Hydrology and Earth System Sciences Discussions

Interactive comment on "Root reinforcement and slope bioengineering stabilization by Spanish Broom (*Spartium junceum* L.)" *by* F. Preti and F. Giadrossich

Anonymous Referee #2

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This manuscript presents results of investigations into the root architecture and tensile strength characteristics of Spanish Broom, and its potential benefits for stabilizing Mediterranean soils. The paper is well structured and shows that the authors have collected a fairly extensive data set, using appropriate field and laboratory techniques, which are described in very good detail in the paper. The analysis of the data, however, is less clear, as is the basis for the conclusions reached. With additional information regarding how the field data were used to obtain C_v and F_s values, and a greater discussion of these values in the text, comparing them to other literature values for root-reinforcement, this paper could be suitable for publication in this journal. Addi-

tionally, more discussion of fiber bundle models versus the Wu eqn, and the potential magnitude of overestimation using the Wu equation can lead to should be added (more in specific notes below). Finally, results and values should be mentioned and discussed in the text and the reader should not simply be referred to a figure to find the values for RAR, Cv, Fs etc.

Specific comments are listed below (Several editorial comments have been made by the first reviewer so these comments concentrate on additions/ clarifications needed in the text):

p.3999, line 13: Bohm (1979) is the original reference for the trench-profile method and should be mentioned here.

p.4000, line 1: by only measuring above 0.5mm aren't you missing a lot of the fine roots - other studies (eg Pollen and Simon, 2005) have gone down to 0.1mm. Can you explain how/why you picked this lower limit?

p.4001, line 20: The most important assumption made in the Wu eqn, and the one that leads to the most overestimation of root-reinforcement values, is the assumption that all of the roots break simultaneously and at their peak strength. This assumption should be mentioned here along with the magnitude of potential estimation discussed in several papers including but not limited to Pollen and Simon (2005).

p.4005: change root average number to average root number throughout text. Also, what is the plant density (# of roots per plant are shown in Fig. 5 but how do you get from # of roots per plant to the number of roots crossing a square meter of the shear surface so you can calculate root-reinforcement?

p.4006: State and discuss the values in Figs 10 and 11, rather than just referring the reader to the figures. The Cv values for the Spanish Broom seem very high, especially for a shrub type species, and compared to values published by others for Cv of a range of species. Granted the Wu eqn can overestimate significantly but even reducing the

values by an appropriate reduction factor of approximately 50% these values would still be very high. The tensile strength values seem within an acceptable range, as do the RAR values, but without knowing what plant density/ how many roots were assumed to cross the shear plane in your analysis, it is not possible to tell if these calculations are correct. Also, the section on Fs values needs to be greatly expanded. It is not clear at all how the values in Fig 10 were used to get the Fs values in Fig 11, and none of these values are even discussed in the text. In Fig.11 how are Fs values calculated for different depths? Surely Fs is calculated for a given slope not a point within a slope, and Fs is based on a failure plane and failure block not a point? This figure and how the values were obtained definitely needs clarification. In addition, a note that if the Cv values are overestimated by using the Wu eqn, then similarly the Fs values will be overestimated and overly conservative, should be added.

p.4008. tensile strength values seem reasonable based on species I have tested in the past. In fact exponents seem on the low end of the range I have seen, further questioning the final root-reinforcement values calculated.

p.4009. State the range of values in the text not just the figure.

p.4010: conclusions: the RAR and tensile strength seems similar to other plants. Rooting depth is also similar to other Mediterranean species. The benefit of this plant in terms of bioengineering, in particular then, seems to lie in its ability to spread and establish quickly, rather than it's root properties. Cv values should be checked as they do seem high based on the RAR and Tr values given. This may be explained by a very high rooting density/ plant density, but the data to show that are not given here. Also, the root diameter distribtion can have a big effect on calculated Cv values and this may also be causing the values to be high, but again, the root diameter distribution measured from field data and used in the data analysis is not given. Some comparison of values with other literature values at some point in the discussion or conclusions would be useful, especially a comparison with the values for 25 Mediterranean spp studied by deBaets et al. (2008) who I believe included Spanish Broom in their study.

Fig 6: x axis - do you mean mean root diameter?

Fig 9: to compare against other studies it would be better to plot tensile strength (MPa) against root diameter (mm) showing the power law relation.

Fig. 12: might not need this figure.

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