



Rainfall simulations as a tool for quantification of soil erosion processes caused by the trampling of sheep and goats in semi-arid and arid landscapes

Jonas Ruthenberg, Jonas Tumbrink, Tobias Wilms, Klaus Daniel Peter, Stefan Wirtz, and Johannes B. Ries
Trier University, Physical Geography, Trier, Germany (jonas-ruthenberg@web.de)

As there is a massive increase of livestock husbandry in semi-arid and arid landscapes, the investigation of trampling-induced soil erosion has become indispensable for a better understanding of erosive processes such as loosening and translocation of sediment, as well as the genesis of rill erosion and gully systems. Our work will support other studies focusing on desertification and land-use changes in the investigated landscapes. Up to this date, research on livestock-induced soil erosion, even in relation to other erosion processes such as aeolian and fluvial/pluvial sediment translocation, is very scarcely found in literature.

The presented study on trampling-induced soil erosion by sheep and goats in arid and semi-arid landscapes aims to create a general understanding, an estimation and quantification of the influencing factors of these erosive processes. Within this study, we present the first results of several field rainfall experiments on rock fragment translocation as well as loosening and transportation of coarse and fine sediment depending on the motion sequence and the individual weight, size, and hoof beat of the animals.

Furthermore, we conducted additional experiments to investigate the trampling-induced erosion processes for various other sediments, especially those in the range of clay, silt, and sand. To do so, we used a specially designed test plot, equipped with sediment traps on each side. For a clear and reliable analysis of the measured parameters, univariate as well as multivariate statistical methods have been used. For all field methods, we developed relevant statements concerning flock size.

The rock fragment translocation experiments done so far have shown that a flock of 45 sheep or goats moved 87 % of 320 spread out rock fragments with a mean translocation distance of 0.123 m when trampling across a test plot of 3.2 m². Besides that we found out that the soil surface was worked up in a way that the loosened fine sediment proved to be easily detachable by secondary erosive processes such as rainfall. The conducted rainfall simulations confirmed this assumption. They have shown that sediment yields were significantly higher on trail areas than on intershrub or shrub areas.

The preliminary work done up until now suggests that the grazing and trampling of sheep and goats can be regarded as an important factor for soil degradation in semi-arid and arid landscapes. However, the understanding of the erosive processes in detail remains to be defined, i.e. the exact movement of the sheep and goats, the energy they can impart with their hooves, and how that energy affects different sediments or surfaces they tread upon, as well as the general quantification of trampling-induced erosion rates and transport processes of clastic sediments.