



Rill and pipe channel characteristics in badlands with a case study in Tuscany (Italy)

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River geometry relationships have been demonstrated to apply to rills and gullies as well. Moreover evidences show that these relationships seem to apply to natural pipes. Eroding channels can usually be characterized by a power relationship between channel width (W) and channel discharge (Q). This relationship has been recently improved and linked to some physical soil characteristics such as its resistance to erosion and grain sizes (median and maximum grain size). This paper summarizes results obtained so far for channels developed in badlands. Furthermore, a particular attention has been given to characterize pipe channels relationships and characteristics (i.e. channel width, slope and surface roughness). Results substantially confirm what was observed for open channels. The effect of the slow penetration rate of the wetting front into slightly weathered dry clayey sediments, which is a limiting factor in rill and pipe development, has also been considered for improving the explanatory characteristics of the empirical relationships. Wetting of the badlands sedimentary rocks is a main factor in producing new porosity and favoring the formation of the weathered layer. This layer usually is more susceptible to erosion processes, particularly to detachment by concentrated flow. In principle it can introduce a dependence on the characteristics of the local climate on the erosion intensity and the erosion features which characterize rill and pipe channels. It can bring either to the disappearance of the badlands itself, favoring soil formation, or to the intensification of the erosion processes.