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“Can agroecological farming feed the world?  
Farmers’ and academia’s views”

## Rangeland desertification and land use changes on commercial land in Namibia’s Waterberg region

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### Abstract

Looming desertification and ongoing climate change put semi-arid rangelands and thus fodder resources for livestock and farmers’ livelihoods under increasing pressure. In Namibia, the driest country in Sub-Saharan Africa, cattle farmers are repeatedly forced to apply short-term risk coping and long-term risk mitigation strategies to maintain their farming business. This distinct interdependence between society and nature make Namibian rangelands a prime example for tightly coupled social-ecological systems (SES). In order to sustain rangelands in the face of rapid global environmental change, a deeper understanding of land use and land cover changes and their drivers and related effects is necessary.

Addressing the complexity of rangelands as SES, a mixed method approach was chosen comprising remote sensing techniques, semi-structured interviews with freehold farmers, participatory on-farm mapping, and archival research of the historical development. An object-based classification of aerial photographs and satellite images was applied to classify land cover and investigate the changes from 1961 onwards.

The most important changes over the past 60 years include the progressive bush encroachment, its containment by de-bushing, the subdivision of rangeland into progressively smaller management units, and income diversification. Overall, the area of shrub-dominated savannah has increased by 18% and the area of grass-dominated savannah has simultaneously decreased by the same amount within the last 60 years. However, the extent of this varies greatly among farms in dependence of the underlying site conditions and applied management strategies.

Direct causes of land cover changes are driven and shaped by underlying, synergistically acting socio-economic (e.g., market/price changes, guidelines, policies) and biophysical drivers (e.g., resource scarcity, site conditions, rainfall variability). In particular, climatic trigger events (e.g., droughts) associated with short-term and long-term land use changes play a key role.

To achieve sustainable future land use, small-scale selective bush control and aftercare measures, the full utilisation of removed shrubs, further diversification of farm-income generating activities, strategic decision-making, and proactive management are pivotal.

**Keywords:** Cattle farming, freehold farmers, land cover changes, object-based image classification, savannah, social-ecological system

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