



Role of the morphology of Salix tillers barriers in marly sediment trapping efficiency in gully floor under ecological restoration: a flume experiment

A. Erktan, B. Pianu, P. Lucisine, and F. Rey

Cemagref /IRSTEA, Centre de Grenoble, France (amandine.erktan@cemagref.fr)

In the southern French Alps, the brittleness of the black marls, combined to the erosivity of the rain and the scarce vegetative cover, has led to high sediment yields at the exit of gullies. From the observation that gullies, with a 20% vegetative cover located in the lower gully bed, can shut down gully exit activity through sediment trapping, a bioengineering strategy to restore eroded gullies has been developed. It consists implanting a linear brush layer of Salix tillers, resprouting from cuttings arranged perpendicularly to the flow in gullies beds, on a dead-wood sill. Implanting vegetative barriers to increase sedimentation is a well-known strategy. Nevertheless, only few studies investigated the link between the barriers morphology and their efficiency in sediment trapping. Our goal was therefore to link the morphology of Salix tillers barriers to their sediment trapping efficiency. Salix tillers barriers with various morphologies have been recreated in a flume experiment (flow features: 0,5L/s; 60s duration; sediment concentration 33g/L). First, we recreated barriers aged of 2 to 9 years-old as we observed in the field. The young-shaped barriers show dense (spacing: 55mm) and thin stems (2mm) while the older ones show opposite morphological features (spacing: 2,5cm and diameter: 9mm). Thus, we tested the influence of the distribution of an invariant surface of tillers obstacle in sediment trapping efficiency. Then, we investigated the influence of oak litter on sediment efficiency of both young and old-shaped Salix tillers barriers. Fifteen replicates were conducted for each barrier tested. The sediment trapping efficiency is given by the ratio of the dried trapped sediment mass divided by the dried sediment mass initially loaded. Results show that the distributions of the tillers influence significantly the sediment trapping efficiency. The young-shaped barriers trap significantly more sediment than the old-shaped one. The oak litter increases significantly the amount of trapped sediment only for old-shaped barriers. We discuss the results from this flume experiment (0,5L/s) with results obtained from a previous field experiment, characterized by more intense flows (up to 20L/s for a two-year return period flow). It led us to build a conceptual model linking Salix barriers morphology with marly sediment trapping efficiency along a flow intensity gradient. The young-shaped barriers are more efficient to trap sediment in case of low flow intensity (0,5L/s) and the old-shaped barriers are more efficient to trap sediment in case of high flow intensity (20L/s). This study provides insightful results to better understand and predict the efficiency of restoration strategies of eroded gullies with bioengineering works.