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Evaluation of Mediterranean plants for controlling gully erosion

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In Mediterranean environments, water erosion is one of the main soil degradation processes. Several studies indicate that in such environments gully erosion may be responsible for up to 80% of total soil loss due to water erosion, whereas this process often only operates on less than 5% of the land area. Re-vegetation of concentrated flow zones is considered as one of the most effective ways to reduce sediment production and to decrease sediment connectivity. Most studies attribute the effect of vegetation on reducing soil erosion rates to the effects of the above-ground biomass. The effects of root characteristics on topsoil resistance to concentrated flow erosion are much less studied. However, in a Mediterranean context, the above ground biomass can temporally disappear because of fire or overgrazing and when concentrated flow erosion occurs, roots can play an important role in controlling soil erosion rates. Unfortunately, information on Mediterranean plant characteristics, growing on semi-natural lands, and knowledge of their suitability for gully erosion control is lacking. A methodological framework to evaluate entire plants for this purpose is absent as well. Therefore, a methodology to assess the suitability of plants for erosion control was developed and measurements of important plant characteristics were made for 25 representative Mediterranean plant species. In this analysis determination of suitable plants for gully erosion control is based on three main requirements, i.e. having a high resistance to erosion, a high resistance to removal and to have the ability to trap sediments and organic debris. Both above- as well as below-ground plants characteristics were selected and measured to assess the potential of plants to fulfil these requirements, i.e. stem density, trapping efficiency, stem rigidity, root density, root area ration, % of fine roots and root tensile strength. In order to compare species, these measured charac-

teristics were rescaled to scores ranging from 0 to 4. For each set of continuous data (each plant characteristic) 5 scores were used, i.e 0= very low value, 1= low value, 2= medium value, 3= high value, 4= very high value. The score for each property are then plotted on star diagrams. The results show that grasses have the highest surfaces on the star diagrams, but do not score well for all criteria. Only the shrubs *Tamarix canariensis, Salsola genistoides* and *Rosmarinus officinales* have an overall good performance by scoring medium to high for all criteria. It can be concluded that *Tamarix canariensis* is preferred for restoration works in channels. Also the grass *Lygeum spartum* and the reed *Juncus acutus* can resist erosion to a great extent in channels, but they are less resistant to removal. The shrub *Rosmarinus officinales* is preferred for erosion control measures on abandoned fields. The grasses *Brachypodium retusum* and *Avenula bromoides* can also resist erosion by concentrated flow to a large extent in this habitat, but their resistance to removal is also very low. *Salsola genistoides* is the best suited species to control gully erosion on steep slopes, but also the grasses *Helictotrichon filifolium* and *Stipa tenacissima* can be planted on steep slopes to increase the resistance to erosion. The methodology developed in this study can be applied to other plant species under areas of risk of rill and gully erosion.