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Soil nutrients as indicators of desertification in Northern Kenya

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Introduction Monitoring processes of desertification using nutrient indicators has not been widely reported. Research on desertification is usually concerned with the impacts of agricultural and pastoral production but less on the ecosystem processes (Tongway & Whitford, 2002). A common assumption is that desertification results in loss of soil fertility in the grazing lands. Assumed linkages between desertification processes and soil nutrient loss around settlements in the arid zones of Africa (Lusigi, 1981) has however not been confirmed by research. We investigated if there is a gradient of nutrient loss from two pastoral settlements in Northern Kenya.

Materials and methods We selected the settlements of Kargi (N 02 31°275' E 037°34') and Korr (N 02 00°200' E 037°30') that were associated with *in situ* desertification from overexploitation of the vegetation by sedentary Rendille pastoralists earlier in the 1980s (Lusigi, 1981). We established 4 km transects set in four compass directions from the centres of the two settlements. The settlements showed different patterns of pastoral camps. In Kargi, the pastoral camps formed a central cluster within 0-1 km radius of the settlement, while for the Korr site, the pastoral camps were located >4 km from the settlement. In Kargi settlement there was evidence of sand dune movements in the areas of pastoral camps, while in Korr soil movements were evident 4 km from the settlement. Along the transects, soils were sampled at 200 m intervals from 0-20 cm depth (n=80 samples for each site). Soils were mixed and about 250 g analyzed for total nitrogen (% N), total organic carbon (% C), extractable phosphorus (% P) and electro-conductivity (Ec) using the standard laboratory methods. Woody cover was also estimated. Soil nutrient gradients and woody cover were analysed using linear constrained ordination in CANOCO. Redundancy Analysis (RDA) was used with soil nutrients and woody cover as response variables and distance as explanatory variable.

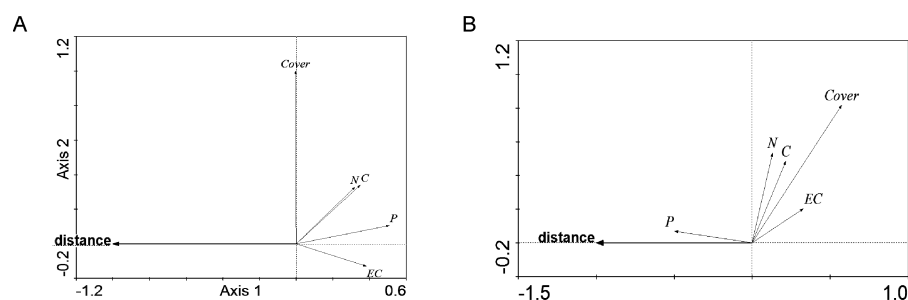


Figure 1 Soil nutrients and woody cover ordination from the settlements: (A) Kargi and (B) Korr in Northern Kenya.

Results Total nitrogen, total organic carbon and Ec were negatively correlated with distances from the settlements, but the correlations were not significant ($p > 0.05$) (Figure 1A-B). Extractable phosphorus was negatively correlated for the Kargi but positively for the Korr settlement ($p < 0.05$). In Kargi woody cover showed no spatial patterns, while for Korr, woody cover decreased with increasing distance from the settlement. Woody cover showed no correlation with soil nutrients except for Ec for the Korr site ($r = 0.20$, $p < 0.05$).

Conclusions In both settlements, the patterns of extractable Phosphorus varied according to the locations of the pastoral camps suggesting that the changes were related more to livestock activities than to losses attributable to degradation. The distributions of total nitrogen and total organic matter were also greater around the settlements (albeit being insignificant). The results showed that soil nutrients in the settlements did not directly reflect the losses often linked to the processes of desertification. The responses of different nutrients along degradation gradients appeared to reflect the positive roles played by livestock in nutrient transport into the pastoral camps. The study concluded that settlements in the arid zones of Northern Kenya accumulated nutrients contrary to the common expectations.

References

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