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Experimental investigation of the modification of the flow field, past instream vegetation elements, for distinct bedsurface roughness.

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The presence of vegetation in rivers and estuaries has important implications for the modification of the flow field and sediment transport. In-stream vegetation has the potential to regulate the morphology and ecological health of a surface water body, and as such it finds a wide range of applications. Even though a number of controls influencing the local flow field past aquatic vegetation elements or patches of instream vegetation have been identified (such as shape, areal density, size and flexibility), conclusive evidence is lacking, particularly on how sediment transport processes are affected.

Here, an experimental study is designed to identify how the flow field past different types of elements simulating in-stream emergent vegetation is modified. Two sets of experiments are conducted, each with a distinct value of high and low hydraulic roughness for the bed surface. In both experiments a rigid cylindrical element, a patch of rigid tubes and a plant shaped element (Cupressus Macrocarpa), simulating instream emergent vegetation are utilized. The flow field is measured at various locations downstream the element and average and turbulent flow statistics are obtained at near bed, mid-flow depth and near the water surface regions.

It is found that different structural aspects of the elements, particularly the geometry, can significantly affect the flow field downstream the elements. Specifically, the average flow profiles are practically restored to near ambient flow conditions at about 5 diameters downstream the rigid element, while this happens at longer distances for the other elements. The flow structures shed past the elements are also very distinct, as confirmed via appropriately designed fluorescent dye flow visualizations. Potential ecosystem feedbacks and implications for formation of geospatial patterns are also discussed.