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## The Desertification Paradox — Decreasing Degradability with Increasing Aridity in Semiarid to Arid Rangelands

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### Abstract

In the context of the BIOTA Maroc project, we installed a transect of permanent plots on the southern slopes of the High Atlas, Southern Morocco. The transect covers a precipitation gradient from semiarid to arid ecosystems and was assessed annually since 2001. Using a pair-wise enclosure design, we observe the vegetation dynamics on dry steppes with and without grazing. Assessments are based on population censuses and measurements at individual level. The shifts in species composition and increasing differences in standing biomass between grazed and excluded plots over time are used as indicators for the intensity of degradation due to actual land use intensities.

With increasing aridity, we find decreasing differences in species composition and standing biomass. At the arid test sites below the 100 mm isohyet, species composition fluctuates according to annual precipitation pattern but does not show significant differences between fenced and grazed plots. With increasing mean annual precipitation, interannual fluctuations of species composition decrease but long term shifts in vegetation composition gain in importance. Vegetation increasingly differs between inside and outside the fences. After eight years of enclosure at semiarid sites, the standing biovolume (as a proxy for standing biomass) strongly exceeds the biovolume at grazed reference plots.

Using the difference between enclosed and grazed plots as a degradation measure, we can conclude that semi-arid ecosystems in Southern Morocco are more prone to desertification caused by firewood cutting and overgrazing than arid ecosystems. Finally, we discuss the underlying ecological and socioeconomical processes of what we call the “desertification paradox” of dry rangelands and their consequences for sustainable land management.

**Keywords:** Enclosure experiments, monitoring, Morocco