



Herder-cattle-rangeland interactions: shaping grazing behaviour in the mountainous rangelands of Kunene, Namibia

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Abstract

Livestock grazing behaviours play an important role on the health of animals and the rangelands, significantly impacting livestock production and human livelihoods. Grazing success relies on the intricate interactions between people, animals, and their rangelands. This relationship is particularly vital for pastoral communities, which often face challenges in developing environmental infrastructure. On the mountainous rangelands of Kunene in Namibia, dry seasons and drought reserves pasture areas are difficult to access. Small pockets of resources can provide essential fodder, and the ability to navigate mountainous terrain becomes vital, as pasture is often found at higher elevations. Up to now, our knowledge of the human-animal-environment relationships that shape such grazing practices is still limited. To address this gap, this study aims to investigate factors that influence cattle behaviour associated with mountain grazing. Data on cattle keeping and grazing practices were gathered with Himba pastoralists through semi-structured and narrative interviews. The findings indicate that Himba pastoralists are well aware of features of their cattle that are essential for mountain grazing. They do not only select specific traits in their cattle but also teach them new behaviours, such as foraging behaviour or navigation skills. The climbing performance of the individual animal is shaped by factors like breed, body condition, familiarity with the area, and mountain climbing experiences. Herders employ different techniques to train and assist cattle to climb, including establishing paths by removing rocks that may have caused fear due to past injuries or placing cattle dung along a track to guide the animals uphill. Himba pastoralists skilfully utilize the individual variability among their livestock, enabling cattle to learn from one another while actively shaping their grazing patterns through the instruction of new behaviours. The results specify the interrelationships between humans, animals, and environments and explain in detail how they contribute to an effective utilization of rangeland resources. The skills and knowledge of the herders, along with the skills of their cattle, enable the use of hardly accessible pasture resources, essential for the sustainability of pastoral systems in the mountainous regions of northern Kunene.

Introduction

The northern part of Kunene region is predominantly inhabited by Himba pastoralists who utilize common rangeland resources. During the critical periods, forage vegetation can still be found on rocky mountainous areas, distant from water sources (Bollig 1997). To ensure that cattle access these pastures herders adopt different practices. This human-animal-environment interaction is critical for rangelands characterized by high spatial and temporal variability in rainfall leading to high variability in the distribution of water and fodder resources (African

Union 2010). To optimize livestock grazing, herders utilize their empirical knowledge to develop grazing strategies that stimulate animals' appetite and subsequently promote increased food intake (Meuret and Provenza 2015). Understanding the behavioural patterns of individual animals facilitate livestock keepers in shaping the animals' grazing behaviours, thereby enhancing efficiency and productivity (Dimitri and Longland 2018). Due to the challenging conditions in Kunene north, accessing pastures during the dry season and drought periods depends on the relationships between herders, their herds, and their rangeland. Both the herders' practical knowledge and the cattle's adaptability are critical factors for the successful utilization of these pasture areas (Kaufmann et al. 2016). In the study region, cattle calve once a year, contributing to the sustenance of the Himba people's livelihoods for centuries. This is made possible through these interactions, which highlights the collective importance of human expertise and animal adaptability in pastoral ecosystems. However, comprehensive knowledge on how this interaction influences herding and grazing practices within these pastoral systems remains limited. The aim of this study is to understand cattle-rangeland interactions from the perspective of Himba pastoralists and to explore the factors influencing cattle behaviour associated with mountain grazing in Kunene North.

Methods

This study was conducted in the northern part of the Kunene region, which is characterized by low and erratic precipitation, with annual rainfall ranging from 50 to 400 mm over a maximum of four months. Kunene region is described as a rocky mountainous landscape (NPC, 2015).

Between March 2023 and June 2024, a total of 45 semi-structured interviews and 15 narrative interviews were conducted with Himba pastoralists in three study areas: Omuhonga, Etanga, and Etoto. Semi-structured interviews typically lasted 1 to 1.5 hours, while narrative interviews ranged from 1.5 to 2 hours. The initial participants were selected through purposive sampling, and thereafter respondents were identified through snowball method. The interviews were conducted with herders actively engaged in daily cattle management to capture first-hand experiences, knowledge, and practices. Participant observation, combined with informal discussions and prolonged engagement over 9 months, contributed to the robustness and validity of the collected data. To ensure accuracy all interviews were recorded and transcribed by a native speaker of the local language. Data analysis followed a multi-stage approach. The recorded interviews and data were organized, transcribed, and coded. Recurring themes and patterns were then identified. Respondents were grouped, and their answers to the research questions were examined. Content analysis was conducted to develop codes and categories (Creswell, 2007). Data analysis was performed with the help of MAXQDA.

