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Parameterization of shrubby riparian vegetation for mechanically based modelling of plant deformation in flowing water

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During higher discharges, riparian vegetation becomes partially or fully submerged and interacts with the flow and sediment transport by acting as a roughness element to the flow. The geometry of flexible vegetation such as willows adjusts to the drag forces exerted by the flow, resulting in a strong variation of the flow resistance depending on the flow characteristics. So far, the deformation of submerged shrubby plants through bending and streamlining was considered in friction factors based on empirical data on plant deformation. We attempt to develop a mechanically based streamlining model for shrubby vegetation by considering the bending of stem and branches as well as the torsion acting onto the bases of the branches as a consequence of drag forces of the flow.

For that purpose, we investigated several plants of *Salix viminalis*, which were coppiced to obtain multiple branches for a more natural, shrubby growth, to be further used in a research channel which offers free flowing discharges up to 10 m^3 s^{-1}. We determined the three-dimensional geometries of several plants by performing a photogrammetric analysis, and systematically measured branch and stem thicknesses at several locations. The obtained geometries and data on elastic modulus and shear modulus served for the development of a generic representation of the plant geometry and properties, which is used for the development of the mechanically based model of plant deformation. Preliminary results showed a significant contribution of torsion to plant deformation, emphasising the need of its consideration in physically based deformation models.