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Severe Goat Grazing Alters Soil Seed Bank Characteristics and Regeneration Perspectives in Southern Arid Namibia

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Abstract

High stocking densities and a lack in regimentations preventing a sustainable land management are the main driving factors determining the widespread degradation of communal rangelands in Namibia. Most often land degradation is exemplified by associated processes such as the expansion rate of bare land, the loss of soil stability or changes in above-ground vegetation. However, to describe the rangeland condition more precisely the condition of the soil seed bank should also be taken into account. By this not only information on potential below-ground degradation is gained, e.g. the composition of current seed reserves, but also on the recovery and restoration potential of disturbed habitats. The present study addresses the long-term effect of high grazing pressure on soil seed bank characteristics at a degraded communal rangeland in southern Namibia's shrub savannah as opposed to an adjacent reference site under sustainable land management. Soil samples were collected in contrasting microhabitats differing in their ability to trap seeds, and germination experiments conducted. Plant species composition, species richness and seed densities of the soil seed bank were significantly affected by grazing intensity, microhabitat, and sampling year. In general, seeds showed a clumped spatial distribution within the study sites, except seeds of perennial grasses, which showed to be randomly distributed on the degraded site. Further under shrub canopy seed banks were most species rich and contained highest seed numbers, while bare ground seed banks provided only limited seed material. Although highest seed densities per m² were found throughout all microhabitats on the degraded rangeland, the seed bank lacked favourable plant species occurring under low grazing pressure. While the seed bank of the reference site contained a high number of valuable fodder plants, the seed bank of the degraded site was dominated by two annual, generalist plant species of low grazing value only. It is argued that the seed bank of the communal rangeland could play a minor role in ecological restoration only if the aim is to improve the site. The study shows evidence for below-ground degradation taking place after decades of over-utilisation, and highlights the implications for rangeland restoration seed bank studies can provide.

Keywords: Degradation, land management, rangeland restoration, savannah, seed densities, species composition