Evaluation of critical source areas to reduce nutrient loading from agriculture in river basins in Saxony/Germany

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We modelled sediment and nutrient (N, P) input in water bodies of the Federal State of Saxony (Germany) using the simulation tool „Stoffbilanz". Future scenarios were developed for the cultivation of energy crops with a share of up to 30% of arable land. Results are an important contribution to elucidate the current and future situation of N and P loads of groundwater and surface water. Funding was provided by the Saxonian Agency for Environment, Agriculture and Geology responsible for water quality in scope of the Water Framework Directive.

The model calculates N leaching from the soil zone based on input, output and turnover of N. Turnover processes for cropland are simulated in the "Stoffbilanz" model by using indicators for mineralization and immobilization of N. C:N ratio, mean annual temperature, crop specific management practice, and contents of humus, clay, calcium carbonate and rock fragments.

Sediment and particle bound phosphorus inputs are calculated using the concept of "area connectivity". GIS functions are used to delineate areas with high hydraulic connectivity to river network. The likelihood of connectivity is computed, considering the distance to watercourse, transport capacity of surface runoff and sedimentation of soil in landscape. Sediment and particle bound P inputs in the watercourse were calculated according to the concept of sediment delivery ratio, which was adapted to regional scale.

Critical source areas and driving forces of N and P inputs are analysed, considering sources and sinks at regional scale. Landscape properties, management practice and spatial distribution of crops (food crops, energy crops, short rotation coppice) were found to be the most important factors controlling loading of groundwater and surface water for all scenarios.