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Examining the dynamic shift between pastoralism and agropastoralism: comparative insights from South Africa and south Asia

Samuels, I*; Louhaichi, M**

*Agricultural Research Council - Range and Forage Science, South Africa

**International Center for Agricultural Research in the Dry Areas, Tunisia

Corresponding author: Igshaan Samuels <isamuels@uwc.ac.za>

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Abstract

Often, pastoralism conflicts with cropping for land and other resources, leading to tensions between these two land uses. Nevertheless, pastoralism and agropastoralism can coexist, with the same people often engaging in both land use practices. However, the dominance of each land use is dependent on various factors, which are often dynamic. In South Africa's arid zone, pastoralists have become spatially constrained through land grabbing during colonialism and apartheid, and due to the smaller size of the grazing lands, both land uses operate in proximity but vary according to climatic and socio-economic conditions and the governance of the land. Due to increases in rainfall variability and a reduction in rainfall, and drought recurrences, dryland cropping has declined whereby only about 12% of all croplands are utilized. These croplands are located within a matrix of arid, yet biodiverse shrublands that have been used by indigenous Nama pastoralists for centuries. On the other hand, in the arid zone of Rajasthan, India, livestock mobility as practiced by the Raika people is a mechanism to cope with climate change in search for better forage and water resources. Our results indicate that 80% of the grazing time was spent on cropland and fallow land along migration routes. In both cases, the rapid decline of cropping practices has had negative implications for livestock and concerted efforts needs to be undertaken to support this historic land use in rangelands that have shown to complement pastoralism in the face of rapid environmental and socio-economic change.

Introduction

Rangelands cover about 54% of the globe's terrestrial surface and these agroecological systems are key for maintaining planetary health including their ability to sequester carbon, sustaining biodiversity, water regulation, and other services (ILRI et al., 2021). For millennia, livestock grazing managed by pastoralists, have been the dominant land use in rangelands and this has shaped the ecological, cultural and economic character of those regions (Reid et al. 2014). As such, these landscapes are also support more than two billion livelihoods worldwide, along its value chain. Despite its importance, rangelands are under threat from various competing land uses such as urban development, mining, agriculture, conservation etc. and these make rangelands very dynamic. However, some land uses are complementary to the pastoral way of life in rangelands.

Dryland cropping, particularly in semi-arid and arid regions have co-existed, became integrated and therefore complemented livestock farming for centuries resulting in new agropastoral societies that have diversified income streams. For example, crop residues are used by livestock during the dry periods whereas livestock manure act as a fertilizer for crops (Samuels et al. 2008). This is particularly true in southern Africa where small-scale dryland cropping has been practiced by the indigenous Nama people to grow winter cereals that they use to make bread and to grow supplementary forage for their livestock (Samuels 2013). In the south of India, livestock provide draught power, transportation, milk and manure for crop farmers and crops serve as food for livestock. This mutualistic interaction has allowed agropastoralists to adapt to the variability in their climate, local economy, and socio-political contexts (Rangnekar 2006).

Then again, the relationship between cropping and livestock farming is dynamic and has been influenced by numerous factors that can shift the balance in favour of the other. For example, large expansions of cropping areas will encroach onto valuable rangelands and fragment grazing areas whereas the absence of cropping could lead to forage shortages in times of drought. The integration of cropping and livestock farming is one of the fundamental elements for climate change adaptation and sustainable land use in drylands around the world (Valbuena et al. 2012). Therefore, understanding the dynamic shift between these two land uses is important for policy development and programmatic interventions. This paper assessed the changes in cropping activities in two dryland pastoral regions in South Africa and South Asia and makes policy recommendations.

Materials and Methods

The research on agropastoralism in South Africa was done over two decades as part of larger national and international projects. Thus, the information reported on in this paper reflects the experience and observations of the authors who were part of that research working with pastoralists using quantitative and qualitative methods. Results also reflect information conveyed by local and indigenous knowledge holders. A stratified random sampling method was applied to select households across districts, tehsils (administrative units), and villages. Villages were chosen based on their livestock migration patterns to neighbouring states. A comprehensive inventory of migratory and non-migratory livestock households was conducted in the selected villages (Louhaichi et al. 2014).

Description of the Study Areas

The study in South Africa was conducted in the Leliefontein communal area that is 192,000 ha in size. The climate is semi-arid with predominantly winter rain from May to August. In summer, temperatures exceed 40 ^{0}C and in winter, it often falls below freezing point in the uplands above 1,000m above sea level. The vegetation falls within two global biodiversity hotspots, namely the Mediterranean shrubland called Fynbos, and the semi-arid Succulent Karoo, which comprises about 90% of Leliefontein. The pastoral area is divided into ten villages with each having associated (unfenced) grazing lands, cropping units and watering points. The cropping units are 12% of Leliefontein and about 10% had been used actively (Samuels 2013). Crops grown are wheat and oats and sometimes lucerne, rye, and barley. The primary livestock kept are goats and sheep, which are herded daily from corrals.

Rajasthan state in India is semi-arid with 70% being desert. Rajasthan has four seasons: summer, monsoon, post-monsoon, and winter. The climate varies from arid to humid. June is the warmest, with temperatures nearly 40°C. The state hosts extensive rangelands, forming the core of its pastoral system, which also relies on croplands. The vegetation is predominantly xerophilous and includes several grass and scrub-type vegetation of low trees species. Livestock serve as food security, and protection against economic and environmental shocks.

