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Rangeland Management Practices and Perceptions of Communal Livestock Farmers' Towards Rangeland Degradation in the North West Province of South Africa

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ABSTRACT

This study assessed rangeland management practices and perceptions of livestock farmers towards rangeland degradation in the Moretele communal areas of North West Province, South Africa. Understanding these issues is crucial for developing interventions to improve rangeland productivity and sustainability. A semi-structured questionnaire surveyed 106 randomly selected communal farmers across four villages (Lebalangwa, Mmakgabetlwane, Noroki, & Swartdam). Data analysis was conducted using SPSS software. The majority of participants were males. Most farmers had less than years of farming experience, and most were farming with mixed livestock (cattle, sheep, and goats). Based on the farmers' perceptions, over 70% of the farmers agreed that rangelands are overgrazed and considered the condition of the rangelands to have declined dramatically over time. The most important traditional rangeland management strategy adopted by the farmers was mobility. Better pastures and water access were common reasons for mobility across all areas. The study suggests that, in future, development agencies and government must work closely with local communities to train and empower them in rangeland management skills.

Keywords: Rangelands, Communal Land, Livestock Farmers, Sustainable Practices

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1. INTRODUCTION

Generally, rangelands are natural or semi-natural vegetation areas supporting livestock grazing and wildlife (O'Connor & van Wilgen, 2020). About 74% of the total land surface of South Africa is arid and semi-arid rangelands (Mudau *et al*., 2022). Over the past few decades, the impact of rangeland degradation has been a major challenge faced, especially by communal farmers in most developing countries, including South Africa (Reed *et al*., 2015; Zerga, 2015; Bolo *et al*., 2019). An estimated 25% of South Africa's natural arid and semi-arid rangelands are already degraded (Kellner & de Wet., 2021; Marquart *et al*., 2023). Kassahun *et al*. (2008) and Diogo *et al*. (2021) stated that poor grazing practices, land-use intensification, and livelihood diversification, particularly in communal areas, cause rangeland degradation. Furthermore, the increasing number of communal livestock farmers and livestock in South Africa has led to challenges in rangeland management (Selemani, 2014). Mismanaged access to rangeland and variations in livestock owners' intentions result in poor rangeland conditions and overgrazing (Beyene *et al*., 2014; Mphinyane & Omphile, 2016).

According to Marquart *et al*. (2020) and Yousefi *et al*. (2021), overgrazing significantly threatens rangelands. It can lead to reduced biodiversity, loss of palatable species, and degradation of soil physical properties. Cai *et al*. (2020) further stated that other negative consequences of overgrazing could also lead to the proliferation of woody plants and decreased water infiltration. Overgrazing compacts the topsoil, making it denser and less porous. Numerous studies, such as those by Belayneh and Tessema (2017) and Maphanga *et al*. (2022), have demonstrated that bush encroachment primarily affects savanna ecosystems and is considered an environmental problem. Mani *et al*. (2021) indicated that communal land degradation in South Africa has been mainly characterised by woody plant encroachment, whether this phenomenon is more prevalent in communal areas with unrestricted open grazing or conservation areas with restricted closed grazing (Mangani, 2021).

Communal farmers in developing countries possess valuable indigenous knowledge of rangeland management, which should be considered when planning rangeland management practices (Finca *et al*., 2023; Baloyi, 2023). Sandhage *et al*. (2015) stated that the lack of resources available to communal farmers is a significant challenge for rangeland management in South Africa. Despite limited access to advanced technologies, these farmers have successfully maintained livestock for generations. Their ecological knowledge can contribute to the development of effective rangeland management programs.

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This study aimed to assess rangeland management practices and perceptions of livestock farmers towards rangeland degradation in Moretele Local Municipality. This information is considered vital for possible interventions to improve these rangelands' productivity and sustainable use.

