and P loads of the inflows although all municipalities surrounding Lake Neusiedl (with one exception) and the cities and municipalities within the catchment area of the river Wulka discharge their (treated) wastewater into Lake Neusiedl. The amount of wastewater in 2010 was more than 22 x 10^6 m^3. Although the amount of wastewater increased by more than 70 % in the last 30 years, it was possible to reduce the ammonium load from 38 t/a to 8 t/a (as NH_4-N), the nitrate load from 83 t/a to 34 t/a (as NO_3-N), the phosphate load from 8 t/a to 3 t/a (as PO_4-P) and the total phosphorus load from 11 t/a to 6 t/a (comparison of the average annual loads of 1982 and 2010).

Another environmental risk for Lake Neusiedl is the nitrogen input due to agricultural activities. Therefore a pilot action within the EULAKES-project focused on the nitrate levels during annual cycles (2011-2012) in groundwater as well as in selected rivers, channels and ditches discharging into Lake Neusiedl.

The monitoring programme demonstrated clearly that the major contribution of the total nitrogen load discharged by surface water into Lake Neusiedl originated from River Wulka. For a general assessment of the influence of surface water discharge into Lake Neusiedl it is necessary to investigate the data of River Wulka for a longer period. Therefore data at the monitoring station Schützen were analysed for the period 1992-2010.

Evaluation of the monitoring data showed that due to the higher nitrogen concentrations at higher average annual discharges the inorganic nitrogen load was about 6.5 times higher in 2010 (average discharge of Wulka 2.1 m^3/s) than in the year 2001 (average discharge of Wulka 0.56 m^3/s). The total inorganic nitrogen load amounted to 304 tons in 2010, compared to 47 tons in 2001. In the period 1992-2010 the nitrogen load caused by diffuse sources was 4.3 times higher than the point source nitrogen load (2 wastewater treatment plants).

The proportion of total discharge, of inorganic nitrogen load and of phosphorus load caused by the two wastewater treatment plants depended on the discharge rate of the river Wulka (monitoring station Schützen). In 2001 (low precipitation year: 578 mm annual sum) point sources contributed about 47% of the discharge, 51% of the nitrogen load and 65% of the phosphorus load of the river Wulka. In 2010 (high precipitation year: 945 mm annual sum) point sources contributed 25% of the discharge, 11% of the nitrogen load and 31% of the total phosphorus load.

In the period 1992 to 2010 the inorganic nitrogen load caused by surface water (Wulka, WWTP, creeks and channels) varied from 65 t/a to 675 t/a (mean:233 t/a).