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Rainfall Simulators – how plot scale affects results

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Rainfall simulators (RS) are commonly used tools for soil erosion research under natural conditions. This research was focused on the plot scale effect in the formation of surface runoff and soil loss. Two surface conditions were tested - grass and bare soil. All experiments were performed in field conditions on undisturbed soil samples located on the experimental site Řisuty, where CTU has been performing experiments with rainfall simulators for many years. Three experiments were performed to investigate the formation of surface runoff depending on area size, surface type and precipitation intensity. These experiments were performed on a surface with grass cover and also on a plot of cultivated bare soil. For the bare soil experiment, the area was prepared just prior to the experiment itself. The grass plots were left to develop naturally for 2 years after sowing. A large rainfall simulator with a maximal experimental area of 16 m^2 (8 m length 2 m wide) was used for this experiment. Four plots with lengths of 1, 2, 4 and 8 m (with widths of 1 m) were placed under the RS. Soil moisture sensors were placed on the plot at various depths to monitor the evolution of soil moisture over time. For the plot with the grass cover, a rainfall with variable intensity over 75 minutes was used (rainfall intensities 40, 60, 90 mm/h). Two follow-up experiments were conducted on the plot with bare soil. Rainfall intensities were a constant 60 mm/h for 30 minutes after surface runoff starts. The second experiment started 15 minutes after the conclusion of the first one. This same methodology has been used in other, past, experiments with RS so our results are directly comparable to those previously conducted experiments. All results were recalculated to 1m^2 and 1 minute intervals for comparison in addition to the cumulative values for each experiment.

Results from the plots with grassland showed significant differences between plots of different lengths. Experimental plots with bare soil provided higher variability in results on the plots in their natural moisture (dry condition), than those of the fully saturated samples. Results showed that the length of the plot is more important for soil loss than for surface runoff processes. The heterogeneity of the infiltration soil properties would play significant role on the experiment results.

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