

# Field monitoring in the Upper Basin of the Biebrza wetlands

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In the framework of bilateral scientific and technical cooperation between Flemish and Polish universities, a research project 'Environmental River Catchment by Natural or Artificial Wetlands', is conducted in the Upper Basin of the Biebrza River in Northeast Poland. The aim of the project is the development of methods to increase the use and the efficiency of the wetland areas themselves and the potential development of artificial wetland areas with similar impact.

Until now, two field measurement campaigns have been carried out in the study area, in September 1999 (autumn) and May 2000 (spring), respectively. Both of them were set up to collect input data for modelling the hydrology of the wetland area. Basically, the measurements were related to two fields of interest: surface-water flow and groundwater flow.

The local surface-water flow has been recorded in several, discrete cross-sections along the Biebrza River and its main tributaries. The local water surface levels and channel shapes were assessed by way of general geodetic levelling. The traject length of the river segments between consecutive cross-sections has been calculated using new digital topographical maps in 1:10,000 scale in ArcView GIS. Based on the respective, local altitudes of surface water levels in the cross-sections of the recorded spots, associated surface water slopes in the river segments have been calculated, leading to an initial estimation of friction characteristics of the river channel.

About 50 groundwater level measurement sites were selected all over the Upper Basin. The measurement sites are all local house wells, with a typical diameter of about 1 m. With GPS equipment X, Y and Z coordinates of these wells were determined. Registered groundwater depth values ranged from 1 to 18 m and were similar in both campaigns. During the second measuring period, hydrochemical characteristics were also determined at 37 wells by analysing 10 parameters: temperature, electrical conductivity, pH,  $O_{2(aq)}$ , Cl, total alkalinity,  $HCO_3$ ,  $PO_4$ ,  $NO_3$ , and  $NH_4$ . The hydrochemical characteristics of the groundwater will be used in deriving the relationships between the groundwater flow path through the aquifer and the mineralogy of the aquifer. This information is essential in understanding the recharge of the natural wetlands and the impact on the overall water quality.

The collected field data will be used for modelling the surface water flow and the groundwater flow. For the surface water flow modelling, the 1D model ACCESSUS, the quasi-2D model UNET, and the full 2D hydrodynamic model RMA2 will be used. The groundwater flow model will be set up by means of the MODFLOW modelling code as implemented in GMS version 3.0. The groundwater recharge will be determined by way of the water balance model WetSpa and the seepage to the natural wetlands by way of the DRAIN package.

The purpose of the modelling is a proper understanding of both surface water flow and groundwater flow characteristics in the Upper Basin. This will be a first step to an operational mathematical tool for integrated water management of resources in the Biebrza wetlands. In addition, it will lead also to more fundamental knowledge of water quality improvements induced by the typical ecosystem of this reference wetland.