Land subdivision, heterogeneity, and declining food security for African Pastoralists

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Introduction Pastoral livestock inhabit landscapes that are spatially heterogeneous and have forage patches that pulse in their value to animals. Mobile pastoralists have evolved movement patterns to maximize use of these ephemeral food sources. In pastoral communities across Africa, changes in land tenure policy and socioeconomic pressures have caused pastoralists to decrease their mobility. Pastoralists recognize that shrinking access to land reduces their options to find forage, and theory suggests that the capacity of land to support herbivores decreases as a power of the square root of area accessible. We used ecosystem modelling in South Africa and Kenya to quantify declines in the number of livestock that can be supported under subdivision.

Study areas and methods A generic but flexible application of the SAVANNA ecosystem model was adapted from an application from the semi-arid Vryburg area of the North-West Province of South Africa. A 300 km^2 area was subdivided into progressively smaller parcels until it was composed of thirty 10 km^2 parcels, simulations run for each parcel, and changes in the number of cattle across the entire 300 km^2 summed (Boone and Hobbs 2004). A more representative application of SAVANNA was created for southern Kajiado District, Kenya. In Kajiado, lands were divided into group ranches beginning in the 1960s, and subdivided into individual parcels owned by Maasai pastoralists and agro-pastoralists, a process still ongoing. Simulations were run for three intact group ranches, and for each ranch, 20 randomly placed parcels for each area of 10, 5, 3, and 1 km^2.

Results When a 300 km^2 area in South Africa was subdivided into smaller parcels, a linear decline in the number of cattle the area could support occurred (Figure 1). Animals in an isolated patch with poor forage could not move to better forage patches, leading to a decline in the population. At the smallest parcel area, 19% fewer animals could be supported. In Eselenkei Group Ranch, Kajiado District, the number of livestock that could be supported declined by 25% when subdivided to 1 km^2 parcels (Figure 2) (Boone et al., In press), associated with reduced access to heterogeneous forage patches, and greater travel costs associated with accessing water. Declines in group ranches were not equal. In Olgulului Group Ranch, the livestock population on 10 km^2 parcels was 20% lower than for the intact ranch, but did not decline as subdivision continued. The ranch had low heterogeneity, so that as land was subdivided, the variety of forage patches did not change. The most productive group ranch, Osilalei, livestock did not decline under subdivision.

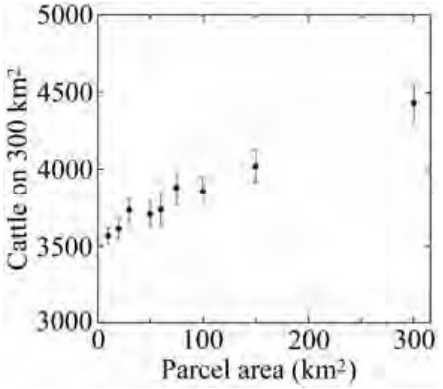

Figure 1 Cattle on a subdivided area South Africa

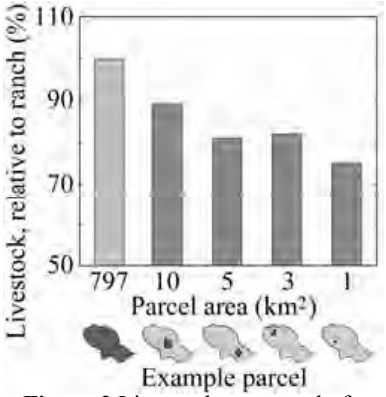

Figure 2 Livestock supported of on Eselenkei under subdivision

Conclusions Declines in livestock populations were dramatic in modelling results from South Africa, and for some group ranches in southern Kajiado, Kenya. The Maasai of Kajiado are facing diminishing food security due to large increases in human population without concurrent increases in livestock. Based on our research, declines in food security will be exacerbated by subdivision. National and international governments may expect to offset losses of 25% of livestock populations if pastoralists are sedentarized. There are some benefits to subdividing lands, and additional costs; we encourage stakeholders to retain open access, so that benefits may be enjoyed without the concurrent declines in livestock populations.

References

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