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Interaction of River Hydraulics and Vegetation Dynamics

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The universities of Ghent and Antwerp are investigating the impact of the vegetation on hydraulic characteristics of the river Aa (Antwerp, Belgium) and the Bierbza river (Poland). In these areas the interaction between groundwater, surface water and vegetation will be studied.

In a first phase of this multidisciplinary study, the influence of the vegetation on the flow resistance in the stretch is examined. Introducing the effective roughness of the bottom and the banks of the river into hydraulic computations is not that easy, but important. Different expressions for the roughness coefficient are available, each with their own restrictions. Certainly when plants occur in the channel and reduce the flow area, determination of the roughness coefficient is difficult. Simultaneously, flood forecasting and other impacts of changing water levels and flows, ask for an accurate hydraulic model. Modelling summer situations with winter data and vice versa imply problems.

The roughness coefficient of the river, as used in the Manning formula, is influenced by the vegetation. Further more, the Manning coefficient is also linked to the water velocity and the discharge. The kind of correlation is determined by the vegetation type.

Field measurements are carried out to collect data on discharge and stage and on the amount and variation of aquatic weed growth. Velocity measurements in multiple cross sections are performed with both, a hydrometric propeller and an electromagnetic device. Further more, leakage or seepage from the groundwater influences the water balance and has to be included. Several measurement campaigns on both rivers

allow to determine the variation of the friction factor (Manning n) as a function of time, vegetation and distance and the important hydraulic parameters, and all the information can be related to each other.

Following a seasonal cycle, flow resistance increases with plant growth in spring, reaches a maximum in early summer and then decreases slowly to the minimum in winter. Knowledge of the variation of the biomass as a function of time should lead to appropriate use of roughness coefficients in modelling surface flow in rivers.