

Grazing in semi-arid areas as a tool for soil conservation

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ABSTRACT

A mosaic-like spatial pattern, consisting of three main cover types (patches) – shrubs, trampling routes, and open areas in between – characterizes the landscape of many semiarid rangelands. These patches may differ in their pedological and hydrological characteristics, and they play important roles in ecogeomorphic system functioning.

In the northern Negev region of Israel, soil properties such as organic carbon content and aggregation were measured in each of the above patch types. The soil was sampled from two depths (0-2 and 5-10 cm), inside and outside long-term grazing exclosures (grazed and control areas, respectively) on a north- and a south-facing hillside, in the peak of the growing season (March) and at the end of the dry season (September). On each hillside at the grazed and control areas, small runoff plots (0.25-1.0 m²) representing the three patches and combinations between the patches, were constructed. Overland flow and sediment yield were measured during two consecutive winters of 2007/8 and 2008/9.

Whereas the shrub patches exhibited the lowest overland flow and sediment yields, the highest soil moisture and organic carbon contents, and the lowest bulk density and calcium carbonate contents, the trampling routes were at the other end of each scale; in the remainder of the intershrub areas, intermediate values were found. The values of runoff and sediment in the route and in the intershrubs were higher than those in their respective combined plots.

Under the prevailing biotic and abiotic conditions of the study area, the effect of grazing on overland flow and soil properties was not significant at the plot scale but highly significant at the patch scale. Grazing increased the spatial heterogeneity of the soil properties and created a network of trampling routes on the hillsides. These routes exhibited a locally degraded soil status, but their existence improved the soil properties of the remainder of the open area, because they enhance the efficiency of source-sink relationships.

Keywords: soil properties, runoff, sediment, shrubs, trampling routes