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Spatial-structural analysis of leafless woody riparian vegetation for hydraulic considerations

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Woody riparian vegetation is a vital element of riverine environments. On one hand woody riparian vegetation has to be taken into account from a civil engineering point of view due to boundary shear stress and vegetation drag. On the other hand it has to be considered from a river ecological point of view due to shadowing effects and as a source of organic material for aquatic habitats. In hydrodynamic and hydro-ecological studies the effects of woody riparian vegetation on flow patterns are usually investigated on a very detailed level. On the contrary vegetation elements and their spatial patterns are generally analysed and discussed on the basis of an integral approach measuring for example basal diameters, heights and projected plant areas.
For a better understanding of the influence of woody riparian vegetation on turbulent flow and on river ecology, it is essential to record and analyse plant data sets on the same level of quality as for hydrodynamic or hydro-ecologic purposes. As a result of the same scale of the analysis it is possible to incorporate riparian vegetation as a sub-model in the hydraulic analysis. For plant structural components, such as branches on different topological levels it is crucial to record plant geometrical parameters describing the habitus of the plant on branch level. An exact 3D geometrical model of real plants allows for an extraction of various spatial-structural plant parameters. In addition, allometric relationships help to summarize and describe plant traits of riparian vegetation.
This paper focuses on the spatial-structural composition of leafless riparia woddy vegetation. Structural and spatial analyses determine detailed geometric properties of the structural components of the plants. Geometrical and topological parameters were recorded with an electro-magnetic scanning device. In total, 23 plants (willows, alders and birches) were analysed in the study. Data were recorded on branch level, which allowed for the development of a 3D geometric plant model. The results are expected to improve knowledge on how the architectural system and allometric relationships of the plants relate to ecological and hydrodynamic properties.