Results

In South Africa, environmental factors such as increases in rainfall variability and drought recurrences have resulted in a decline in dryland cropping (Table 1). However, during good rainfall periods, agropastoralists will

attempt to plant winter cereal crops for their livestock. Socio-economically, the lack of seed, farming implements, and labour, have also contributed to a decline in cropping. Poor governance that led to the neglect of infrastructure further added to this decline. The erosion of indigenous knowledge amongst Nama agropastoralists has resulted in the inability to know when and how to plant cereal crops.

Rajasthan faces unique vulnerabilities to climatic extremes. Unlike South Africa, recent pre-monsoon rainfall in Rajasthan has caused severe flooding. Despite increased mechanization in India, much agricultural work remains labor-intensive. In irrigated areas, farmers rely on flood irrigation, while micro-irrigation is mostly used by larger landholders. Improper cropping systems and continuous cultivation have depleted soil quality, leading to land degradation, high production costs, and low productivity.

Table 1: Drivers of cropping abandonment in the study areas.

Drivers	**South Africa**	**South Asia**
Environmental		
Reduced rainfall	✓	
Increased rainfall variability	✓	✓
Soil fertility depletion		✓
Socio-economic		
Lack of seed	✓	
Lack of farming implements	✓	
Lack of labour	✓	
Poor adoption of mechanization		✓
Poor irrigation facilities		✓
Stray livestock incl. donkeys	✓	
Older agropastoralists passing on	✓	
Cheaper & convenient to buy feed	✓	
Lack of marketing		✓
Inadequate access to crop insurance schemes		✓
Indigenous knowledge		
Lack of farming skills to plough & threshing of chaff	✓	
Lack of knowledge to read weather conditions on when to plough	✓	
Breakdown in indigenous livestock management to protect crops	✓	

Discussion

While dryland cropping has declined in Leliefontein, it persisted over recent decades due to the need to maintain exclusive cropping rights and to continue to earn its benefits such as supplementary fodder. Here, cropping is one of the major drivers of livestock mobility as herders move their animals away to protect growing crops (Samuels et al. 2008). In western Rajasthan, livestock rely heavily on common grazing lands, fallow fields, and post-harvest crop areas. Livestock mobility is critical for local livelihoods, trade, and coping with climate change (Clifton and Louhaichi, 2015). Cropland and fallow land comprised the majority land type utilized by cattle, totaling 80%. Grasslands, deciduous trees, and scrub forest lands accounted for >10% of the area utilized by cattle (Louhaichi et al. 2015).

If rainfall variability, droughts, poor governance, and other constraints persist, it is uncertain whether cropping will continue in both regions. This outcome will have consequences for Nama and Rajasthani agropastoralists and

there is a need to work towards solutions to continue cropping in these dryland systems. These include co-developing early warning systems based on science and local ecological knowledge, preservation of Indigenous and local knowledge, development of drought resistant indigenous fodder crops as in the case of South Africa from the diversity of native forage legumes found in the winter rainfall region (Muller et al. 2017). Furthermore, we need to protect the rights of crop farmers, implement policies that encourage cropping, and support croppers financially and technically.

In both cases, the rapid decline of cropping practices had negative implications for livestock and a concerted efforts needs to be undertaken to support this historic land use in rangelands, that have shown to complement pastoralism in face of rapid environmental and socio-economic change.

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References

Clifton K, Louhaichi M (2015) Land tenure, climate change and livestock mobility in central and southern Asian grasslands. Proceedings of the XXIII International Grassland Congress. New Delhi-India.

ILRI, IUCN, FAO, WWF, UNEP, ILC (2021) Rangelands Atlas. Nairobi, Kenya: ILRI.

Louhaichi M, Chand K, Ashutosh S, Misra AK, Gaur MK, Johnson DE, Roy MM (2014) Livestock migration in the arid region of Rajasthan (India) - strategy to cope with fodder and water scarcity. Journal of Arid Land Studies 24, 61-64.

Louhaichi M, Chand K, Misra AK, Gaur MK, Johnson DE (2015) Improving a transhumance livestock system of India with modern technologies. Proceedings of the XXIII International Grassland Congress. New Delhi-India.

Müller FL, Raitt LM, Chimphango SBM, Samuels MI, Cupido CF, Boatwright JS, Knight RS, Trytsman M (2017) Prioritisation of native legume species for further evaluation as potential forage crops in water-limited agricultural systems in South Africa. Environmental Monitoring & Assessment 189, 512.

Rangnekar DV (2006) Livestock in the livelihoods of the underprivileged communities in India: A review. *International Livestock Research Institute*.

Reid RS, Fernández-Giménez ME, Galvin KA (2014) Dynamics and resilience of rangelands and pastoral peoples around the globe. *Annual Review of Environment and Resources 39*, 217–242.

Samuels MI (2013) Pastoral mobility in a variable and spatially constrained South African environment. PhD thesis, University of Cape Town, Suth Africa.

Samuels MI, Allsopp N, Hoffman MT (2008) Mobility patterns of livestock keepers in semi-arid communal rangelands of Namaqualand, South Africa. Nomadic Peoples 12, 123-148.

Valbuena D, Erenstein O, Tui SHK, Abdoulaye T, Claessens L, Duncan AJ, Gérard B (2012) Conservation agriculture in mixed crop-livestock systems: Scoping crop residue trade-offs in sub-Saharan Africa and South Asia. *Field Crops Research 132*, 175–184.