Results

Cattle breeds and their characteristics

Three common cattle breeds and their respective characteristics in the study area were identified through interviews. (i) The Nguni, which is an indigenous breed (sometimes referred to as Nguni/Sanga or Sanga sub-type/eco-type), has a small body frame and low milk production (<3L/day). However, this breed is well-adapted to the region and demonstrates competence in walking long distance as well as mountainous terrain and rocky areas. Consequently, this attribute contributes to its ability to reach pastures across the seasons, enabling it to meet its nutritional needs, which in turn supports reproductive performance, by maintaining good body condition and hence go on heat few months after calving and uphold an annual calving pattern. A high calving rate not only enhances herd growth but also ensures a steady supply of milk. Although the quantity may be limited, it is often sufficient during critical periods, particularly for younger children. (ii) The Brahman which was introduced to the area from commercial farms, primarily through exchanges; it is not well-adapted to the region but can cope with extended dry season and the rocky mountainous areas to some extent. It has a big body frame that provides favourable prices when sold. (iii) The Herero (locally referred to as a breed originating from Hereroland, also referred to as composite of Brahman, Simmental, Nguni and possibly Bonsmara), demonstrates limited ability to survive drought conditions, but it is larger and produces more milk (5-7L/day) than the other two. Despite their susceptibility to drought events, about 80% of the herders maintain them, as deadly droughts occur approximately

once every six to ten years. Thus, the benefits of increased milk production and meat yield, or potential financial gains from sales, are perceived to be worth the risk of losing these animals during drought periods. In terms of calving rate, both Brahman and Herero breeds are reported by the herders to likely skip one or two years of calving. Herders maintain a diverse combination of breeds and crossbreeds in their herds, as each breed offers distinct advantages.

Herders' perceptions on cattle breeds grazing behaviours

Kunene North pastoralists prefer cattle that are capable of performing grazing activities independently, such as walking to water sources, to the pasture and returning home to their calves (particularly lactating cows). This preference stems from the dominant free-ranging practices, where cattle are guided to grazing zones and left to forage on their own. This cattle-free-ranging practices is driven by labour constraints and low presence of cattle predators unlike for small ruminants that need to be herded due to the presence of jackal and leopards in the area. During the dry season, navigating mountainous and rocky terrain is crucial for the livestock to meet their nutritional requirements. Additionally, in these periods watering animals becomes one of the main activities, hand-dug wells need to be re-excavated reducing herders active herding time. Animals unable to carry out grazing activities on their own are considered by the Himba to be lazy, weak, or incapable, requiring herder's intervention. Himba pastoralists specify several cattle characteristics that resonate with their preferences.

Breed-dependent factors: The mountainous terrain poses varying levels of challenges for different cattle breeds. Nguni cattle are capable of independently ascending to mountain pastures. In contrast, Brahman cattle typically ascend partially and require herder intervention to reach grazing areas at higher elevations. Herero cattle, however, depend entirely on herders for any uphill movement.

Breed-independent factors: Individual cattle experience with mountainous environments plays a crucial role in their ability to navigate such terrain. Animals originating from non-mountainous areas lack the experience and depend on herder's support. Additionally, body condition is a critical factor; weak animals lack the strength for independent uphill ascending and thus require herders' intervention.

