Determination of soil degradation from flooding for estimating ecosystem services in Slovakia

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Floods as natural hazards are related to soil health, land-use and land management. They not only represent threats on their own, but can also be triggered, controlled and amplified by interactions with other soil threats and soil degradation processes. Among the many direct impacts of flooding on soil health, including soil texture, structure, changes in the soil's chemical properties, deterioration of soil aggregation and water holding capacity, etc., are soil erosion, mudflows, depositions of sediment and debris.

Flooding is initiated by a combination of predispositive and triggering factors and apart from climate drivers it is related to the physiographic conditions of the land, state of the soil, land use and land management. Due to the diversity and complexity of their potential interactions, diverse methodologies and approaches are needed for describing a particular type of event in a specific environment, especially in ungauged sites. In engineering studies and also in many rainfall-runoff models, the SCS-CN method has remained widely applied for soil and land use-based estimations of direct runoff and flooding potential.

The SCS-CN method is an empirical rainfall-runoff model developed by the USDA Natural Resources Conservation Service (formerly called the Soil Conservation Service or SCS). The runoff curve number (CN) is based on the hydrological soil characteristics, land use, land management and antecedent saturation conditions of soil. Since the method and curve numbers were derived on the basis of an empirical analysis of rainfall-runoff events from small catchments and hillslope plots monitored by the USDA, the use of the method for the conditions of Slovakia raises uncertainty and can cause inaccurate results in determining direct runoff.

The objective of the study presented (also within the framework of the EU-FP7 RECARE Project) was to develop the SCS – CN methodology for the flood conditions in Slovakia (and especially for the RECARE pilot site of Myjava), with an emphasis on the determination of soil degradation from flooding for estimating ecosystem services. The parameters of the SCS-CN methodology were regionalised empirically based on actual rainfall and discharge measurements. Since there has been no appropriate methodology provided for the regionalisation of SCS-CN method parameters in Slovakia, such as runoff curve numbers and initial abstraction coefficients (λ), the work presented is important for the correct application of the SCS-CN method in our conditions.