



Spatial variation of size distribution of *Sarcopoterium spinosum* in semi-arid rangelands

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Rangelands of semi-arid regions exhibit a three-phase mosaic spatial pattern comprising three representative patches: shrubs, trampling routes, and the remaining intershrubs area (hereafter: intershrubs). These patches differ in their soil properties, vegetation, and hydrological characteristics, and the differences are attributed to the differing intensities of animal hoof impacts and trampling: highest in the routes, sporadic in the intershrubs and minimal in the shrubs.

A study conducted in the area described below revealed that soil moisture and organic matter contents, and topographic incline varied in the increasing order: routes < intershrubs < beneath shrubs. The opposite trend was found for soil bulk density. Therefore, it was hypothesized that routes should yield more runoff than intershrubs. This led to the present research hypothesis: that, from a hydrological point of view, the size of shrub is controlled by its distance from the routes, i.e. shrubs located near trampling routes are expected to be bigger than those far from them.

The research was conducted in the Goral Hills, in the northern Negev region of Israel. This is a hilly, semi-arid area, 350-500 m above sea level, with mean annual rainfall of 300 mm that falls between October/December and May. Average daily temperatures range from 10° C in the winter to 25° C in the summer. The lithology is chalk and limestone of the Eocene era. The soil is shallow, generally not deeper than 20 or 40 cm in the open spaces between shrubs and beneath shrubs, respectively. The research area, like many other semi-arid areas of the Old World, has been grazed by flocks of sheep and goats since prehistoric times. The predominant shrub in the area is *Sarcopoterium spinosum*.

To confirm the above hypothesis 10 representative hillslopes – five south-facing and five north-facing – were randomly selected within the research area. On each, a plot measuring 3 X 18 m running down the backslope was randomly selected and divided into squares of 1 m². The shrubs – *Sarcopoterium spinosum* – and routes were mapped and, for each shrub, the height, maximal length, and width at the middle of the canopy were measured, in order to determine the area of the canopy and the volume of the shrub. The shrubs were divided into two categories according to their distance from the closest route upslope: close to the route, i.e. up to 50 cm, and far from the route, i.e. further than 50 cm.

The results showed that shrubs were associated with trampling routes. Most of the shrubs on both south- and north-facing hillslopes were located close to the route, and they were taller and wider than those far from it. These findings might indicate that a shrub developing lower down the slope and close to a route may possess an existential advantage, since it receives more water than shrubs far from the route. Furthermore, ecological factors such as animals' hoof activity in the vicinity of the trampling routes should account for the size distribution of the shrubs.