2. MATERIALS AND METHODS

2.1. Description of Study Area

The study was conducted in Moretele Local Municipality, located under the Bojanala Platinum district in the North West Province of South Africa. The area is located at the following coordinates: latitudes 25.142°S to 25.285°S and longitudes 27.970°E to 28.253°E above sea level. It covers an area of about 1 369km2 km^2 of land. The area has an average annual rainfall of 565 mm, with rain falling in the summer months between October and March. The maximum monthly average temperatures in summer range from 27 to 34 °C and 20 to 23 °C in winter, and the respective minimum temperatures range from 15 to 16 °C in summer and 3 to 6 °C in winter (DIGES, 2012). Mixed Bushveld, Kalahari Thornveld, and Springbok Flats Turf Thornveld (Letsoalo *et al*., 2000) are the veld types. The vegetation type comprises open to dense low thorn savanna, dominated by *Acacia* species recently divided into two genera, namely Vachellia and Senegalia. The common woody species include *Vachellia karoo*, *Vachellia tortilis*, *Vachellia, nilotica*, *Senegalia, mellifera*, *Vachellia, luederitzii*, and *Ziziphus mucronata* (Mucina & Rutherford, 2006). The following grasses dominate the herbaceous layer: *Ischaemum afrum*, *Dichanthium annulatum*, *Aristida bipartita*, and *Brachiaria eruciformis* (Mucina & Rutherford, 2006).

2.2. Data Collection

The data for the study was collected from a sample of 106 livestock farmers in four villages: Lebalangwa (n = 24), Mmakgabetlwane (n = 26), Noroki (n = 21), and Swartdam (n = 35), which are among the largest communal areas in Moretele. These included male and female farmers with a minimum of 10 Large Stock Units (LSU) or animal/s unit equivalent, as long as they were ruminants (goats, sheep, and/or cattle). A meeting was held with North West Department of Agriculture and Rural Development officials to introduce the study's purpose before selecting farmers. The questionnaires were administered by well-trained enumerators proficient in the local language (Setswana), and face-to-face interviews were conducted. This ensured that the farmers could understand the questions and provide accurate answers. Primary

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data obtained included 1) demographic information, 2) rangeland management practices, and 3) causes of degradation.

Ethical clearance was obtained from the University of the Free State for conducting the survey. A briefing was then held with extension officers, community leaders, and communal livestock farmers to explain the purpose of the study and schedule dates for interviews. The questionnaire survey was pre-tested in 10 households to improve clarity and reliability. A structured questionnaire was randomly administered to 106 communal livestock farmers of the four selected villages in Moretele Local Municipality.

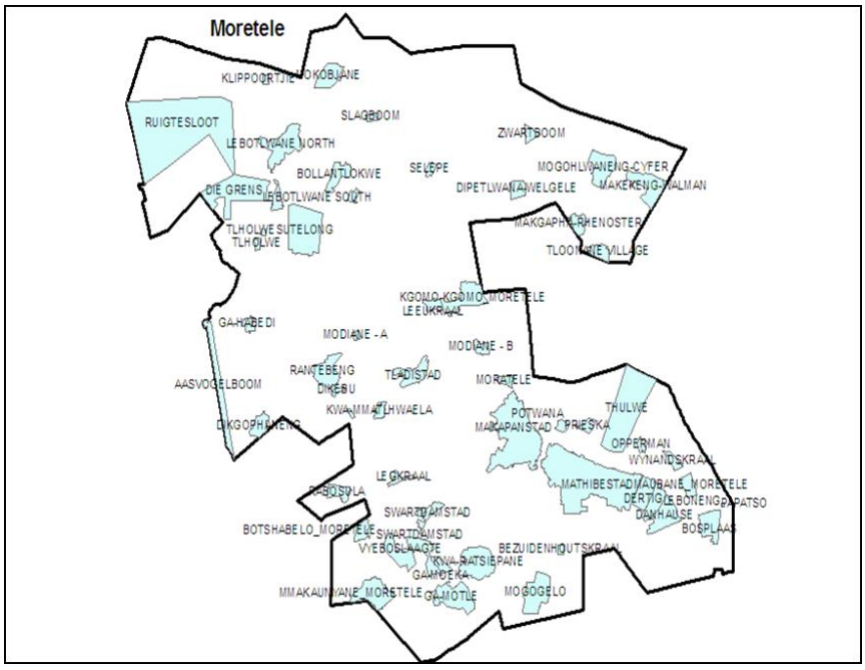

FIGURE 1: Map of the Study Area

2.3. Data Analysis

The Microsoft Office Excel 2022 software package was used to capture the coded data and to test the reliability of the information gathered from the questionnaires. The data was analysed using SPSS.

