Factsheet # 9

Why the seeds in the soil matter

The importance of the soil seed bank (SSB) in determining rangeland health in Namibia

Challenge

- Drylands worldwide face persistent challenges characterized by environmental variability, often due to climate-related drivers and overgrazing.
- After prolonged periods of unfavorable conditions, the regeneration of aboveground vegetation depends on the abundance of dormant seeds in the soil (SSB).
- Insights from SSB studies can help us adapt rangeland management plans to maintain its health and to restore it where it has been degraded.
- Unfortunately, most rangeland assessment studies tend to exclude this crucial part of a plant's life cycle despite its potential in helping us to understand whether our rangelands are staying healthy or starting to degrade.

Soil seed bank determination

- The effect of grazing management (freehold farms with rotational grazing and communal areas with continuous grazing) on SSB was studied by collecting soil samples and germinating them to determine the density, number of species and the type of species in the seeds bank.

Fig. 1. Soil seed bank sample collection procedures, sample germination and seedling identification. Credit: Ndamonenghenda Hamunyela

Number and type of seeds in the SSB

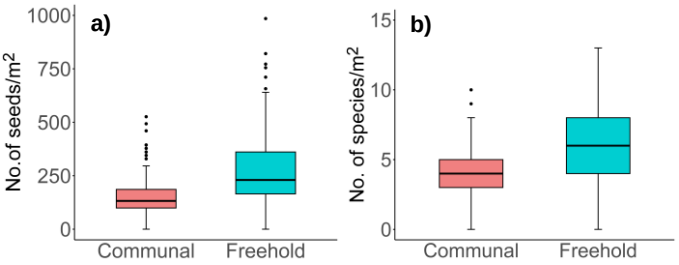

Fig. 2. a) The number of seeds and; **b)** the number of species per square meter in the SSB of communal areas and freehold farms.

Table 1. The description of the characteristics of the SSB of the two grazing management systems shown in Fig. 2 and 3.

Communal areas with continuous grazing	Freehold farms with rotational grazing
Fewer seeds in the soil	More seeds in the soil
Few types of plant species	More types of plant species
Species that indicate high rangeland degradation	Species that indicate healthier rangelands even in highly grazed areas
Mostly annual grasses and invasive forb species e.g. *Tragus berteronianus, Eragrostis dinteri, Sida cordifolia, Mollugo cerviana, Kohautia subverticillata*	A diversity of both perennial and annual grass species e.g. *Eragrostis rigidior, Eragrostis trichophora, Eragrostis lehmanniana, Urochloa brachyura, Melines repens* spp. *grandiflora, Dactyloctenium aegyptium*

Credit cover photo: Ndamonenghenda Hamunyela

Differences in plant species types

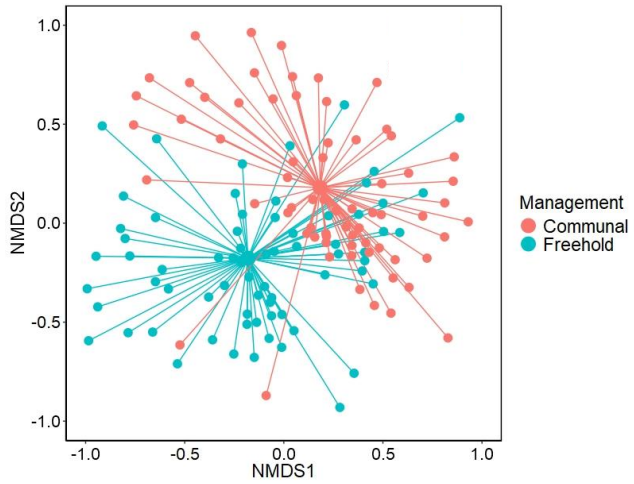

Fig. 3. Ordination diagram (Non-Metric Multidimensional Scaling, NMDS) showing clear differences in the type of plant species in the SSB found in freehold farms and communal areas. The points represent the different sampling locations in each management system. Points that are closer together are more similar in the type of plant species while, those further apart have different plant species types. Tighter cluster indicate greater similarity within a group. The overlapping points are those with similar type of plants between the two management systems. The middle point represent the average position of all points in each group in the ordination space.

Practical Implications

- **Monitoring** what species come up after the rains can help track early signs of land degradation.
- **Rangeland monitoring programs** should include soil seed bank surveys.
- **Support for improved grazing management** in communal areas is critical.
- **Restoration programs** should target areas with low seed bank size and species of low grazing importance.
- **Capacity building** should be promoted for farmers and extension workers on how to read vegetation signals.

Key Findings

- Rangeland health can be inferred from the type of seeds that are hidden in the soil.
- Rangelands on freehold farms were in a much healthier state than on communal areas.
- Rotational grazing may help to protect the seed reserves, retaining important rangeland grass species.
- Continuous grazing can wear out the land, promoting unwanted plant species in the seed reserves.
- Within the grazing management systems there are other factors that are important for rangeland health (e.g. longer resting periods and bush control efforts).

References

Hamunyela, N., Nesongano, W. C., Tielbörger, K. (manuscript in prep.). Soil seed bank dynamics as potential indicators of grazing-induced land degradation threshold in a dryland savanna.

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The NamTip Project

The collaborative German-Namibian research project “NamTip – A Namibian Perspective on Desertification Tipping Points in the Face of Climate Change” aims to better understand the development of ecological tipping points in dryland rangelands by assessing desertification and woody plant encroachment processes. It also explores management options for preventing such tipping points and restoring degraded rangeland ecosystems.

www.uni-potsdam.de/en/namtip

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