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Soil aggregate stability: comparison of field and laboratory data

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Eco-engineering first and foremost, aims at stabilising soil and slopes in order to protect humans and infrastructure from potential damages caused by soil failure, usually due to heavy rainstorms. Whereas the technical constructions are well-defined and their protective effects in general calculable, this is rarely the case for biological measures. Furthermore, unlike engineering structures which are immediately useable and operative after their completion, the effects of plants are developing as a function of time. Within this scope, soil aggregation processes play a decisive role in in the re-colonisation process and the re-establishing of a protective vegetation cover. The strength of soil aggregates is not only critical to the stability of slopes but plays a key role in ecosystem functioning in general as it affects water, gas and nutrient fluxes and storage influencing the activity and growth of living organisms. Not by chance, therefore, soil aggregate stability has been proposed as an indicator reflecting multiple aspects allowing extensive information on ecosystem status to be gathered in a relatively short time, in particular in respect of protecting slopes from erosion and shallow mass movements. Various methods and approaches have been used to quantify soil aggregate stability but the lack of standardisation complicates the comparison of different investigations.

From this perspective we investigated soil samples from the field as well as samples artificially prepared in the laboratory using the same soil material and testing procedure. The field samples were collected at two sites in the landslide area of Dallenwil-Wirzweli in Central Switzerland, once in a gully recently affected by erosion and landslide processes bare of vegetation (control site) and once in a re-stabilised gully with 25 year old eco-engineering measures dominated by *Alnus incana* (re-vegetated site). The laboratory samples were prepared with the soil from the control site. Two different treatments were used in this comparison including untreated soil (control) and soil planted with *A. incana* inoculated with the mycorrhizal fungus *Melanogaster variegatus s.l.* (vegetated).

In both cases, the vegetated specimens had a significantly higher soil aggregate stability compared to their respective control samples without vegetation. Furthermore, it turned out that the increase in soil aggregate stability in the samples with vegetation was quite similar in both the artificially prepared laboratory and the natural field samples. However, the level was remarkably higher in the latter. In order to better understand this different behaviour, various parameters were analysed. Aspects of the development and succession processes of plants are compared as well as rooting and the degree of mycorrhization. Additionally, soil development and the methodical approach are presented and discussed.