3. RESULTS

3.1. Demographic Information of the Farmers

Table 1 illustrates the demographics of the farmers who participated in this study. The gender of most respondents who participated in this study were male farmers (60%) and female farmers (40%). The study found that many respondents had formal education, with only 14%

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of farmers having no formal education in Noroki. Mmakgabeltwane had the highest percentage of farmers with primary education (31%), while Lebalangwa had the highest percentage with high school education (25%). Swartdam had the highest percentage of farmers with post-matric education (63%). Most farmers in all four areas had less than five years of farming experience.

TABLE 1: Demographic Information of the Farmers

Demographics				
Area	**Lebalangwa**	**Mmakgabetlwane**	**Noroki**	**Swartdam**
Gender/area (%)				
Female	38	46	38	37
Male	62	54	62	63
Education level (%)	**Lebalangwa**	**Mmakgabetlwane**	**Noroki**	**Swartdam**
No-formal Educ	8.0	4.0	14	3.0
Primary	21	31	10	23
High school	25	12	19	11
Post matric	46	54	57	63
Years of experience	**Lebalangwa**	**Mmakgabetlwane**	**Noroki**	**Swartdam**
< 5 years	46	46	43	31
6-10 years	29	27	33	37
11-20 years	8.0	12	14	29
> 20 years	17	15	10	3.0

TABLE 2: Livestock Production Types Among Farmers on Rangeland

Variables	**Frequency (*n*=106)**	**Percentage (%)**
Type of livestock owned		
Large stock	24	23
Mixed livestock (large and small stock)	54	51

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Small stock	28	26

n=number; %=percentage

The most common livestock production system was mixed livestock, with 51%. The second most common livestock production system was small stock (26%), followed by large stock (23%).

Table 3 outlines the livestock farmers' understanding of rangeland farming practices. This study shows a high level of variation in the perception of overgrazing in communal lands among livestock farmers. This is reflected in Mmakgabetlwane, of which most respondents (85%) believe that communal grazing lands are overgrazed. In comparison, several respondents (4%) believe they are not overgrazed, and some (12%) are unsure.

TABLE 3: The Livestock Farmers' Perspective on Rangeland Practices

Variables (%)					
Communal lands are overgrazed by livestock.	**Yes**	**No**	**Not sure**		
Area					
Lebalangwa (*n*=24)	79	13	8.0		
Mmakgabetlwane (*n*=26)	85	4.0	12		
Noroki (*n*=21)	76	19	5.0		
Swartdam (*n*=35)	80	9.0	11		
Animals graze according to the grazing plan.					
Lebalangwa (*n*=24)	21	71	8.0		
Mmakgabetlwane (*n*=26)	8.0	50	42		
Noroki (*n*=21)	14	52	33		
Swartdam (*n*=35)	20	66	14		
Reasons for the mobility of livestock from one area to the other	**Pasture**	**Pasture + water**	**Water**	**Because others are doing it**	**Other**
Lebalangwa (*n*=24)	8.0	42	42	4.0	4.0

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Mmakgabetlwane (*n*=26)	4.0	31	46	15	-
Noroki (*n*=21)	5.0	33	52	10	-
Swartdam (*n*=35)	3.0	37	51	6.0	3.0

Type of grazing system	**Rotational grazing**	**Seasonal grazing**	**Other**	**Not sure**
Lebalangwa (*n*=24)	42	33	-	25
Mmakgabetlwane (*n*=26)	35	31	-	35
Noroki (*n*=21)	38	19	5.0	38
Swartdam (*n*=35)	60	23	-	17

Plants have adequate time to recover.	**Yes**	**No**	**Not sure**
Lebalangwa (*n*=24)	21	33	46
Mmakgabetlwane (*n*=26)	12	31	58
Noroki (*n*=21)	19	29	52
Swartdam (*n*=35)	20	40	40

n=number; %=percentage

The study found that the Lebalangwa farmers (71%) do not have a rangeland management plan, while only several (21%) believe that they do, and some (8%) are not sure. In contrast, Swartdam has the highest level of compliance with grazing plans, with several respondents (20%) indicating that animals graze according to grazing plans.

