Geophysical Research Abstracts
Vol. 19, EGU2017-16341, 2017
EGU General Assembly 2017

Experimental and field investigations on uprooting of riparian vegetation

Giulio Calvani (1), Simona Francalanci (1), Luca Solari (1), and Bruna Gumiero (2)

(1) Department of Civil and Environmental Engineering, University of Florence, Florence, Italy, (2) Department of Biological, Geological and Environmental Sciences, Bologna University, Bologna, Italy

The morphology of a river reach is the result of many processes involving the motion of sediment (erosion, transport and deposition), the hydrological regime and the development and growth of vegetation.
River evolution in the presence of vegetation depends on establishment of pioneer woody riparian seedlings on bars, and consequently on either their survival or death. Flooding events can cause young vegetation mortality by uprooting (Corenblit et al., 2007). These processes, despite their important implications on river morphodynamics, have been poorly investigated in the past. Most of previous research focused on the mechanism of root breakage and on measuring the vegetation resistance to uprooting in the vertical direction, while few works considered the effect of flow direction on the uprooting process (Bywater-Reyes et al., 2015).
In this work, we focused on vegetation uprooting due to flow and to bed erosion. We considered two different types of vegetation: Avena Sativa, grown from seeds in external boxes, was used to investigate instantaneous uprooting, and Salix Purpurea, collected in the field, for delayed uprooting (namely type I and type II mechanisms, according to Edmaier et al., 2011). The experiments were carried out in a 5 m long flume in the Hydraulic Laboratory in Florence. A 2 m long mobile bed was build inside the flume, and vegetation was arranged according to several configurations on it. Both types of vegetation were subject to constant discharges to investigate the effects of a general bed degradation in modifying the occurrence of uprooting. We also performed some experiments with Avena Sativa located in a fixed bed and subjected to an increasing flow discharge in order to simulate instantaneous uprooting due to the action of hydrodynamic forces.
We measured flow velocity, flow discharge and water depth and characterized vegetation by stem and root diameter, height and root length. The experimental results have been interpreted in terms of a balance between drag and resisting forces acting on the single plant.
In order to compare experimental results with real river conditions, we also performed field measurements of Salix Purpurea resistance to uprooting on a lateral bar in the Ombrone Pistoiese river.
Ongoing research is focused on i) the definition of threshold criteria for the prediction of vegetation uprooting, ii) interpretation, by means of numerical modelling, of vegetation removal on a lateral bar in the Ombrone Pistoiese river during a flood that occurred on 19th November 2016.

References

Bywater-Reyes, Sharon, Andrew C Wilcox, John C Stella, and Anne F Lightbody. 2015. ‘Flow and Scour Constraints on Uprooting of Pioneer Woody Seedlings’. Water Resources Research 51 (11): 9190–9206.
Corenblit, Dov, Eric Tabacchi, Johannes Steiger, and Angela M Gurnell. 2007. ‘Reciprocal Interactions and Adjustments between Fluvial Landforms and Vegetation Dynamics in River Corridors: A Review of Complementary Approaches’. Earth-¬-Science Reviews 84(1): 56–86.
Edmaier, K, P Burlando, and P Perona. 2011. ‘Mechanisms of Vegetation Uprooting by Flow in Alluvial Non-Cohesive Sediment’. Hydrology and Earth System Sciences 15(5): 1615–1627.