Herders' supportive strategies towards accessing mountain pasture

Due to the availability of pastures solely in the rocky mountainous areas during critical periods, and the inability of some cattle to access these pasture areas, it is crucial for herders to intervene to ensure continuous provision of feed resources for the animals. Herders' intervention involves different approaches, based on the individual animal's specific limitations. When livestock are unfamiliar with the area and unaware of pasture locations, the herder may employ the following strategies: *Dung application method* - herders strategically apply fresh dung along an imaginary trail. When cattle detect the scent, they assume the route is commonly used to access pasture, motivating them to ascend. *Training the lead cow* - the lead cow, typically possessing good memory and learning capabilities, is guided for about a week. Once trained, it takes the lead, and the rest of the herd follows. When animals are in poor body condition, alternative strategies are employed such as: *Creating pathways* - herders remove large, sharp rocks to facilitate cattle movement. Navigating slopes and rocky terrain can be exhausting, especially for weak animals. *Evening ascension* - to avoid daytime temperatures that can reach 35–40°C, herders move livestock during the cooler evening hours. Slow, deliberate movement also reduces exhaustion and minimizes the risk of slips, falls, and injuries. *Choosing flatter routes* - whenever possible, herders select flatter paths, as these are easier to climb, and some animals are fearful of steep slopes. *Dividing the herd* - The herd is separated into strong and weak groups and grazed on different mountains based on distance and slope gradient. Strong animals capable of efficient walking and climbing are assigned to more challenging routes, while weaker animals, including lactating cows, thin, ill, or old individuals, are grazed on less demanding terrain.

Discussion

Adaptive herding strategies: cattle breeds, environmental knowledge, and pastoral expertise

Accessing mountain pastures: Each cattle breed exhibits distinct characteristics and behaviour patterns that reflect its adaptability to the region's conditions and its value to livestock keepers. While exotic breeds perform well under optimal conditions, such as during the wet season, producing substantial amount of milk and larger framed offspring, they face challenges due to the prolonged dry seasons, drought, and the difficulty of navigating mountainous and rocky terrain. This limitation reduces their ability to access the scattered and difficult to reach pockets of fodder available on mountain pastures during the dry season/drought periods and ultimately hampers their survival under the region's peculiar conditions. In contrast, the indigenous Nguni cattle, are well-adapted to the pedo-climatic conditions. Similarly, pastoralists highlighted the strengths of local breeds, noting their resistance to drought, ability to travel long distances without water, and capacity to adapt to new or changing environments (e.g., Marshall et al. 2019; Ayantunde 2007; Tamou et al. 2018).

Herding skills: The training that herders perform to teach their animals to access to mountain pasture and to encourage them to walk on rocky paths allow continuous fodder intake of their cattle for sustenance and production. Experienced herders are known to create meal sequences for their livestock to optimise feed intake, hence improving the nutrition, health, and production of animals and landscapes (Meuret and Provenza 2015).

Calving rate: The ability of Nguni cattle to access mountain pastures enable them to meet their nutritional needs, maintaining good body condition and also enhancing annual calving rate. Adequate nutrition helps cows return to oestrus faster after calving and maintain optimal reproductive efficiency (Diskin and Kenny 2014); cows have a 70% probability of conception if they are gaining weight, compared to only 17% if they are losing weight (Pradhan & Nakagoshi, 2008). Research conducted on a Namibian research station on comparing the calving rate of different breeds over a period of 10 years under equal conditions found that, Nguni cattle have a calving rate of 89,6%, compared to the 77,4% average of four other breeds (Afrikaner, Simmental, Hereford and Santa Gertrudis) (Schoeman 1989).

Herd composition: The majority of herders, where the topographic conditions permit, prefer maintaining a mix of cattle breeds. This strategy enables them to capitalize on higher yields during favourable years while benefiting from the resilience of Nguni cattle, which ensure a consistent supply of milk and offspring with minimal input requirements. Similarly, Rendile camel herders in Kenya do not prioritize a single breed but instead maintain a diverse herd composition, recognizing that different breeds serve various roles in terms of production and self-sustenance within the herd (Kaufmann, 2007). This underscores the importance of herders' strategic herd composition, which is determined by a variety of factors beyond the simple "production" aspect often emphasized.

Conclusions

The strategic importance of herd composition enables herders to mitigate risks associated with climate variability, and ensure that immediate household requirements and long-term production objectives are met. The strategies utilized by Himba herders reflect their profound knowledge of animal behaviour and rangeland conditions, demonstrating a sophisticated understanding of the potential of the interplay between the two. The human-animal-environment interactions play significant role in utilising the hardly accessible rangeland resources, which enables livestock production, thus sustaining livelihoods of Himba pastoralists.

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