Pasture and water are the most common reasons for livestock mobility by livestock farmers in all researched sites. The majority of livestock owners by farmers in Lebalangwa (42%) cited pasture and water as the reason for their animals' mobility, followed by some (37%) in Swartdam, others (33%) in Noroki, and the least (31%) in Mmakgabetlwane.

The reason for livestock movements from area to area is common in all four villages, with better pasture being the most common reason for animals to move. In Lebalangwa, the majority of the livestock owners (8%) cited pasture and water as the reason for livestock mobility, followed by some (5%) in Noroki, others (4%) in Mmakgabetlwane and the least (3%) in Swartdam.

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The majority of the farmers indicated livestock mobility is a common practice in the area, with the majority of livestock farmers in Mmakgabetlwane (15%), followed by some (10%) in Noroki, others in Swartdam (6%) and the least in Lebalangwa (4%) using this system. The decision to move livestock, because others are doing it, has shown to be a relatively rare reason for livestock mobility, with a percentage of (4%) in Lebalangwa and Swartdam (3%) only livestock farmers.

The majority of farmers in all the research sites, Mmakgabetlwane (58%), Noroki (52%), Lebalangwa (46%) and Swartdam (40%), indicated not being sure about the recovery time of natural plants.

4. DISCUSSIONS

Results from this current study are in line with those of Letsoalo (2019), Mapiliyao *et al*. (2019) and Letsoalo *et al*. (2023), who reported male participation dominance in agricultural activities. A study conducted by Adedeji *et al*. (2013) and Obayelu *et al*. (2020) in Nigeria further noted that men had a higher proportion than women in agriculture. Charles (2014) suggests that this difference in gender distribution may be due to the different roles that men and women play in traditional agriculture in these areas. For example, in Tunisia, women often experience additional challenges due to gender norms and cultural practices, which exclude them from agri-training, rangeland governance, and owning land on par with men (Najjar, 2020). Gcumisa *et al*. (2016) reported that men generally owned cattle, goats and sheep.

Regarding education, our results are similar to those of Letsoalo (2019), who found that most farmers in Gauteng Province had formal education. Educated farmers are more likely to adopt sustainable rangeland management practices are significant because they suggest that education can be an effective tool for improving rangeland health.

Mixed livestock was the most common livestock production system in this study; these results agree with Martin *et al*. (2020) and Rowntree *et al*. (2020), who found that multi-species livestock farming can enhance the sustainability of livestock farming systems. Moreover, it is essential to properly integrate different livestock species and manage pasture and livestock enterprises effectively.

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The second most common livestock production system in this study was small stock; a similar trend was reflected by Rinehart (2018). The study conducted by Rinehart (2018) shows that mixed grazing (cattle and sheep) improves productivity by 20 to 25% and carrying capacity. Additionally, goats, which are browsers, are used to control woody plants and use biologically efficient agents (O'Connor *et al*., 2014; Hare *et al*., 2020). Moreover, sheep can help prevent parasite populations and improve pasture quality (Kumar *et al*., 2013; Dettenmaier *et al*., 2017).

The least common livestock kept by farmers was large stock. A similar trend is reflected in Mapiye *et al*. (2018) findings that beef cattle production is a crucial and multipurpose survival practice in rural areas, particularly in remote and distant places with degraded lands and few socioeconomic possibilities. This may be due to the recent trend towards smaller-scale livestock farming. Multi-species livestock farming and the movement of livestock can benefit sustainability. Still, it is important to carefully consider the factors influencing the decision to adopt these practices.

