*12th International AIIA Conference: September 19-22, 2022 Palermo - Italy “Biosystems Engineering towards the Green Deal”*

*Improving the resilience of agriculture, forestry and food systems in the post-Covid era*

# Hydraulic roughness estimation induced by riparian vegetation in Tuscany rivers for management

**purposes**

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**Riparian vegetation, roughness, hydraulic modeling, flood, Best Management Practices**

Riparian vegetation and its management on vegetated bank and flood-plains can affect hydraulic and hydrologic characteristics of the river flow and can reduce or increase hydraulic risk, especially in urban areas.

In the present work, roughness estimation has been carried out by applying models that take into account relatively simple descriptive parameters, i.e. the diameter (d) and the spatial distribution of plants. Vegetation density (m) and distribution were gauged on homogeneous areas by using forest-related field surveys on river bank and floodplain on Tuscan rivers and creeks: Albegna, Arbia, Ombrone Grossetano,Ombrone Pistoiese, Serchio and Tevere. An alternative field survey method based on the MOTI app, developed by the School of Agricultural, Forest and Food Sciences HAFL of Zollikofen for forest environments, was tested on the same sample plots to evaluate its performance in the riparian zone. This speditive approach can provide basal area, number of plants per hectare (m) by using relascopic theory to obtain the needed parameters for the most widespread roughness estimation models .Other measurements have been obtained by UAV surveys and remote sensing echniques. Significant results were obtained for the m(d) relations, which lead to estimates of roughness and associated hydraulic risk, useful for management purposes:

