Geophysical Research Abstracts
Vol. 16, EGU2014-5551, 2014
EGU General Assembly 2014

Experimental response of Salix cuttings to different flow regimes due to human activities

Lorenzo Gorla (1), Constant Signarbieux (2), Pascal Turberg (2), Alexandre Buttler (2), and Paolo Perona (1)

(1) AHEAD, Institute of Environmental Engineering, EPFL, Lausanne, Switzerland , (2) ECOS, Institute of Environmental Engineering, EPFL, Lausanne, Switzerland

Hydropower production and other human activities change the natural flow regime of rivers, in turn impacting the riparian environment. The main challenge in order to define eco-sustainable flows is to quantify the effects in terms of geomorphology and ecosystem adaptation.

We present 2-years controlled experiments to investigate riparian vegetation (Salix Viminalis) response to forced water table changing dynamics, from one water regime to another, in a temperate region (Switzerland). Three synthetic flow regimes have been simulated and applied to three batteries of Salix cuttings growing outdoor within plastic pots, each about 1 meter tall. In 2012 one treatment simulated a minimal flow policy for small run-of-river hydropower plants, which drastically impacts the low and the medium-low components of the hydrograph, but not the extremes. In 2013 we confirmed and completed some of 2012 results, by reproducing typical hydropeaking effects due to dam management and focusing on daily water table variations and offsets.
For both the seasons, after an initial period where all pots undergone the same oscillations in order to uniform the plants initial conditions, the experiment started, and the water dynamic was changed. Cuttings transitory response dynamics has been quantified by continuous sap flow and water potential measurements, and by regularly collecting growth parameters, as well as leaves photosynthesis, fluorescence, and pictures of each plant. At the end of the experiment, all cuttings were carefully removed and the both above and below ground biomass analyzed in detail. Particularly, the 3D root structure was obtained by High Resolution Computer Tomography.

Our analyses revealed a clear dependence between roots distribution and water regime reflecting the need for adaptation, in agreement with field observations of Pasquale et al. (2012). In particular, an initial strong difference in terms of stress and growth performances was then followed by a later adjustment in the roots system, notably detected from tomographic images.
Macroscopic effects in terms of growth parameters at weekly time step have found correspondence at higher time resolution in terms of sap flow and stem pressure, strengthening our results interpretation.

REFERENCES

- Pasquale et al. "Effects of streamflow variability on the vertical root density distribution of willow cutting experiments." Ecological Engineering 40 (2012): 167-172.
- Gorla et al., “Transient response of Salix cuttings to changing water level regimes”, WRR, submitted.