Ravhuhali's (2018) work reports findings consistent with this study, which found that large portions of the communal grazing areas in the North West Province rangelands are not effectively managed. Bolo *et al*. (2019) and Kellner *et al*. (2021) also indicated that excessive grazing by domestic livestock leads to overgrazing because of overcrowding and unmanaged grazing, which can lead to the degradation of rangelands. This suggests that overstocking and overgrazing are widespread problems in these areas. However, most farmers indicated that they have a rangeland management plan. This is likely because some farmers have 11-20 years of experience, which has given them a better understanding of the importance of grazing plans and how to implement them effectively.

The results of this study are consistent with the findings of Behnke (2018), Turner and Schlecht (2019), and Owen-Smith *et al*. (2020), who asserted that grazers do not follow a fixed pattern of movement but rather move opportunistically in search of food and water. This is because livestock must graze on fresh grass for daily nutritional needs. The area will become overgrazed if the grazing pressure is too high due to overstocking.

Water was also an important factor in the decision to move livestock. The results of this study are consistent with the findings of Franke and Kotzé (2022) and Fust (2022), who found that the behaviour of grazers does not follow a fixed pattern and is mainly opportunistic, driven by

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the availability of water, linked to highly variable precipitation in the semi-arid to arid regions of the savannahs and grasslands. This indicates that some livestock farmers may sometimes decide where to move their livestock based on what other farmers are doing. This can be a way to ensure that livestock have access to good grazing and water, but it can also lead to overgrazing and other environmental problems.

This type of grazing system is where livestock is moved to different pastures regularly, allowing the pasture time to recover and prevent overgrazing. However, these results contradict the point made by Kellner *et al*. (2021), which stated that reducing grazing pressure by grazing exclusion is difficult in rural areas that are managed communally. Moreover, on this note, Angassa (2014), Reid *et al*. (2018) and Mcdonald *et al*. (2018) warned that continuous grazing practice reduces biodiversity and ecosystem functions, promoting bush encroachment.

Lamidi and Ologbose (2014) found that the availability of natural pasture varies seasonally in Nigeria, with a peak in the rainy season (May–November) and a decline in the dry season (November–April). The rainy-season pasture is more succulent, highly nutritious, and abundant, while the dry-season pasture is fibrous, scarce, and devoid of essential nutrients. Rotational grazing is the most effective grazing system for preventing overgrazing and promoting biodiversity in communally managed grazing lands. This is because rotational grazing allows the pasture to recover and regenerate while providing livestock access to fresh grass and water. These findings provide a better understanding of the challenges of managing communal lands and the impact of overgrazing on rangeland management practices.

5. CONCLUSIONS

This study investigated rangeland management practices and perceptions among communal livestock farmers in the Moretele Local Municipality, South Africa. The findings highlight a critical need for interventions to address rangeland degradation and promote sustainable rangeland management.

Our results revealed a disconnect between farmer perceptions and the potential severity of rangeland degradation. The limited experience and knowledge of sustainable practices among farmers, particularly regarding rotational grazing effectiveness and plant recovery times, suggests a crucial role for educational programs. Furthermore, the dominance of opportunistic livestock movement due to dependence on readily available pasture and water sources

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underscores the need for improved grazing plans considering stocking rates and carrying capacity. Additionally, collaborative management strategies involving farmers, government agencies, and research institutions hold promise for knowledge sharing and fostering sustainable practices.

By implementing the proposed interventions, including educational programs, community-based grazing plans, improved water access infrastructure, and collaborative management initiatives, this study paves the way for improved rangeland management in Moretele. These interventions have the potential to enhance livestock production, conserve vital ecosystems, and ensure the long-term sustainability of these rangelands for future generations.

Further research is warranted to delve deeper into the specific causes of overgrazing in Moretele. Additionally, evaluating the effectiveness of different grazing management strategies in communal settings is crucial for optimising rangeland utilisation. Finally, developing culturally appropriate methods for disseminating knowledge on sustainable rangeland management practices among communal farmers is essential for long-term success. This study provides a valuable foundation for understanding Moretele's rangeland management practices and perceptions. By addressing the identified knowledge gaps and implementing the proposed interventions, along with the suggested areas for future research, we can contribute significantly to the sustainable management and conservation of these critical ecosystems.

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