

Groundwater pollution modelling in an intensive livestock farming region

Objective and modelling approach

In December 2000, the European Water Framework Directive (WFD) took effect. Its main objective is the achievement of the "Good Status" of all European waters in 2015. Agro-industrial regions are especially affected by the new regulations of the WFD because nitrogen and phosphorus emissions of livestock farming can be a diffuse source of groundwater pollution. Although, in general, huge amounts of applied nutrients pose a threat to groundwater the amount of nutrients that in fact reaches groundwater depends on the local natural conditions.

Therefore, two parameters have to be considered concerning the estimation of groundwater pollution by diffuse sources : 1) groundwater pollution potential due to natural conditions and 2) calculated nutrient emissions. Firstly, the groundwater pollution potential is investigated by use of the DRASTIC model (ALLER et al. 1987). Secondly, nutrient emissions and future land use scenarios are calculated by the STOFFBILANZ model (GEBEL & GRUNEWALD 2005). Results of both approaches are visualized in ArcGIS.

The study aims at the identification of areas that should be given maximum priority in the WFD's programme of measures. These areas combine a great pollution potential with high emissions so that measures being conducted there are expected to be highly efficient.

The aforesaid procedure is implemented taking the Hase River Catchment in Northern Germany as an example.

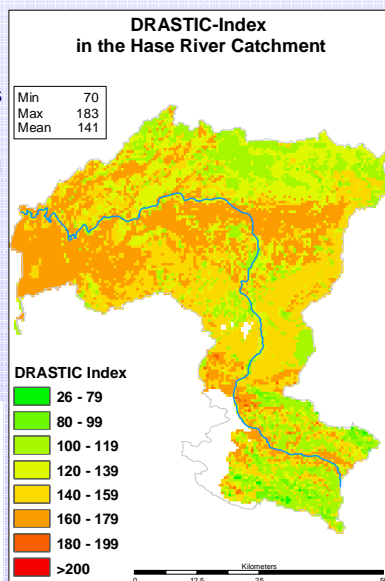
Study area

The Hase River Catchment in Northern Saxony (Germany) covers an area of approximately 3 000 km² and is characterized by intensive livestock farming, particularly pig production. The five districts in the Hase River Catchment feature the highest pig density of all districts in Germany. They hold 4.7 million pigs, which amounts to almost 20% of the pigs in Germany. Livestock density in the region is 2.1 animal units per hectare agricultural area on the average which is twice as much as the German average.

Results DRASTIC model

The DRASTIC index was grid-based calculated for the study area. The result is a high groundwater pollution potential regarding all of the DRASTIC parameters except for Depth to Water and Influence of the Vadose Zone Media.

Parameters	Rating	Weight
Depth to Water	(1 - 10)	5
(Net) Recharge	(1 - 10)	4
Aquifer Media	(1 - 10)	3
Soil Media	(1 - 10)	2
Topography (Slope)	(1 - 10)	1
Impact of the Vadose Zone Media	(1 - 10)	5
Conductivity	(1 - 10)	3



First results STOFFBILANZ model

In STOFFBILANZ one first land use scenario was calculated: "Good agricultural practice". STOFFBILANZ calculated for this scenario nitrogen emissions out of the soil zone from <10 to 40 kg/ha/a.

In the present stage of work grassland calculations have to be revised because model results are not reliable.

