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Role of bioengineering structures made of willow cuttings in marly sediment trapping: a real size experiment in the Francon catchment

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Improving the understanding of the role of vegetation and bioengineering structures on erosion and sedimentation control is a key issue today for the scientific community working both in geosciences and restoration ecology. In the Southern French Alps, ecological rehabilitation works were carried out in April 2008 in a marly basin (Francon, 73 ha) belonging to an experimental catchment of the Draix-Bléone complex, labellized Observatoire of Research in Environment (ORE). It focused on 30 gullies on 20 ha and consisted in the set-up of 672 bioengineering structures of two different types: brush layers of cuttings on deadwood microdams (BL) and brush layers and brush mats of cuttings on deadwood microdams (BLM). 25.000 cuttings of willows (Salix purpurea and S. eleagnos) were used for this purpose. Our objective was to validate former results and to improve the knowledge on the performance of bioengineering structures for sediment trapping during heavy rainfall events. Measurements were made on 305 structures (38 BL and 267 BLM) in 25 gullies. After 5 years (2008 to 2012), results revealed a mean annual trapping of 0.05 m3.yr-1 of sediment per structure, with 0.03 m3.yr-1 for BL and 0.06 m3.yr-1 for BLM. These results show lower values compared to those obtained in previous studies, due to damages on a large part of the structures by high intensity rainfall events. These damages have been mainly observed in case of low vegetation cover on gully sides and when gully floors showed steep slopes. On opposite cases, works were not damaged due to vegetation roughness which limits runoff concentration. We observed that 78 of these structures annually trapped more than 0.05 m3, with maximum values of up to 0.25 m3 per structure, thus showing the potential of efficient structures for sediment trapping. The bioengineering strategy has therefore been improved by implanting vegetation on bare gully sides to avoid damages and allow efficient sediment trapping. Measurements will be further conducted in the forthcoming years to improve data and results.