Modeling groundwater-surface water interactions for analysing ecological state of aquatic and riparian habitats

In lowland landscapes where anthropopression have dominated environmental processes, which is the case of nearly the whole Europe, rivers remain the most important refuges for biodiversity. Among the other aspects shaping functional diversity of riverine ecosystems, especially the ones that remain low dynamic due to the low flow velocities, there were processes of water exchange in the river bed zone reported as critically important. Hydrological modelling is one of the tool needed for the management in order to simulate the current situation or predict future behavior. Appropriate hydraulic conditions within the river bed zone remain also the topic in environmental restoration, for which assurance of appropriate contact of groundwater and surface water remains an ultimate goal of water management measures to improve the resilience of aquatic habitats in the rivers and the adjacent wetland zones.

The essential part of the project is setting theoretical basis and construction of model describing with high precision the water exchange flux between the river, riverbed and the aquifer beneath. Identification and verification of the hybrid model will be accomplished through the proper planning and execution of specific and direct measurements of water exchange. Eco-hydrological research of the riverine and riparian habitats conducted simultaneously with hydrological modelling will become the basis for quantitative analysis of the relationship between changing state of these habitats and the dynamics of groundwater-surface water interaction.

The case study area is located in Biebrza National Park. The choice of the upper course of Biebrza river (the section between Rogożyn and Rogożynek) has been made following two features of this particular location: (1) undisturbed river bed due to the ban on mowing and dredging since 1992 and (2) number of research activities conducted in the area aiming at ecohydrology. The earlier research conducted by SGGW together with the Free University Brussels and University of Ghent brought preliminary insight on possible water exchange processes. Also the Antwerp University used this area for the last 10 years as a field study for the students of biology, which resulted in gathering a number of data on terrestrial, riparian and in-stream ecosystems. The data will be used in this project follow up ecohydrological study after calibration and verification of hydrological models.